

# Technical Sessions

## 21st International Conference on Advanced Vehicle Technologies (AVT) MONDAY, AUGUST, 19

### AVT-1 ADVANCES IN GROUND VEHICLES DYNAMICS AND CONTROLS (AVT/MSNDC)

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#### Session AVT-1-1

Palisades 8:00AM–9:00AM

**8:00AM** The Research and Design of In-Arm Torsional Electromagnetic Active Suspension  
Technical Paper Publication. IDETC2019-97022

*Chengleng Han, Lin Xu, Mohamed A.A. Abdelkareem, Enkang Cui, Junyi Zou, Kipkorir Rono, Zhen Zhao, wuhan university of technology, wuhan, China, Bo Yang, Academic Affairs Office, Wuhan University of Technology, Wuhan, Hubei, China*

**8:20AM** Improving the stability of a Bulletproofed Vehicle using modified Suspension system  
Technical Paper Publication. IDETC2019-97110

*Alhossein Sharaf, Mostafa Yacoub, Military Technical College, Cairo, Egypt, Amro Elhefnawy, Egyptian Armed Forces, Cairo, Select State/Province, Egypt*

**8:40AM** Efficiency Calculation of Hydro-mechanical Differential Turning Mechanism of Tracked Vehicle  
Technical Paper Publication. IDETC2019-97196

*Fuyi CAO, Zhili ZHOU, Wei ZHAO, Henan University of Science and Technology, Luoyang, China*

### AVT-9 KEYNOTE LECTURE

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#### Session AVT-9-1

Palisades 9:10AM–10:30AM

### AVT-2 ADVANCES IN MODELLING AND TESTING TIRE-TERRAIN INTERACTION

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#### Session AVT-2-1

Palisades 10:50AM–12:10PM

**10:50AM** PREDICTION OF OUT-OF-PLANE RIGID RING TRUCK TIRE MODEL PARAMETERS OVER FLOODED SURFACE USING FEA-SPH TECHNIQUES  
Technical Paper Publication. IDETC2019-97036

*Zeinab El-Sayegh, University of Ontario Institute of Technology, Oshawa, ON, Canada, Moustafa El-Gindy, University of Ontario Institute of Technology, Oshawa, ON, Canada, Inge Johansson, Volvo Group Trucks Technology Vehicle Analysis, Goteborg, Sweden, Fredrik Ojier, Volvo Truck Corp, Gothenburg 40508, Sweden*

**11:16AM** Adaptive Identification of Friction in Tire-suspension HILS System  
Technical Presentation. IDETC2019-97449

*Taichi Shiiba, Kaoru Endo, Meiji University, Kawasaki, Japan*

**11:42AM** Effects of Surface Condition On Traction of Two-Wheeled Inverted-Pendulum Transporters  
Technical Paper Publication. IDETC2019-98129

*Arnoldo Castro, Georgia Tech, Atlanta, GA, United States, Christopher Adams, Georgia Institute of Technology, Smyrna, GA, United States, William Singhose, Georgia Tech, Atlanta, GA, United States*

### AVT-1 ADVANCES IN GROUND VEHICLES DYNAMICS AND CONTROLS (AVT/MSNDC)

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#### Session AVT-1-2

Palisades 2:10PM–3:45PM

**2:10PM** Water-Egressing Mobility of an Amphibious Vehicle with a Controllable H-Driveline  
Technical Paper Publication. IDETC2019-97307

*Vladimir V. Vantsevich, University of Alabama at Birmingham, Birmingham, AL, United States, David Gorsich, U.S. Army CCDC-Ground Vehicle Systems Center, Warren, MI, United States, Jesse Paldan, University of Alabama at Birmingham, Birmingham, AL, United States, Sergey Sandomirsky, PG, RC Integrated Systems LLC, Irvine CA 92612, CA, United States*

**2:33PM** Research On Instability Principle Of Virtual Tracks Train When Braking On Curve  
Technical Paper Publication. IDETC2019-97596

*Jianyong Zuo, Tongji Univ., Shanghai, China, Yihao Gu, Tongji University, Shanghai, China, Haiying Lu, CRRC Changchun Railway Vehicles Co.,LTD, Changchun, China, Cheng Liu, Jie Yu, Tongji University, Shanghai, China*

**2:56PM** THE DRIVER-IN-THE-LOOP SIMULATION ON REGENERATIVE BRAKING CONTROL OF FOUR-WHEEL DRIVE HEVs  
Poster Paper Presentation. IDETC2019-97794

*he xu yang, Ningxia Institute of Science and Technology, shizuishan, China*

**3:19PM** Virtual Sensing In High-Performance Vehicles With Artificial Intelligence  
Technical Paper Publication. IDETC2019-97906

*Angelo Bonfitto, Stefano Feraco, Nicola Amati, Andrea Tonoli, Politecnico di Torino, TORINO, Italy*

# Technical Sessions

## AVT-1 ADVANCES IN GROUND VEHICLES DYNAMICS AND CONTROLS (AVT/MSNDC)

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Session AVT-1-3

Palisades 4:10PM–5:50PM

4:10PM Control strategy for vehicle lateral dynamics combining Torque Vectoring with four wheel steering  
Technical Paper Publication. IDETC2019-98157

*Michele Vignati, Mauro Bravin, Politecnico di Milano, Milan, Italy, Edoardo Sabbioni, Politecnico Di Milano, Dip. Mecc., Milan, Italy*

4:43PM DRIVER-FRIENDLY EMERGENCY COLLISION AVOIDANCE SYSTEM VIA FLATNESS DIRECT YAW MOMENT CONTROL

Student Competition Poster. IDETC2019-98174

*Zejiang Wang, Junmin Wang, University of Texas at Austin, Austin, TX, United States*

5:16PM Objective Characterization of Brake Systems in Motorcycles  
Technical Paper Publication. IDETC2019-98213

*Andreas Eisele, Frank Diermeyer, Markus Lienkamp, Technical University Munich, Garching, Germany*

## TUESDAY, AUGUST, 20

## AVT-3 ADVANCES IN METHODS FOR GROUND VEHICLE SYSTEMS DESIGN

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Session AVT-3-1

Palisades 8:00AM–9:00AM

8:00AM Concurrent topological optimization of a wheel and brake caliper assembly  
Technical Paper Publication. IDETC2019-97280

*Massimiliano Gobbi, Politecnico di Milano, Milan, Italy, Giorgio Previati, Politecnico Di Milano, Milano, Italy, Federico Ballo, Politecnico di Milano, Milan, Italy*

8:20AM On the Use of Multi-disciplinary Optimisation Methods for Road Vehicle Passive Suspension Design  
Student Competition Poster. IDETC2019-97308

*Liunan Yang, Federico Ballo, Politecnico di Milano, Milan, Italy, Giorgio Previati, Politecnico Di Milano, Milano, Italy, Massimiliano Gobbi, Gianpiero Mastinu, Politecnico di Milano, Milan, Italy*

8:40AM Defining the Space of Feasible Transmission Designs for Retrofitting a Rear-Wheel-Drive Automobile with a Power Split CVT  
Technical Paper Publication. IDETC2019-97663

*Sean Vermillion, Innovative Decisions, Inc., Vienna, VA, United States*

## AVT-10 MILLIKEN LECTURE

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Session AVT-10-1

Palisades 9:10AM–10:30AM

## AVT-3 ADVANCES IN METHODS FOR GROUND VEHICLE SYSTEMS DESIGN

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Session AVT-3-2

Palisades 10:50AM–12:10PM

10:50AM field test and characteristic analysis of railroad track vibration energy harvester  
Technical Paper Publication. IDETC2019-98273

*Jianyong Zuo, Tongji Univ., Shanghai, China, Jie Yu, Yihao Gu, Cheng Liu, Tongji University, Shanghai, China, Lei Zuo, Yu Pan, Virginia Tech, Blacksburg, VA, United States, Teng Lin, Stony Brook University, New York, NY, United States*

11:10AM Speed Based Power Control of Integrated Powertrain With Two-Speed Transmission for PEV  
Technical Paper Publication. IDETC2019-98275

*Zhenghong Lu, Liangyao Yu, Song Jian, Shengnan Fang, Lanie Abi, Tsinghua University, Beijing*

11:30AM Design of a human-powered roll stabilization attachment for utilitarian two-wheeled vehicles  
Technical Paper Publication. IDETC2019-98469

*Guillermo F Diaz Lanckenau, Lea Daigle, Samuel H Ihns, Eric Koch, Jana Saadi, Patrick Tornes, Jessica M Wu, Amos G. Winter, V, MASSACHUSETTS INSTITUTE OF TECHNOLOGY, Cambridge, MA, United States*

11:50AM Investigating the impact of component uncertainty in autonomous vehicles overtaking maneuver  
Technical Presentation. IDETC2019-98658

*Hsin-Ting Tsai, National Taiwan University, Taipei, Taiwan*

## AVT-5 ADVANCES IN VEHICLE ELECTRIFICATION AND POWERTRAIN DESIGN

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Session AVT-5-1

Palisades 2:10PM–3:50PM

# Technical Sessions

**2:10PM** Self-Starting Cogging-Torque-Assisted Motor Drive For Use In A Heavy-Duty Diesel Engine  
Technical Paper Publication. IDETC2019-97581

*Devin Reinholz, Brad Reinholz, University of British Columbia Okanagan, Kelowna, BC, Canada, Rudolf Seethaler, Univ Of British Columbia, Kelowna, BC, Canada*

**2:35PM** Modeling and Control of New Multi-Mode Plug-in Hybrid Electric Vehicle  
Technical Paper Publication. IDETC2019-97660

*Abhinandan Raut, Suryaji Phalke, Diane Peters, Kettering University, Flint, MI, United States*

**3:00PM** Numerical Co-Simulation of Drag Torque in the Gearbox Combined Multibody Dynamics with Moving Particle Semi-Implicit Method  
Technical Paper Publication. IDETC2019-97746

*Lifu Zhang, Guangqiang Wu, Tongji University, Shanghai, China*

**3:25PM** Kinetic Energy Recovery System for Urban Mobility  
Technical Paper Publication. IDETC2019-98158

*Michele Vignati, simone barzaghi, davide tarsitano, Politecnico di Milano, Milan, Italy, Francesco Braghin, Politecnico Di Milano CIG X17129F3E2, Milan, MI, Italy*

## AVT-7 ADVANCES IN MILITARY AND COMMERCIAL GROUND

### VEHICLE DESIGN

#### Session AVT-7-1

Manhattan **2:10PM–3:50PM**

**2:10PM** A Novel Autonomous Scaled Electric Combat Vehicle  
Technical Paper Publication. IDETC2019-97163

*Aaron Tan, Haoxiang Lang, University of Ontario Institute of Technology, Oshawa, ON, Canada, Moustafa El-Gindy, Univeristy Of Ontario Institute of Technology, Oshawa, ON, Canada*

**2:30PM** Simulation of 4x4 Light Tactical Vehicle for Next Generation NATO Reference Mobility Model  
Technical Presentation. IDETC2019-98144

*Ole Balling, Morten Rydahl-Haastrup, Louise Ørsted Bendtsen, Frederik Hømaa, Aarhus University, Aarhus, Denmark, Abhinandan Jain, Jet Propulsion Laboratory, Pasadena, CA, United States*

**2:50PM** Durable Rubber Suspension Development for Vibratory Soil Compactor  
Technical Presentation. IDETC2019-98394

*Peijun Xu, Ebco Inc, Elgin, IL, United States*

**3:10PM** Verification and Validation of the CREATE-GV Mercury Co-Simulation Tool with the Fuel Efficient Ground Vehicle Demonstrator  
Technical Presentation. IDETC2019-98542

*Jacob Brendle, U.S. Army CCDC GVSC, Warren, MI, United States, Jeremy B. Mange, Sara E. Boyle, US Army CCDC-GVSC, Warren, MI, United States*

**3:30PM** Advancing Strategies to Reduce Worker Injury Risk on Mobile Mining Equipment  
Technical Paper Publication. IDETC2019-98041

*Alan Mayton, Jonisha Pollard, Mahiyar Nasarwanji, CDC/NIOSH/PMRD, Pittsburgh, PA, United States, Brian Kim, Centers for Disease Control and Prevention/National Institute for Occupational Safety and Health, Pittsburgh, PA, United States*

## AVT-6

### ADVANCES IN LIGHT VEHICLES DESIGN

#### Session AVT-6-1

Manhattan **4:10PM–5:50PM**

**4:10PM** Modal Analysis of a Utility Bicycle from the Perspective of Riding Comfort  
Technical Paper Publication. IDETC2019-97277

*Alberto Doria, University of Padova-Dept of Industrial Eng, Padova, Italy, Edoardo Marconi, Pierluca Cialoni, University of Padova DII, Padova, Italy*

**4:43PM** Effect of Rider Posture on Bicycle Comfort  
Technical Paper Publication. IDETC2019-97763

*Alejandra Polanco, Pontificia Universidad Javeriana, Bogota, Cundinamarca, Colombia, Edoardo Marconi, University of Padova DII, Padova, Italy, Luis Munoz, Universidad de los Andes, Bogota, Colombia, Daniel Suarez, Pontificia Universidad Javeriana, Bogotá, Colombia, Alberto Doria, University of Padova-Dept of Industrial Eng, Padova, Italy*

**5:16PM** Assessment of Shoulder and Chest Protection of Wearable Motorcycle Airbags  
Technical Paper Publication. IDETC2019-97782

*Davide Girardi, University of Padova, Padova, Italy, Edoardo Marconi, University of Padova DII, Padova, Italy, Matteo Massaro, University of Padova, Padova, Italy*

## AVT-8

### ADVANCES IN INTELLIGENT VEHICLES

#### Session AVT-8-1

Palisades **4:10PM–5:50PM**

# Technical Sessions

**4:10PM**            **Non-contact Vehicle Overload Identification Method Based on Body Vibration Theory**  
Technical Paper Publication. IDETC2019-97282

*Yiran Ding, Daolin Zhou, Shimin Yu, Zhenyu Wang, Gangfeng Tan, Wuhan University of Technology, Wuhan, China*

**4:30PM**            **Probabilistic Modeling of Driver Behaviors in Urban Crossroads**  
Technical Paper Publication. IDETC2019-97502

*Yuan-Cheng Liu, Kuei-Yuan Chan, National Taiwan University, Taipei, Taiwan*

**4:50PM**            **Investigating the impact of component uncertainty on autonomous vehicle overtaking maneuvers**  
Technical Paper Publication. IDETC2019-97504

*Hsin-Ting Tsai, Kuei-Yuan Chan, National Taiwan University, Taipei, Taiwan*

**5:10PM**            **Convolutional Neural Network-Based Intention Forecasting and Lane Change Path Predicting of the human driver**  
Technical Paper Publication. IDETC2019-97521

*Kaiming Yang, Tsinghua University, Beijing, China, Zhanhong Yan, The University of Tokyo, Tokyo, Tokyo, Japan, Di Chen, Cornell University, Ithaca, NY, United States, Nakano Kimihiko, University of Tokyo, Tokyo, Tokyo, Japan, Xuewu Ji, Tsinghua University, Beijing, Beijing, China*

**5:30PM**            **Human Computer Interface Using Electroencephalography for Driver Behavior Classification**  
Technical Paper Publication. IDETC2019-97540

*Vamsi Krishna Manchala, Alvaro Vargas Clara, Susheelkumar Cherangara Subramanian, Sangram Redkar, Arizona State University, Mesa, AZ, United States, Thomas Sugar, ASU, Mesa, AZ, United States*

## WEDNESDAY, AUGUST, 21

### AVT-6

#### ADVANCES IN LIGHT VEHICLES DESIGN

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##### Session AVT-6-2

Palisades            **8:00AM–9:40AM**

**8:00AM**            **Enhancing the Performance of an FSAE Car**  
Technical Paper Publication. IDETC2019-97892

*Giovanni Schiavinotto, University of Padova, Padova, Italy, Giovanni Meneghetti, University of Padova DII, Padova, Italy, Matteo Veneri, Matteo Massaro, University of Padova, Padova, Italy*

**8:33AM**            **Methodology for the Estimation of the Aerodynamic Drag Parameters of Cyclists**  
Technical Paper Publication. IDETC2019-98067

*Alejandra Polanco, Pontificia Universidad Javeriana, Bogota, Cundinamarca, Colombia, Juan Fuentes, Sebastian Porras, Daniel Castiblanco, Julian Uribe, Universidad de los Andes, Bogota, Colombia, Daniel Suarez, Pontificia Universidad Javeriana, Bogotá, Colombia, Luis Munoz, Universidad de los Andes, Bogota, Colombia*

**9:06AM**            **Multibody simulation of an Electric Go-kart: Influence of Power-Train's weight distribution on Dynamic Performance**  
Technical Paper Publication. IDETC2019-98112

*Jonathan Mikler Anaya, Santiago Camacho Calderon, Universidad de los Andes, Bogota, Colombia, Andrew Bradley, Oxford Brookes University, Oxford, United Kingdom, Andres Gonzalez-Mancera, Universidad de los Andes, Bogotá, Colombia*

### AVT-8

#### ADVANCES IN INTELLIGENT VEHICLES

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##### Session AVT-8-2

Palisades            **10:00AM–11:40AM**

**10:00AM**            **A Model For Vehicular Interactions Extracted From Real-World Traffic Data**  
Student Competition Poster. IDETC2019-97750

*Jay Patel, Clemson University, Greenville, SC, United States, Ioannis Karamouzias, Clemson University, Clemson, SC, United States, Beshah Ayalew, Clemson University, Greenville, SC, United States*

**10:20AM**            **End-to-End Multi-Task Machine Learning of Vehicle Dynamics for Steering Angle Prediction for Autonomous Driving**  
Technical Paper Publication. IDETC2019-97850

*Nicholas Merrill, Virginia Tech, Blacksburg, VA, United States, Azim Eskandarian, Virginia Tech Univ., Blacksburg, VA, United States*

**10:40AM**            **Autonomous Vehicle Driving via Deep Deterministic Policy Gradient**  
Student Competition Poster. IDETC2019-97884

*Wenhui Huang, Politecnico Di Milano, Yanji, China, Francesco Braghin, Politecnico Di Milano CIG X17129F3E2, Milan, MI, Italy, Stefano Arrigoni, Politecnico Di Milano, Milan, Italy*

**11:00AM**            **Combined Lane Keeping And Longitudinal Speed Control For Autonomous Driving**  
Technical Paper Publication. IDETC2019-97922

*Stefano Feraco, Angelo Bonfitto, Nicola Amati, Andrea Tonoli, Politecnico di Torino, Torino, Italy*



# Technical Sessions

**11:20AM** Data Association and Fusion Framework for Decentralized Multi-Vehicle Cooperative Perception Student Competition Poster. IDETC2019-98001

*DoHyun Yoon, G G Md Nawaz Ali, Beshah Ayalew, Clemson University, Greenville, SC, United States*

## AVT-8

### ADVANCES IN INTELLIGENT VEHICLES

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#### Session AVT-8-3

**Palisades 1:15PM–2:55PM**

**1:15PM** Coordinated Model Predictive Control On Multi-Lane Roads

Technical Paper Publication. IDETC2019-98117

*Nathan Goulet, Beshah Ayalew, Clemson University, Greenville, CT, United States*

**1:40PM** A Self-supervised Learning Technique for Road Defects Detection through Monocular Three-dimensional Reconstruction

Technical Paper Publication. IDETC2019-98135

*Yazhe Hu, Virginia Tech, Blacksburg, VA, United States, Tomonari Furukawa, VA Tech, Blacksburg, VA, United States*

**2:05PM** TELEOPERATED VEHICLE- PERSPECTIVE PREDICTIVE DISPLAY ACCOUNTING FOR NETWORK TIME DELAYS

Technical Paper Publication. IDETC2019-98159

*Jai Prakash, Michele Vignati, Stefano Arrigoni, Politecnico Di Milano, Milan, Milan, Italy, Mattia Bersani, simone mentasti, Politecnico di Milano, milano, Italy*

**2:30PM** An Artificial Intelligent System for the Connected and Autonomous Vehicle Ecosystem

Technical Presentation. IDETC2019-98309

*Jiucui Zhang, Jin Shang, Xiao Lin, Yonggang Xu, Shuai Tang, Weizhe Zhang, Hai Xiao, GAC R&D Center in Silicon Valley, Sunnyvale, CA, United States*

## 39th Computers and Information in Engineering Conference (CIE) MONDAY, AUGUST, 19

### CIE-1

#### ADVANCED MODELING AND SIMULATION (AMS)

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##### Session CIE-1-1

Advanced Modeling and Simulation (AMS)

**Malibu 8:00AM–9:00AM**

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Session Organizer: **Krishnanand Kaipa**, Old Dominion University, Norfolk, VA, United States

Session Co-Organizer: **Duane Storti**, Univ Of Washington, Seattle, WA, United States

**8:00AM** A SYSTEMATIC RAPID CREATIVE DESIGN FRAMEWORK FOR COMPLEX MECHANICAL SYSTEMS FROM CONCEPTUAL DESIGN TO 3D VIRTUAL SIMULATION  
Technical Paper Publication. IDETC2019-98150

*Yu-Tong LI, China University of Petroleum, Huangdao, Qingdao, China, Yu-Xin Wang, China University of Petroleum, Huadong, Qingdao, China*

**8:20AM** A Coarea Formulation for Grid-based Evaluation of Volume Integrals  
Technical Paper Publication. IDETC2019-98247

*Chris Uchytil, University of Washington-Seattle, Seattle, WA, United States, Duane Storti, Univ Of Washington, Seattle, WA, United States*

**8:40AM** Design of NRL66.4: an Electro-Hydraulic 6-DoF Parallel Robotic Multiaxial Material Testing System  
Technical Paper Publication. IDETC2019-98360

*Athanasios Iliopoulos, U.S. Naval Research Laboratory, W, DC, United States, John Michopoulos, U.S. Naval Research Laboratory, Washington, DC, United States, John Steuben, US Naval Research Laboratory, Washington, DC, United States, Benjamin Graber, U.S. Naval Research Laboratory, Washington, DC, United States*

### CIE-13

#### CAPPD: MOTIVATION AND EMOTION

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##### Session CIE-13-1

CAPPD: Motivation and Emotion

**EI Capitan A 8:00AM–9:00AM**

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Session Organizer: **Shuichi Fukuda**, Keio University, Yokohama, Kanagawa, Japan

Session Co-Organizer: **Monica Bordegoni**, Politecnico Di Milano Dip. Mecc., 20156 Milan, Italy

**8:00AM** Effective of Assistive Methods On Sense Of Fulfillment With Agency: Modeling With Flow Theory And Attribution Theory  
Technical Paper Publication. IDETC2019-97500

*Dan Nanno, Hideyoshi Yanagisawa, The University of Tokyo, Tokyo, Japan*

**8:30AM** Mahalanobis-Taguchi-Fukuda Approach to Human Motion Control  
Technical Paper Publication. IDETC2019-98030

*Shuichi Fukuda, Keio University, Yokohama, Kanagawa, Japan*

# Technical Sessions

## CIE-20 VES: METHODS, PROCESSES AND STRATEGIES FOR TECHNOLOGY (MPS-T)

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Session CIE-20-1  
Methods, Processes and Strategies for Technology and User Interface  
**Coronado 8:00AM–9:00AM**

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Session Organizer: **Atif Mahboob**, Technische Universität Ilmenau, Ilmenau, Germany

Session Co-Organizer: **Andrea Vitali**, University of Bergamo, Dalmine, Italy

**8:00AM** Toolbox For User-Centered Specification Of VR Systems  
Technical Paper Publication. IDETC2019-97340

**Andreas Liebal**, Technical University of Ilmenau, Ilmenau, Germany, **Heidi Krömker**, **Atif Mahboob**, **Christian Weber**, Technische Universität Ilmenau, Ilmenau, Germany

**8:20AM** Augmented Reality Interface: Guidelines For The Design Of Contrast Ratios  
Technical Paper Publication. IDETC2019-97341

**Regina Koreng**, **Heidi Krömker**, Technische Universität Ilmenau, Ilmenau, Germany

**8:40AM** ASSESSMENT OF JOINT PARAMETERS IN A KINECT SENSOR BASED REHABILITATION GAME  
Technical Paper Publication. IDETC2019-97519

**Soumya K. Manna**, Bournemouth University, Bournemouth, Dorset, United Kingdom, **Venketesh N. Dubey**, Bournemouth University, Poole, Dorset, United Kingdom

## CIE-1 ADVANCED MODELING AND SIMULATION (AMS)

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Session CIE-1-2  
Advanced Modeling and Simulation (AMS)  
**Malibu 9:10AM–10:30AM**

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Session Organizer: **Ravi Burla**, AUTODESK, Novi, MI, United States  
Session Co-Organizer: **Seung-kyum Choi**, Georgia Tech, Atlanta, GA, United States

**9:10AM** OPTIMAL DESIGN OF THERMO-COMPRESSION BONDING FOR ADVANCED PACKAGING SYSTEM UNDER UNCERTAINTY  
Technical Paper Publication. IDETC2019-97988

**Sungkun Hwang**, **Seung-kyum Choi**, Georgia Tech, Atlanta, GA, United States

**9:30AM** Five-Axis Flank Milling of Spiral Bevel and Hypoid Gears with a Filleted End Mill Cutter  
Technical Presentation. IDETC2019-97810

**Yuansheng Zhou**, Central South University, Changsha, Hunan, P.R.China, China

**9:50AM** Data-Driven Dynamical System Modeling and Parameter Identification  
Technical Presentation. IDETC2019-97057

**Ghazaale Leylaz Mehrabadi**, **Shangjie Ma**, University of California, Merced, MERCED, CA, United States, **Jian-Qiao Sun**, Univ Of California, Merced, Merced, CA, United States

**10:10AM** Experimental and Modeling Analysis of a Free Cooling System in Ceiling Fans using Phase Change Materials (PCM)  
Technical Presentation. IDETC2019-98533

**Seyed Mojtaba Sadrameli**, **Mostafa Alizadeh**, Tarbiat Modares University, Tehran, Islamic Republic Of Iran

## CIE-2 COMPUTER-AIDED PRODUCT AND PROCESS DEVELOPMENT (CAPPD)

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Session CIE-2-3  
CAPPD Panel: Structural Optimization, Multiscale Multiphysics Simulation, and Democratization for Additive Manufacturing  
**El Capitan A 9:10AM–10:30AM**

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Session Organizer: **Chiradeep Sen**, Florida Institute of Technology, Melbourne, FL, United States

## CIE-15 SEIKM: DESIGN INFORMATICS

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Session CIE-15-1  
Design Informatics  
**Coronado 9:10AM–10:30AM**

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Session Organizer: **Zhenghui Sha**, University of Arkansas, Fayetteville, AR, United States

Session Co-Organizer: **Ying Liu**, Cardiff University, Cardiff, United Kingdom

**9:10AM** TECHNOLOGY KNOWLEDGE GRAPH FOR DESIGN EXPLORATION: APPLICATION TO DESIGNING THE FUTURE OF FLYING CARS  
Technical Paper Publication. IDETC2019-97605

**Serhad Sarica**, **Binyang Song**, **Jianxi Luo**, Singapore University of Technology and Design, Singapore, Singapore, **Kristin Wood**, Singapore University of Technology and Design, Austin, TX, United States

# Technical Sessions

**9:30AM**      **A DEEP LEARNING BASED APPROACH TO PREDICTING SEQUENTIAL DESIGN DECISIONS**  
Technical Paper Publication. IDETC2019-97625

*Molla Hafizur Rahman, University of Arkansas, Fayetteville, AR, United States, Charles Xie, Concord Consortium, Concord, MA, United States, Zhenghui Sha, University of Arkansas, Fayetteville, AR, United States*

**9:50AM**      **Semantic Network Differences Across Engineering Design Communication Methods**  
Technical Paper Publication. IDETC2019-97728

*Christian Lopez, Penn State University, Newport, PA, United States, Zixuan Zhao, Purdue University, West Lafayette, PA, United States, Conrad Tucker, Penn State University, State College, PA, United States*

**10:10AM**      **PHYSICS-BASED FUNCTION FEATURES FOR A SET OF MATERIAL-PROCESSING VERBS**  
Technical Paper Publication. IDETC2019-98343

*LAKSHMI NARASIMHON ATHINARAYANA VENKATANARASIMHAN, Xiaoyang Mao, Ahmed Chowdhury, Florida Institute of Technology, Melbourne, FL, United States, Chiradeep Sen, Florida Institute of Technology, Melbourne, FL, United States*

**CIE-4**  
**SYSTEMS ENGINEERING INFORMATION KNOWLEDGE MANAGEMENT (SEIKM)**

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**Session CIE-4-1**  
**SEIKM Panel: The recent advances and future direction of model-based systems engineering**  
**Malibu 10:50AM–12:10PM**

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Session Organizer: **Zhenghui Sha, University of Arkansas, Fayetteville, AR, United States**  
Session Co-Organizer: **Yan Lu, NIST, Gaithersburg, MD, United States**

**CIE-16**  
**SEIKM: SYSTEMS ENGINEERING**

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**Session CIE-16-1**  
**Systems Engineering**  
**Coronado 10:50AM–12:10PM**

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Session Organizer: **Douglas Allaire, Texas A&M University, College Station, TX, United States**  
Session Co-Organizer: **Bryan O'Halloran, Naval Postgraduate School, Monterey, CA, United States**

**10:50AM**      **Modeling and Analysis of Subsystem Interactions in Robotic Assembly**  
Technical Paper Publication. IDETC2019-98081

*Shaurya Shriyam, Satyandra K. Gupta, University of Southern California, Los Angeles, CA, United States*

**11:10AM**      **Topological Semantics for Lumped Parameter Systems Modeling**  
Technical Paper Publication. IDETC2019-98181

*Randi Wang, Vadim Shapiro, University of Wisconsin-Madison, Madison, WI, United States*

**11:30AM**      **Spacecraft Failure Analysis From The Perspective Of Design Decision-Making**  
Technical Paper Publication. IDETC2019-98420

*Vikranth Kattakuri, Jitesh Panchal, Purdue University, West Lafayette, IN, United States*

**11:50AM**      **A PHYSICS-BASED FORMAL VOCABULARY OF ENERGY VERBS FOR FUNCTION MODELING**  
Technical Paper Publication. IDETC2019-98502

*Chiradeep Sen, Florida Institute of Technology, Melbourne, FL, United States, Joshua Summers, Clemson University, Clemson, SC, United States, Xiaoyang Mao, Florida Institute of Technology, Melbourne, FL, United States*

**CIE-28**  
**CIE KEYNOTES**

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**Session CIE-28-1**  
**CIE Keynotes**  
**Malibu 2:10PM–3:45PM**

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**2:10PM**      **Redesigning Manufacturing Machines, Design Tools, and Robotics for Smart Human Augmented Spatial Interfaces**  
Keynote Presentation. IDETC2019-98699

*Karthik Ramani, Purdue University, W Lafayette, IN, United States*

**2:57PM**      **On Bringing Mars to Earth: Mars Sample Return and Earth Entry Vehicle Development**  
Keynote Presentation. IDETC2019-98700

*Scott Perino, JPL, Pasadena, CA, United States*

**CIE-22**  
**VES: VIDEO PRESENTATION EXHIBIT: VISUALIZATION AND VIRTUAL DEMONSTRATION OF PROTOTYPES AND SIMULATIONS**

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**Session CIE-22-1**  
**VES: Video Presentation Exhibit: Visualization and Virtual Demonstration of Prototypes**  
**Malibu Foyer 4:10PM–5:50PM**

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Session Organizer: **Andrea Vitali, University of Bergamo, Dalmine, Italy**

# Technical Sessions

## CIE-25 DAC/CIE JOINT SYMPOSIUM: DESIGN FOR RESILIENCE AND FAILURE RECOVERY

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Session CIE-25-1  
DAC/CIE Joint Symposium: Design for Resilience and Failure  
Recovery  
Malibu 4:10PM–5:50PM

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## CIE-26 GRADUATE STUDENT POSTER SYMPOSIUM

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Session CIE-26-1  
Graduate Student Poster Symposium  
Malibu Foyer 4:10PM–5:50PM

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Session Organizer: **Tsz Ho Kwok**, Concordia University, Montreal, QC, Canada

**4:10PM** Object-Oriented Graph-Based Modeling for Resilient Design  
Student Competition Poster Presentation. IDETC2019-98565

*Daniel Hulse*, Oregon State University, Corvallis, OR, United States

**4:15PM** Design Synthesis and Optimization for Next Generation High Power and Energy Lithium-ion Batteries  
Student Competition Poster Presentation. IDETC2019-98568

*Chih-Hsuan Hung*, University of Washington, Seattle, WA, United States, *Corie Cobb*, University of Washington, Seattle, WA, United States

**4:20PM** Modeling and Prediction of the Flexural Behavior of Additively Manufactured Continuous Carbon Fiber-Reinforced Polymer Composites  
Student Competition Poster Presentation. IDETC2019-98571

*Ziyang Zhang*, *Dazhong Wu*, University of Central Florida, Orlando, FL, United States

**4:25PM** Design Of Multi-Robot Systems With Evolving Constraints: Cooperative 3D Printing System Design  
Student Competition Poster Presentation. IDETC2019-98575

*Laxmi Poudel*, University of Arkansas, Fayetteville, AR, United States

**4:30PM** Kinematics and Dynamics of Soft Magnetic Robot for Minimally Invasive Procedures  
Student Competition Poster Presentation. IDETC2019-98576

*Amanda de Oliveira Barros*, Texas Tech University, Lubbock, TX, United States, *James Yang*, Texas Tech University - Dept of Mechanical Engineering, Lubbock, TX, United States

**4:35PM** Computational Method for Design of Carbon Fiber Reinforced Parts Fabricated by Fused Filament Fabrication  
Student Competition Poster Presentation. IDETC2019-98578

*Felipe Meneguzzo Pasquali*, University at Buffalo, Buffalo, NY, United States

**4:40PM** Empathy in Engineering Design  
Student Competition Poster Presentation. IDETC2019-98579

*Mohammad Alsager Alzayed*, The Pennsylvania State University, State College, PA, United States

**4:45PM** Integrating Quality of Life in Socio-Technical Design of Microgrid Systems  
Student Competition Poster Presentation. IDETC2019-98580

*Hailie Suk*, University At Buffalo, Amherst, NY, United States, *John Hall*, University At Buffalo, Buffalo, NY, United States

**4:50PM** A New Localized Muscular Fatigue Model For Dynamic Target Loads  
Student Competition Poster Presentation. IDETC2019-98581

*Ritwik Rakshit*, Texas Tech University, Lubbock, TX, United States, *James Yang*, Texas Tech University - Dept of Mechanical Engineering, Lubbock, TX, United States

**4:55PM** Utilizing Additive Manufacturing for Polymer Component Repair in Tribological Applications  
Student Competition Poster Presentation. IDETC2019-98586

*Kyle Koren*, Florida Institute of Technology, Melbourne, FL, United States

**5:00PM** Pattern and Mold Design and Optimization for Rapid Investment Casting to Reduce Mold Cracking During Burnout  
Student Competition Poster Presentation. IDETC2019-98587

*Christopher T. Richard*, *Tsz Ho Kwok*, Concordia University, Montreal, QC, Canada

**5:05PM** Nonlinear Dynamics of Human Upright Postural Stability Based on an Ankle-Knee-Hip Model on a Balance Board  
Student Competition Poster Presentation. IDETC2019-98588

*Mahmuda Ishrat Malek*, Texas Tech University, Lubbock, TX, United States, *James Yang*, Texas Tech University - Dept of Mechanical Engineering, Lubbock, TX, United States

**5:10PM** Structural Design Of Shoe Midsole For Directional Energy Transfer  
Student Competition Poster Presentation. IDETC2019-98592

*Ankhy Sultana*, *Tsz Ho Kwok*, Concordia University, Montreal, QC, Canada



# Technical Sessions

**5:15PM** Developing Interview Protocol for Engineering Capstone Design Course Student Competition Poster Presentation. IDETC2019-98594

*McKenzie Clark, Florida Institute of Technology, Melbourne, FL, United States*

**5:20PM** A Feature-based Approach to Function Modeling and Reasoning for Thermal-Fluid Systems Engineering Student Competition Poster Presentation. IDETC2019-98595

*LAKSHMI NARASIMHON ATHINARAYANA VENKATANARASIMHAN, Florida Institute of Technology, Melbourne, FL, United States, Chiradeep Sen, Florida Institute of Technology, Melbourne, FL, United States*

**5:25PM** An Evolutionary Algorithm Approach to Function Model Creation Student Competition Poster Presentation. IDETC2019-98597

*Amaninder Singh Gill, Florida Institute of Technology, Melbourne, FL, United States, Chiradeep Sen, Florida Institute of Technology, Melbourne, FL, United States*

**5:30PM** Examining Factors Influencing Student Motivation, Student Identity and Performance in Engineering Student Competition Poster Presentation. IDETC2019-98598

*Devanshi Shah, Florida Institute of Technology, Melbourne, FL, United States*

**5:35PM** The Effect of Varying FDM Parameters on the Tribological Performance of Engineering Thermoplastics Student Competition Poster Presentation. IDETC2019-98599

*Adam Madison, Florida Institute of Technology, Melbourne, FL, United States*

## TUESDAY, AUGUST, 20

### CIE-9

#### **AMS: SIMULATION IN ADVANCED MANUFACTURING**

##### Session CIE-9-1

#### **AMS: Optimization in Robotic and Manufacturing Systems**

##### **Malibu 8:00AM–9:00AM**

Session Organizer: **Mahesh Mani**, DOE, Maryland, MD, United States  
Session Co-Organizer: **Souma Chowdhury**, University At Buffalo, Buffalo, NY, United States

**8:00AM** JOB SHOP SCHEDULING OPTIMIZATION USING GENETIC ALGORITHM WITH GLOBAL CRITERION TECHNIQUE Technical Paper Publication. IDETC2019-98076

*ke xu, Stevens Institute of Technology, Hoboken, NJ, United States, Souran Manoochehri, Stevens Inst Of Tech, Hoboken, NJ, United States*

**8:20AM** Optimal Reconfiguration Path Decision Method For One RMT System Technical Paper Publication. IDETC2019-98234

*Sihan Huang, Cong Zeng, Guoxin Wang, Yan Yan, Beijing Institute of Technology, Beijing, China*

**8:40AM** Decentralized Informative Path Planning with Balanced Exploration-Exploitation for Swarm Robotic Search Technical Paper Publication. IDETC2019-97887

*Payam Ghassemi, Souma Chowdhury, University at Buffalo, Buffalo, NY, United States*

### CIE-14

#### **CAPPD: HUMAN MODELING-METHODS AND APPLICATIONS IN ENGINEERING**

##### Session CIE-14-1

#### **Human Modeling-Methods and Applications in Engineering**

##### **El Capitan A 8:00AM–9:00AM**

Session Organizer: **James Yang**, Texas Tech University - Dept of Mechanical Engineering, Lubbock, TX, United States

Session Co-Organizer: **Caterina Rizzi**, University of Bergamo, Dalmine, Italy

**8:00AM** OPTIMAL CAMERA CONFIGURATION FOR 3D SCANNING OF HUMAN HAND Technical Paper Publication. IDETC2019-97784

*Yusheng Yang, Willemijn Elkhuisen, Tao Hou, Tessa Essers, Delft University of Technology, Delft, Zuid-Holland, Netherlands, Yu Song, TU Delft, Delft, Netherlands*

**8:20AM** A NEW APPROACH FOR MEDICAL ASSESSMENT OF PATIENT'S INJURED SHOULDER Technical Paper Publication. IDETC2019-97889

*Andrea Vitali, University of Bergamo, Dalmine, Italy, Daniele Regazzoni, University of Bergamo, Dalmine (BG), OO, Italy, Caterina Rizzi, Federico Maffioletti, University of Bergamo, Dalmine, Italy*

**8:40AM** A Customer-to-Manufacturer Design Model for Custom Compression Casts Technical Paper Publication. IDETC2019-98043

*Yunbo Zhang, Rochester Institute of Technology, Rochester, NY, United States, Tsz Ho Kwok, Concordia University, Montreal, QC, Canada*

# Technical Sessions

**CIE-17**

## **SEIKM: KNOWLEDGE CAPTURE, REUSE, AND MANAGEMENT**

**Session CIE-17-1**

**SEIKM: Knowledge Capture, Reuse, and Management**

**Coronado 8:00AM–9:00AM**

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Session Organizer: **David C. Jensen**, *University of Arkansas, Fayetteville, AR, United States*

Session Co-Organizer: **Sundar Krishnamurty**, *University of Massachusetts Amherst, Amherst, MA, United States*

**8:00AM Multi-Scale Model Retrieval for Case**

**Recommendation in Manufacturability Optimization**

**Technical Paper Publication. IDETC2019-97085**

**Zhi Li**, *Institute of Machinery Manufacturing Technology, China Academy of Engineering Physics, Mianyang, Sichuan, China*, **Danchen Zhou, Bo Zhang**, *Institute of Machinery Manufacturing Technology, China Academy of Engineering Physics, Mianyang, Sichuan, China*

**8:30AM A SUPPLY CHAIN REFERENCE ONTOLOGY BASED ON BASIC FORMAL ONTOLOGY**

**Technical Paper Publication. IDETC2019-98278**

**Farhad Ameri**, *Texas State University, San Marcos, TX, United States*, **Boonserm kulvatanyou**, *NIST, Gaithersburg, MD, United States*

**CIE-14**

## **CAPPD: HUMAN MODELING-METHODS AND APPLICATIONS IN ENGINEERING**

**Session CIE-14-2**

**Human Modeling-Methods and Applications in Engineering**

**El Capitan A 9:10AM–10:30AM**

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Session Organizer: **Giorgio Colombo**, *Politecnico Di Milano, Milano, OO, Italy*

Session Co-Organizer: **Yujiang Xiang**, *Oklahoma State University, Stillwater, OK, United States*

**9:10AM REVIEW OF MODELS AND DEVICES FOR STROKE SURVIVOR'S UPPER EXTREMITY REHABILITATION**

**Technical Paper Publication. IDETC2019-97223**

**Shadman Tahmid**, *Texas Tech University, Lubbock, TX, United States*, **James Yang**, *Texas Tech University - Dept of Mechanical Engineering, Lubbock, TX, United States*, **Josep M. Font-Llagunes**, *Universitat Politècnica De Catalunya, Barcelona, Spain*

**9:30AM Effects of Head Supported Mass on Predicted Neck Musculoskeletal Loadings during Walking and Running**

**Technical Paper Publication. IDETC2019-97389**

**Xianlian Zhou**, *New Jersey Institute of Technology, Newark, NJ, United States*, **Xinyu Chen, Paulien E. Roos, Phillip Whitley**, *CFD Research Corporation, Huntsville, AL, United States*

**9:50AM**

**Muscle Force Prediction in OpenSim Using Skeleton Motion Optimization Results As Input Data**  
**Technical Paper Publication. IDETC2019-97520**

**Rahid Zaman, Yujiang Xiang**, *Oklahoma State University, Stillwater, OK, United States*, **Ritwik Rakshit**, *Texas Tech University, Lubbock, TX, United States*, **James Yang**, *Texas Tech University - Dept of Mechanical Engineering, Lubbock, TX, United States*

**10:10AM**

**Using Automated Use Case Generation for Early Design Stage Functional Failure and Human Error Analysis**  
**Technical Paper Publication. IDETC2019-98466**

**Lukman Irshad, H. Onan Demirel, Irem Y. Tumer**, *Oregon State University, Corvallis, OR, United States*

**CIE-19**

## **SEIKM: COMPLEX SYSTEMS ENGINEERING AND DESIGN**

**Session CIE-19-1**

**Complex Systems Engineering and Design**

**Coronado 9:10AM–10:30AM**

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Session Organizer: **Christopher Hoyle**, *Oregon State University, Corvallis, OR, United States*

Session Co-Organizer: **Chiradeep Sen**, *Florida Institute of Technology, Melbourne, FL, United States*

**9:10AM**

**COMPUTATIONAL DESIGN OF SCHEDULING STRATEGIES FOR MULTI-ROBOT COOPERATIVE 3D PRINTING**  
**Technical Paper Publication. IDETC2019-97640**

**Laxmi Poudel, Wenchao Zhou, Zhenghui Sha**, *University of Arkansas, Fayetteville, AR, United States*

**9:30AM**

**CONSTRUCTION OF MULTI-DOMAIN SYSTEM SIMULATION MODEL FOR TRADE STUDIES IN SYSTEM DESIGN CONSIDERING MULTIPLE SCENES**

**Technical Paper Publication. IDETC2019-98042**

**Kazuya Oizumi, Keita Ishida, Yoshihiro Uchibori, Kazuhiro Aoyama**, *The University of Tokyo, Tokyo, Japan*

**9:50AM**

**FINITE-STATE AUTOMATA-BASED REPRESENTATION OF DEVICE STATES FOR FUNCTION MODELING AND FORMAL DEFINITIONS OF SIGNAL-PROCESSING FUNCTIONS**  
**Technical Paper Publication. IDETC2019-98248**

**Ahmed Chowdhury, Xiaoyang Mao, LAKSHMI NARASIMHON ATHINARAYANA VENKATANARASIMHAN**, *Florida Institute of Technology, Melbourne, FL, United States*, **Chiradeep Sen**, *Florida Institute of Technology, Melbourne, FL, United States*

# Technical Sessions

**10:10AM**      **Toward a Functional Failure Analysis Method of Identifying and Mitigating Spurious System Emissions in a System of Systems**

**Technical Paper Publication.** IDETC2019-98255

*Douglas L. Van Bossuyt, Naval Postgraduate School, Monterey, CA, United States, Ryan Arlitt, Technical University of Denmark, Lyngby, Denmark*

**CIE-27**

## **SMART MANUFACTURING PANEL**

**Session CIE-27-1**

**Smart Manufacturing Panel**

**Malibu**      **9:10AM–10:30AM**

Session Organizer: **Mahesh Mani**, DOE, Maryland, MD, United States  
Session Co-Organizer: **Sudarsan Rachuri**, CESMII, Gaithersburg, MD, United States

**CIE-5**

## **ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING IN DESIGN AND MANUFACTURING**

**Session CIE-5-1**

**Artificial Intelligence and Machine Learning in Design and Manufacturing**

**El Capitan A**      **10:50AM–12:10PM**

Session Organizer: **Bryan O'Halloran**, Naval Postgraduate School, Monterey, CA, United States  
Session Co-Organizer: **Conrad Tucker**, Penn State University, State College, PA, United States

**10:50AM**      **From Scan Strategy to Melt Pool Prediction: a Neighboring-effect Modeling Method**

**Technical Paper Publication.** IDETC2019-98215

*Zhuo Yang, University of Massachusetts Amherst, Amherst, MA, United States, Yan Lu, Ho Yeung, NIST, Gaithersburg, MD, United States, Sundar Krishnamurty, University of Massachusetts Amherst, Amherst, MA, United States*

**11:16AM**      **Data and Knowledge Jointly Driving Model for Design Concept Generation**

**Technical Paper Publication.** IDETC2019-98411

*Kai Wang, Qiyu Liu, Sichuan University, Chengdu, China, Yan LI, Sichuan Univ, Chengdu, Sichuan, Ying Liu, Cardiff University, Cardiff, United Kingdom*

**11:42AM**      **Stress Field Prediction in Cantilevered Structures Using Convolutional Neural Networks**

**Technical Paper Publication.** IDETC2019-98472

*Zhenguo Nie, Haoliang Jiang, Levent Kara, Carnegie Mellon University, Pittsburgh, PA, United States*

**CIE-12**

## **AMS/SEIKM/CAPPD: DESIGN, SIMULATION AND OPTIMIZATION FOR ADDITIVE MANUFACTURING**

**Session CIE-12-1**

**Design, Simulation and Optimization for Additive Manufacturing**

**Coronado**      **10:50AM–12:10PM**

Session Organizer: **John Michopoulos**, U.S. Naval Research Laboratory, Washington, DC, United States

Session Co-Organizer: **Ahmad Barari**, University of Ontario Inst of Tech, Oshawa, ON, Canada

**10:50AM**      **Surrogate Models for the Efficient Estimation of Residual Fields Associated with Additively Manufactured Parts**

**Technical Paper Publication.** IDETC2019-98332

*Athanasios Iliopoulos, U.S. Naval Research Laboratory, W, DC, United States, John Steuben, US Naval Research Laboratory, Washington, DC, United States, Nicole Apetre, John Michopoulos, U.S. Naval Research Laboratory, Washington, DC, United States*

**11:10AM**      **Electron Backscatter Diffraction-Enabled Anisotropic Thermo-Elastic Analysis of Additively Manufactured Single Tracks**

**Technical Paper Publication.** IDETC2019-98351

*Andrew Birnbaum, US Naval Research Laboratory, Washington, DC, United States, John Michopoulos, U.S. Naval Research Laboratory, Washington, DC, United States, John Steuben, US Naval Research Laboratory, Washington, DC, United States, Athanasios Iliopoulos, U.S. Naval Research Laboratory, W, DC, United States*

**11:30AM**      **A Review Of Machine Learning Applications In Additive Manufacturing**

**Technical Paper Publication.** IDETC2019-98415

*Sayyeda Saadia Razvi, National Institute of Standards and Technology, Gaithersburg, MD, United States, Shaw Feng, Nist, Gaithersburg, MD, United States, Anantha Narayanan, University of Southern California, Los Angeles, CA, United States, Yung-Tsun Tina Lee, Paul Witherell, nist, Gaithersburg, MD, United States*

**11:50AM**      **Anisotropic Multicomponent Topology Optimization for Additive Manufacturing with Build Orientation Design and Stress-Constrained Interfaces**

**Technical Paper Publication.** IDETC2019-98480

*Yuqing Zhou, University of Michigan, Ann Arbor, MI, United States, Tsuyoshi Nomura, Toyota Research Institute of North America, Ann Arbor, MI, United States, Kazuhiro Saitou, University Of Michigan, Ann Arbor, MI, United States*

# Technical Sessions

## CIE-23 INDUSTRY PRACTICE: COMPUTER AND INFORMATION TECHNOLOGY TRENDS

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Session CIE-23-1  
Industry Practice: Computer and Information Technology Trends  
**Malibu 10:50AM–12:10PM**

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Session Organizer: **Marc Halpern**, Gartner, Inc., Stamford, CT, United States

**10:50AM** Modernizing Engineering IT: The Good, The Bad, and Making the Ugly - Less Ugly  
Technical Presentation. IDETC2019-98622

*Marc Halpern, Gartner, Inc., Stamford, CT, United States*

## CIE-5 ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING IN DESIGN AND MANUFACTURING

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Session CIE-5-2  
Artificial Intelligence and Machine Learning in Design and Manufacturing  
**EI Capitan A 2:10PM–3:50PM**

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Session Organizer: **Levent Kara**, Carnegie Mellon University, Pittsburgh, PA, United States  
Session Co-Organizer: **Piyush Pandita**, GE Research, West Lafayette, IN, United States

**2:10PM** A Standardized Representation of Convolutional Neural Networks for Reliable Deployment of Machine Learning models in the Manufacturing Industry  
Technical Paper Publication. IDETC2019-97095

*Max Ferguson, Stanford University, Palo Alto, CA, United States, Seongwoon Jeong, Stanford University, Stanford, CA, United States, Svetlana Levitan, IBM, Chicago, IL, United States, Anantha Narayanan, University of Southern California, Los Angeles, CA, United States, Rainer Burkhardt, SoftwareAG, San Diego, CA, United States, Tridivesh Jena, Zementis, San Diego, CA, United States, Yung-Tsun Tina Lee, nist, Gaithersburg, MD, United States, Kincho Law, Stanford Univ, Stanford, CA, United States*

**2:30PM** Domain randomization for detection and position estimation of multiples of a single object with applications to localizing bolts on structures  
Technical Paper Publication. IDETC2019-97393

*Ezra Ameperosa, Airforce Research Laboratory, Dayton, TX, United States, Pranav Bhounsule, The University of Texas at San Antonio, San Antonio, TX, United States*

**2:50PM** Machine Learning Assisted Prediction Of The Manufacturability Of Laser-based Powder Bed Fusion Process  
Technical Paper Publication. IDETC2019-97610

*Ying Zhang, Guoying Dong, Sheng Yang, Yaoyao Fiona Zhao, McGill University, Montreal, QC, Canada*

**3:10PM** Prediction of Nitrogen Concentration in Fuel Cells Using Data-driven Modeling  
Technical Paper Publication. IDETC2019-98477

*Tong Lin, Leiming Hu, Shawn Litster, Levent Kara, Carnegie Mellon University, Pittsburgh, PA, United States*

**3:30PM** Pixel To Stroke Sketch Generation Using Reinforcement Learning  
Technical Paper Publication. IDETC2019-98481

*Haizhou Wang, Penn State University, University Park, PA, United States, Conrad Tucker, Penn State University, State College, PA, United States*

## CIE-12 AMS/SEIKM/CAPPD: DESIGN, SIMULATION AND OPTIMIZATION FOR ADDITIVE MANUFACTURING

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Session CIE-12-2  
Design, Simulation and Optimization for Additive Manufacturing  
**Coronado 2:10PM–3:50PM**

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Session Organizer: **John Steuben**, US Naval Research Laboratory, Washington, DC, United States  
Session Co-Organizer: **Paul Witherell**, NIST, Gaithersburg, MD, United States

**2:10PM** Towards Efficient Thermal Simulation of Powder Bed Fusion on Path Level  
Technical Paper Publication. IDETC2019-98046

*Yaqi Zhang, Vadim Shapiro, University of Wisconsin-Madison, Madison, WI, United States, Paul Witherell, NIST, Gaithersburg, MD, United States*

**2:30PM** Phase Transformation Advancements of the Enriched Analytic Solution Method for Additive Manufacturing Applications  
Technical Paper Publication. IDETC2019-98189

*John Steuben, Andrew Birnbaum, US Naval Research Laboratory, Washington, DC, United States, Athanasios Iliopoulos, U.S. Naval Research Laboratory, W, DC, United States, John Michopoulos, U.S. Naval Research Laboratory, Washington, DC, United States*

**2:50PM** DESIGN OF NON-PERIODIC LATTICE STRUCTURES BY ALLOCATING PRE-OPTIMIZED BUILDING BLOCKS  
Technical Paper Publication. IDETC2019-98204

*Haejoon Choi, Adrian M. Chung Baek, Namhun Kim, Ulsan National Institute of Science and Technology, Ulsan, Korea (Republic)*



# Technical Sessions

**3:10PM DIRECT SOLID ELEMENT SLICING IN TOPOLOGY OPTIMIZATION FOR ADDITIVE MANUFACTURING**  
Technical Paper Publication. IDETC2019-98452

*Dylan Bender, University of Ontario Institute of Technology, London, ON, Canada, Ahmad Barari, University of Ontario Inst of Tech, Oshawa, ON, Canada*

**3:30PM Enabling Performance Qualification of Additively Manufactured Parts under Multiaxial Loading Emulating In-Service Conditions**  
Technical Paper Publication. IDETC2019-98458

*John Michopoulos, U.S. Naval Research Laboratory, Washington, DC, United States, Athanasios Iliopoulos, U.S. Naval Research Laboratory, W, DC, United States, John Steuben, US Naval Research Laboratory, Washington, DC, United States, Trung Nguyen, Nam Phan, Naval Air Systems Command, Patuxent River, MD, United States*

**CIE-18**  
**SEIKM: SMART MANUFACTURING INFORMATICS**  
Session CIE-18-1  
**Smart Manufacturing Informatics**  
**Malibu 2:10PM–3:50PM**

Session Organizer: **Ashis G. Banerjee**, University of Washington, Seattle, WA, United States  
Session Co-Organizer: **Farhad Ameri**, Texas State University, San Marcos, TX, United States

**2:10PM Framework for Design from Manufacturing Data Mapping**  
Technical Paper Publication. IDETC2019-97130

*Douglas Eddy, University of Massachusetts at Amherst, Amherst, MA, United States, Sundar Krishnamurty, University of Massachusetts Amherst, Amherst, MA, United States, Ian Grosse, University of Massachusetts, Amherst, MA, United States, Mark Steudel, Mike Shimazu, Raytheon IDS, Waltham, MA, United States*

**2:30PM On Practice and Theory of Constructive Composite Geometry and Topology**  
Technical Paper Publication. IDETC2019-97134

*Thomas Hedberg, Allison Barnard Feeney, National Institute of Standards and Technology, Gaithersburg, MD, United States, Vijay Srinivasan, NIST, Gaithersburg, MD, United States*

**2:50PM Digital Twins for Space Factory 4.0**  
Technical Paper Publication. IDETC2019-97151

*Thiago Weber Martins, TU Darmstadt - Computer Integrated Design, Darmstadt, OO, Germany, Reiner Anderl, TU Darmstadt, Darmstadt, Hessen, Germany*

**3:10PM A FRAMEWORK FOR AUTOMATING MAYNARD OPERATION SEQUENCE TECHNIQUE STUDIES**  
Technical Paper Publication. IDETC2019-97692

*Rahul Sharan Renu, Francis Marion University, Florence, SC, United States*

**3:30PM Extraction and Analysis of Spatial Correlation Micrograph Features for Traceability in Manufacturing**  
Technical Paper Publication. IDETC2019-98378

*Adam Dachowicz, Mikhail Atallah, Jitesh Panchal, Purdue University, West Lafayette, IN, United States*

**CIE-5**  
**ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING IN DESIGN AND MANUFACTURING**  
Session CIE-5-3  
**Artificial Intelligence and Machine Learning in Design and Manufacturing**  
**El Capitan A 4:10PM–5:50PM**

Session Organizer: **Conrad Tucker**, Penn State University, State College, PA, United States  
Session Co-Organizer: **Seung Ki Moon**, Nanyang Technological University, Singapore, Singapore

**4:10PM Automatically Generating 60,000 CAD Variants for Big Data Applications**  
Technical Paper Publication. IDETC2019-97378

*Satchit Ramnath, Payam Haghghi, Ji Hoon Kim, The Ohio State University, Columbus, OH, United States, Duane Detwiler, Honda R & D Americas Inc, Raymond, OH, United States, Michael Berry, Honda R&D Americas Inc., Raymond, OH, United States, Jami Shah, The Ohio State University, Columbus, OH, United States, Nikola Aulig, Patricia Wollstadt, Stefan Menzel, Honda Research Institute Europe GmbH, Offenbach, Germany*

**4:43PM Reinforcement Learning Content Generation For Virtual Reality Applications**  
Technical Paper Publication. IDETC2019-97711

*Christian Lopez, Penn State University, Newport, PA, United States, Omar Ashour, Penn State University, Erie, PA, United States, Conrad Tucker, Penn State University, State College, PA, United States*

**5:16PM Machine Learning Approach for the Prediction of Mechanical Properties Based on the Steel Microstructure Volume Fraction Ratio**  
Technical Presentation. IDETC2019-97671

*Im Doo Jung, Korea Institute of Materials Science, Changwon, Korea (Republic), Hyo kyung Sung, Gyungsang National University, Jin-Ju, Korea (Republic), Seung Ki Moon, Nanyang Technological University, Singapore, Singapore*



# Technical Sessions

## CIE-7

### **AMS: COMPUTATIONAL MULTIPHYSICS APPLICATIONS**

#### Session CIE-7-1

#### **AMS: Computational Multiphysics Applications**

**Malibu 4:10PM–5:50PM**

Session Organizer: **John Michopoulos**, U.S. Naval Research Laboratory, Washington, DC, United States

Session Co-Organizer: **Brian Dennis**, University of Texas at Arlington, Arlington, TX, United States

#### **4:10PM IMPROVEMENT OF THERMAL PERFORMANCE OF PIN FIN HEAT SINK USING DIFFERENT TYPES OF PERFORATIONS: A STUDY UNDER NATURAL CONVECTION**

Technical Paper Publication. IDETC2019-97514

**Aashish Kumar**, Indian Institute of Technology Khargapur, Kharagpur, West Bengal, India, **Manoj Kumar Mondal**, Indian Institute of Technology Khargapur, Kharagpur, West Bengal, India

#### **4:30PM On the Effect of Glassy Coatings on the Wear of a Sliding Contact via Multiphysics Modeling**

Technical Paper Publication. IDETC2019-97677

**John Michopoulos**, U.S. Naval Research Laboratory, Washington, DC, United States, **Athanasios Iliopoulos**, U.S. Naval Research Laboratory, W, DC, United States, **John Steuben**, **Andrew Birnbaum**, US Naval Research Laboratory, Washington, DC, United States, **Nicole Apetre**, U.S. Naval Research Laboratory, Washington, DC, United States

#### **4:50PM A PARAMETRIC MODELING APPROACH FOR PREDICTION OF LOAD DISTRIBUTION DUE TO FLUID STRUCTURE INTERACTION ON AIRCRAFT STRUCTURES**

Technical Paper Publication. IDETC2019-98008

**Recep M. Gorgularslan**, **Ahmet Barutcu**, TOBB University of Economics and Technology, Ankara, Cankaya, Turkey

#### **5:10PM REVERSE ENGINEERING AND OPTIMIZATION OF A STEERING MECHANISM COMPONENT IN A COMPETITION GROUND VEHICLE**

Technical Paper Publication. IDETC2019-98075

**Matheo Lopez-Pachon**, **Diego Gonzalez-Cardenas**, Universidad de los Andes, Bogota, Colombia, **Andres Gonzalez-Mancera**, Universidad de los Andes, Bogotá, Colombia

#### **5:30PM A Computational Model of Wind Turbine Blade Erosion Induced by Raindrop Impact**

Technical Presentation. IDETC2019-98684

**Weifei Hu**, **Xiaobo Wang**, Zhejiang University, Hangzhou, Zhejiang, China, **Yeqing Wang**, Mississippi State University, Mississippi State, MS, United States

## CIE-12

### **AMS/SEIKM/CAPPD: DESIGN, SIMULATION AND OPTIMIZATION FOR ADDITIVE MANUFACTURING**

#### Session CIE-12-3

#### **Design, Simulation and Optimization for Additive Manufacturing**

**Coronado 4:10PM–5:50PM**

Session Organizer: **Seung Ki Moon**, Nanyang Technological University, Singapore, Singapore

Session Co-Organizer: **Tsz Ho Kwok**, Concordia University, Montreal, QC, Canada

#### **4:10PM Cellular Level Set In B-Splines (CLIBS) For Modeling And Topology Optimization Of Cellular Structures**

Technical Paper Publication. IDETC2019-97336

**Michael Yu Wang**, Hong Kong University of Science & Technology, Hong Kong, China, **Hongming ZONG**, **Qingping MA**, **Ye TIAN**, Hong Kong University of Science and Technology, Hong Kong, China, **Mingdong ZHOU**, Shanghai Jiao Tong University, Shanghai, China

#### **4:30PM Simulation of Nucleation and Grain Growth in Selective Laser Melting of Ti-6Al-4V Alloy**

Technical Paper Publication. IDETC2019-97684

**Dehao Liu**, **Yan Wang**, Georgia Institute of Technology, Atlanta, GA, United States

#### **4:50PM OPTIMIZING THE PRINTING OF CONDUCTIVE TRACES IN 3D PRINTED ELECTRONICS**

Technical Paper Publication. IDETC2019-97752

**Tao Hou**, **Yusheng Yang**, **Jun Xu**, **Willemijn Elkhuizen**, **Jo Geraedts**, Delft University of Technology, Delft, Zuid-Holland, Netherlands, **Yu Song**, TU Delft, Delft, Netherlands

#### **5:10PM DIMENSIONAL PREDICTION FOR FDM MACHINES USING ARTIFICIAL NEURAL NETWORK AND SUPPORT VECTOR REGRESSION**

Technical Paper Publication. IDETC2019-97963

**Jiaqi Lyu**, Stevens Institute of Technology, Hoboken, NJ, United States, **Souran Manoochehri**, Stevens Inst Of Tech, Hoboken, NJ, United States

#### **5:30PM Towards Selective Volumetric Additive Manufacturing and Processing of Ceramics**

Technical Paper Publication. IDETC2019-98195

**Athanasios Iliopoulos**, U.S. Naval Research Laboratory, W, DC, United States, **John Michopoulos**, **Benjamin Y. Rock**, **Edward Gorzkowski**, U.S. Naval Research Laboratory, Washington, DC, United States, **John Steuben**, **Andrew Birnbaum**, US Naval Research Laboratory, Washington, DC, United States, **Benjamin Graber**, **Luke A. Johnson**, U.S. Naval Research Laboratory, Washington, DC, United States

# Technical Sessions

**WEDNESDAY, AUGUST, 21**

**CIE-2**

**COMPUTER-AIDED PRODUCT AND PROCESS**

**DEVELOPMENT (CAPPD)**

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**Session CIE-2-1**

**Computer-Aided Product and Process Development (CAPPD)**

**El Capitan A 8:00AM–9:40AM**

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Session Organizer: **Richard Crawford**, Univ Of Texas At Austin, Austin, TX, United States

Session Co-Organizer: **Joshua Summers**, Clemson University, Clemson, SC, United States

**8:00AM Investigating Usability of an Innovation Management Decision Aid**

**Technical Paper Publication. IDETC2019-97801**

*Elizabeth Gendreau, Joshua Summers, Clemson University, Clemson, SC, United States, Lamiae Benhayoun-Sadafiyine, Université Internationale de Rabat, Rabat, Morocco, Marie-Anne Le Dain, Institut Polytechnique de Grenoble, Grenoble, France*

**8:20AM A Spatial Linkage Exoskeleton for a Shape-Adaptive Mobile Robot**

**Technical Paper Publication. IDETC2019-98221**

*David Geyer, Cameron Turner, Clemson University, Clemson, SC, United States*

**8:40AM Reconstruction of Gap-Free Intersections for Trimmed NURBS Surfaces**

**Technical Paper Publication. IDETC2019-98372**

*Benjamin Urick, nVariate, Inc., Austin, TX, United States, Richard Crawford, Univ Of Texas At Austin, Austin, TX, United States, Thomas Hughes, The University of Texas at Austin, Austin, TX, United States, Elaine Cohen, Univ Of Utah, Salt Lake City, UT, United States, Richard Riesenfeld, University of Utah, Salt Lake City, UT, United States*

**9:00AM GEOMETRIC COMPLEXITY ESTIMATION OF CONTINUOUS SURFACES FOR FITTING PROCESSES**

**Technical Paper Publication. IDETC2019-98456**

*Hossein Gohari bahabadi, University of Ontario Institute of Technology, Oshawa, ON, Canada, Ahmad Barari, University of Ontario Inst of Tech, Oshawa, ON, Canada*

**9:20AM Development of Three-Nozzle Extrusion System for Conformal Multi-Resolution 3D Printing with a Robotic Manipulator**

**Technical Paper Publication. IDETC2019-98069**

*Yeo Jung Yoon, University of Southern California, Los Angeles, CA, United States, Minsok Yon, Sung Eun Jung, USC, Los Angeles, CA, United States, Satyandra K. Gupta, University of Southern California, Los Angeles, CA, United States*

**CIE-3**

**VIRTUAL ENVIRONMENTS AND SYSTEMS (VES)**

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**Session CIE-3-1**

**Virtual Environments and Systems (VES)**

**Coronado 8:00AM–9:40AM**

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Session Organizer: **Andrea Vitali**, University of Bergamo, Dalmine, Italy

Session Co-Organizer: **Atif Mahboob**, Technische Universität Ilmenau, Ilmenau, Germany

**8:00AM Sparse scaling iterative closet point for rail profile inspection**

**Technical Paper Publication. IDETC2019-97160**

*Bing Yi, Yue Yang, Long Liu, Central South University, Changsha, Hunan, China*

**8:25AM Smartphone as a Stand-Alone Device for Rendering, Visualization and Tracking for Use During Product Development in Virtual Reality (VR)**

**Technical Paper Publication. IDETC2019-97173**

*Atif Mahboob, Technische Universität Ilmenau, Ilmenau, Germany, Stephan Husung, :em engineering methods AG, Darmstadt, Germany, Christian Weber, Technische Universität Ilmenau, Ilmenau, Germany, Andreas Liebal, Technical University of Ilmenau, Ilmenau, Germany, Heidi Krömker, Technische Universität Ilmenau, Ilmenau, Germany*

**8:50AM Using Virtual Reality To Test Human-Robot Interaction During a Collaborative Task**

**Technical Paper Publication. IDETC2019-97415**

*Roberta Etzi, Siyuan Huang, Politecnico di Milano, Milan, Italy, Giulia Wally Scurati, Poitecnico di Milano, Milan, Italy, Shilei Lyu, Francesco Ferrise, Politecnico di Milano, Milan, Italy, Alberto Gallace, University of Milano-Bicocca, Milan, Italy, Andrea Gaggioli, Alice Chirico, Università Cattolica del Sacro Cuore, Milan, Italy, Marina Carulli, Politecnico Di Milano, Milano, MI, Italy, Monica Bordegoni, Politecnico Di Milano Dip. Mecc., 20156 Milan, Italy*

**9:15AM A Multisensory Virtual Reality system for astronauts' entertainment and relaxation**

**Technical Paper Publication. IDETC2019-97836**

*Marina Carulli, Politecnico Di Milano, Milano, MI, Italy, Monica Bordegoni, Politecnico Di Milano Dip. Mecc., 20156 Milan, Italy, Francesca Bernecich, Elena Spadoni, Patrizia Bolzan, Politecnico di Milano, Milano, Italy*

# Technical Sessions

## CIE-8

### AMS: UNCERTAINTY QUANTIFICATION IN SIMULATION AND MODEL VERIFICATION & VALIDATION

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#### Session CIE-8-1

#### AMS: Uncertainty Quantification in Simulation and Model Verification & Validation

**Malibu 8:00AM–9:40AM**

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Session Organizer: **Yan Wang**, Georgia Institute of Technology, Atlanta, GA, United States

Session Co-Organizer: **Zhimin Xi**, Rutgers University, Piscataway, NJ, United States

**8:00AM** An Uncertainty and Sensitivity Analysis Tool for Building Thermal Energy Consumption: A Performance Comprehension of Static and Dynamic Response Analyses  
Technical Paper Publication. IDETC2019-98510

*Rasool Koosha, Fatemeh Shahsavari, Texas A&M University, College Station, TX, United States*

**8:20AM** A Performance Comprehension of Various Numerical Estimators for Variance-Based Sensitivity Analysis in Building Energy Simulations  
Technical Paper Publication. IDETC2019-98490

*Rasool Koosha, Fatemeh Shahsavari, Texas A&M University, College Station, TX, United States*

**8:40AM** Model Bias Characterization for Effective States Estimation of Lithium-ion Batteries  
Technical Paper Publication. IDETC2019-97954

*Modjtaba Dahmardeh, Rutgers, Piscataway, NJ, United States, Zhimin Xi, Rutgers University, Piscataway, NJ, United States*

**9:00AM** On-the-Fly Sensitivity Analysis in Kinetic Monte Carlo Simulation  
Technical Presentation. IDETC2019-97258

*Yan Wang, Georgia Institute of Technology, Atlanta, GA, United States*

**9:20AM** Robust Topology Optimization for Design of Optimal Heat Transfer Systems  
Technical Presentation. IDETC2019-98382

*Xuchun Ren, Georgia Southern University, Statesboro, GA, United States, Xiaodong Zhang, Chongqing Jiaotong University, Chongqing, China*

## CIE-2

### COMPUTER-AIDED PRODUCT AND PROCESS DEVELOPMENT (CAPPD)

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#### Session CIE-2-2

#### Computer-Aided Product and Process Development (CAPPD)

**El Capitan A 10:00AM–11:40AM**

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Session Organizer: **Chiradeep Sen**, Florida Institute of Technology, Melbourne, FL, United States

Session Co-Organizer: **Chih-Hsing Chu**, National Tsing Hua Univ, Hsinchu 300, Taiwan

**10:00AM** CONCURRENT MULTI-PROCESS DESIGN SYNTHESIS: FRAMEWORK AND ALGORITHM  
Technical Paper Publication. IDETC2019-97076

*Bin Chen, Jie Hu, Jin Qi, Weixing Chen, Shanghai Jiao Tong University, Shanghai, China*

**10:20AM** High Accuracy On-machine Inspection Based On Rotation Theory Of Multi-axis Machine Tool  
Technical Paper Publication. IDETC2019-97508

*Neng Wan, Qixin Zhuang, Zhiyong Chang, Rong Mo, Northwestern Polytechnical University, Xi'an, Shaanxi, China*

**10:40AM** Rapid Investment Casting: Design and Manufacturing Technologies  
Technical Paper Publication. IDETC2019-97554

*Christopher T. Richard, Tsz Ho Kwok, Concordia University, Montreal, QC, Canada*

**11:00AM** Customized Designs of Short Thumb Orthoses Using 3D Hand Parametric Models  
Technical Presentation. IDETC2019-97744

*I-Jan Wang, Tunghai University, Taichung, Taiwan, Chien-Hsiou Liu, Fu Jen Catholic University, New Taipei City, Taiwan, Chih-Hsing Chu, National Tsing Hua Univ, Hsinchu 300, Taiwan*

**11:20AM** 3D user interface for conceptual design and prototyping of automotive chassis  
Technical Presentation. IDETC2019-98520

*Saurabh Jadhav, Zhuoqun Xu, University of California, San Diego, La Jolla, CA, United States, Michael Tolley, UC San Diego, La Jolla, CA, United States, Jurgen Schulze, University of California, San Diego & Qualcomm Institute, La Jolla, CA, United States*

# Technical Sessions

## CIE-3

### VIRTUAL ENVIRONMENTS AND SYSTEMS (VES)

#### Session CIE-3-2

#### Virtual Environments and Systems (VES)

**Coronado 10:00AM–11:40AM**

Session Organizer: **Andrea Vitali**, University of Bergamo, Dalmine, Italy

Session Co-Organizer: **Atif Mahboob**, Technische Universität Ilmenau, Ilmenau, Germany

#### 10:00AM An Augmented Reality-based Training System for Manual Milling Operations

Technical Paper Publication. IDETC2019-97844

**Tung-Jui Chuang, Chih-Kai Yang, Shana Smith**, National Taiwan University, Taipei, Taiwan

#### 10:25AM TOWARDS A BROAD USE OF GAMIFICATION BASED ON HAND TRACKING IN POST STROKE PATIENTS

Technical Paper Publication. IDETC2019-97926

**Daniele Regazzoni**, University of Bergamo, Dalmine (BG), OO, Italy, **Andrea Vitali, Caterina Rizzi**, University of Bergamo, Dalmine, Italy

#### 10:50AM Do Autonomous Vehicle Driving Styles Affect User State? A Preliminary Investigation

Technical Paper Publication. IDETC2019-98186

**Yuan Shi, Wenhui Huang**, Politecnico di Milano, Milano, MI, Italy, **Federico Cheli**, Politecnico di Milano, Milan, Italy, **Monica Bordegoni**, Politecnico Di Milano Dip. Mecc., 20156 Milan, Italy, **Giandomenico Caruso**, Politecnico di Milano, Milan, Italy

#### 11:15AM Mobile Based Real-Time Occlusion Between Real And Digital Objects In Augmented Reality

Technical Paper Publication. IDETC2019-98440

**Pranav Jain, Conrad Tucker**, Penn State University, State College, PA, United States

## CIE-8

### AMS: UNCERTAINTY QUANTIFICATION IN SIMULATION AND MODEL VERIFICATION & VALIDATION

#### Session CIE-8-2

#### AMS: Uncertainty Quantification in Simulation and Model Verification & Validation

**Malibu 10:00AM–11:40AM**

Session Organizer: **Chao Hu**, Iowa State Univ., Ames, IA, United States

Session Co-Organizer: **Ilias Bilonis**, Purdue University, West Lafayette, IN, United States

#### 10:00AM Stochastic Simulation of Turbine Engine Component Under Aleatory and Epistemic Uncertainty

Technical Paper Publication. IDETC2019-97764

**Austin McKeand**, Georgia Institute of Technology, Atlanta, GA, United States, **Recep M. Gorgularslan**, TOBB University of Economics and Technology, Ankara, Cankaya, Turkey, **Seung-kyum Choi**, Georgia Tech, Atlanta, GA, United States

#### 10:20AM Model Based Root Cause Analysis of Manufacturing Quality Problems Using Uncertainty Quantification and Sensitivity Analysis

Technical Paper Publication. IDETC2019-97766

**Kevin Otto**, Aalto University, Sioux Falls, SD, United States, **Josefina Sanchez Mosqueda**, Aalto University, Aalto, Finland

#### 10:40AM sBF-BO-2CoGP: A sequential bi-fidelity constrained Bayesian optimization for design applications

Technical Paper Publication. IDETC2019-97986

**Anh Tran, Tim Wildey**, Sandia National Laboratories, Albuquerque, NM, United States, **Scott McCann**, Xilinx Inc., San Jose, CA, United States

#### 11:00AM Deep active subspaces - a scalable method for high-dimensional uncertainty propagation

Technical Paper Publication. IDETC2019-98099

**Rohit Tripathy, Ilias Bilonis**, Purdue University, West Lafayette, IN, United States

#### 11:20AM A Reliability Model Validation Method for Mitigating the Effects of Measurement Uncertainty

Technical Paper Publication. IDETC2019-98202

**Mohammadkazem Sadoughi, Meng Li**, Iowa State University, Ames, IA, United States, **Joseph Beck**, Perceptive Engineering Analytics, LLC, Minneapolis, MN, United States, **Chao Hu**, Iowa State Univ., Ames, IA, United States

## 45th Design Automation Conference (DAC) MONDAY, AUGUST, 19

### DAC-2

#### ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

#### Session DAC-2-1

#### Artificial Intelligence and Machine Learning

**El Capitan B 8:00AM–9:00AM**

#### 8:00AM LEARNING TO DESIGN FROM HUMANS: IMITATING HUMAN DESIGNERS THROUGH DEEP LEARNING

Technical Paper Publication. IDETC2019-97399

**Ayush Raina**, Carnegie Mellon University, Pittsburgh, PA, United States, **Christopher McComb**, The Pennsylvania State University, State College, PA, United States, **Jonathan Cagan**, Carnegie Mellon Univ, Pittsburgh, PA, United States



# Technical Sessions

**8:20AM ANALYZING CUSTOMER NEEDS OF PRODUCT ECOSYSTEMS USING ONLINE PRODUCT REVIEWS**  
Technical Paper Publication. IDETC2019-97642

*Feng Zhou, Jackie Ayoub, University of Michigan, Dearborn, Dearborn, MI, United States, Qianli Xu, Institute for Infocomm Research, Singapore, Singapore, Jessie Yang, University of Michigan, Ann Arbor, Ann Arbor, MI, United States*

**8:40AM Deep Reinforcement Learning For Transfer Of Control Policies**  
Technical Paper Publication. IDETC2019-97689

*James Cunningham, Penn State University, State College, PA, United States, Simon Miller, Michael Yukish, Penn State Applied Research Laboratory, University Park, PA, United States, Timothy W. Simpson, Penn State University, University Park, PA, United States, Conrad Tucker, Penn State University, State College, PA, United States*

## DAC-14 HUMAN-CENTERED DESIGN

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Session DAC-14-1

Human-Centered Design  
Avila B 8:00AM–9:00AM

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**8:00AM An Automated Approach to Recording and Analyzing Design Activities Using A Graphical User Interface**  
Technical Paper Publication. IDETC2019-98226

*Fares M. Adly Taha, Ramez M. Adly Taha, Keegan West, Mohammad Fazelpour, University of Maryland, College Park, MD, United States, Jeffrey W. Herrmann, Univ Of Maryland, College Park, MD, United States, Matthew Anthony Polvinale, University of Maryland, College Park, MD, United States*

**8:30AM TEC/TAC: Explicit Representation of User Actions in the Product Design Space**  
Technical Paper Publication. IDETC2019-98400

*Tyler Stapleton, Brigham Young University, Lindon, UT, United States, Trent Owens, Christopher Mattson, Brigham Young University, Provo, UT, United States, Carl Sorensen, Brigham Young Univ, Provo, UT, United States, michael anderson, usafa, usafa, CO, United States*

## DAC-18 PLATFORM ARCHITECTURE AND PRODUCT FAMILY DESIGN

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Session DAC-18-1

Platform Architecture and Product Family Design  
Avila A 8:00AM–9:00AM

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**8:00AM Complexity Reduction in Mass Customization To Facilitate Better Decision Support**  
Technical Paper Publication. IDETC2019-97369

*Jai Nath Banerjee, Madhura Mundale, Adnan Sachche, The Pennsylvania State University, University Park, PA, United States, Christopher McComb, The Pennsylvania State University, State College, PA, United States*

**8:30AM Design for Nonassembly: Current Status and Future Directions**  
Technical Paper Publication. IDETC2019-97608

*Sangjin Jung, Rianne E. Laureijs, Christophe Combemale, Kate Whitefoot, Carnegie Mellon University, Pittsburgh, PA, United States*

## DAC-2 ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

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Session DAC-2-2

Artificial Intelligence and Machine Learning  
El Capitan B 9:10AM–10:30AM

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**9:10AM Machine Learning-Augmented Stochastic Search for the Automated Synthesis and Optimization of Cooling Channels**  
Technical Paper Publication. IDETC2019-97830

*Jonas Schwarz, ETH Zürich, Zürich, Switzerland, Kristina Shea, ETH Zurich, Zurich, Switzerland*

**9:30AM A Neuroevolution-based Learning of Reciprocal Maneuver for Collision Avoidance in Quadcopters under Pose Uncertainties**  
Technical Paper Publication. IDETC2019-97975

*Amir Behjat, Krushang Gabani, Souma Chowdhury, University at Buffalo, Buffalo, NY, United States*

**9:50AM GAUSSIAN PROCESS EMULATION FOR BIG DATA IN DATA-DRIVEN METAMATERIALS DESIGN**  
Technical Paper Publication. IDETC2019-98027

*Ramin Bostanabad, Yu-Chin Chan, Northwestern University, Evanston, IL, United States, Liwei Wang, Ping Zhu, Shanghai Jiao Tong University, Shanghai, China, Wei Chen, Northwestern University, Evanston, IL, United States*

**10:10AM Multi-fidelity Physics-constrained Neural Network and Its Application in Materials Modeling**  
Technical Paper Publication. IDETC2019-98115

*Dehao Liu, Yan Wang, Georgia Institute of Technology, Atlanta, GA, United States*

## DAC-3 DATA-DRIVEN DESIGN

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Session DAC-3-1

Data-Driven Design  
Avila A 9:10AM–10:30AM

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# Technical Sessions

**9:10AM** A Digital Twin-Driven Improved Design Approach of Drawing Bench for Brazing Material  
Technical Paper Publication. IDETC2019-97437

*bingtao hu, Yixiong Feng, Yicong Gao, hao zheng, Jianrong Tan, zhejiang university, hangzhou, zhejiang, China*

**9:30AM** Computer-Aided Design Ideation Using InnoGPS  
Technical Paper Publication. IDETC2019-97587

*Jianxi Luo, Serhad Sarica, Singapore University of Technology and Design, Singapore, OO, Singapore, Kristin Wood, Singapore University of Technology and Design, Austin, TX, United States*

**9:50AM** Product Service System Design in New Situations: Prediction of Demand Surfaces from Environment  
Technical Paper Publication. IDETC2019-97691

*Bryan Watson, Georgia Tech, Atlanta, GA, United States, Cassandra Telenko, Georgia Institute of Technology, Atlanta, GA, United States*

**10:10AM** Pseudo-Rigid Body Dynamic Modeling of Compliant Members for Design  
Technical Paper Publication. IDETC2019-97881

*- Vedant, University of Illinois, Urbana, IL, United States, James T. Allison, University of Illinois at Urbana-Champaign, Urbana, IL, United States*

## DAC-21 SUSTAINABLE DESIGN

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Session DAC-21-1  
Sustainable Design

**Avila B** 9:10AM–10:30AM

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**9:10AM** A Computational Framework to Support Social Entrepreneurs in Creating Value for Rural Communities in India  
Technical Paper Publication. IDETC2019-97375

*Abhishek Yadav, TCS Research, Pune, Maharashtra, India, Ashok Das, Sunmokscha, Bangalore, India, Janet K. Allen, Univ of Oklahoma, Norman, OK, United States, Farrokh Mistree, University of Oklahoma, Norman, OK, United States*

**9:30AM** INTEGRATING QUALITY OF LIFE IN SOCIOTECHNICAL DESIGN: MICROGRID DESIGN TOOLS AND SOCIAL INDICATORS  
Technical Paper Publication. IDETC2019-98005

*Hailie Suk, University At Buffalo, Amherst, NY, United States, John Hall, University At Buffalo, Buffalo, NY, United States*

**9:50AM** Extracting Customer Perceptions of Product Sustainability From Online Reviews  
Technical Paper Publication. IDETC2019-98233

*Nasreddine El-Dehaibi, Erin F. MacDonald, Stanford University, Stanford, CA, United States*

**10:10AM** Agent-Based Modeling of Decisions and Developer Actions in Wind Farm Landowner Contract Acceptance  
Technical Paper Publication. IDETC2019-98387

*Sita M. Syal, Yiqing Ding, Erin F. MacDonald, Stanford University, Stanford, CA, United States*

## DAC-3 DATA-DRIVEN DESIGN

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Session DAC-3-2

Data-Driven Design

**Avila A** 10:50AM–12:10PM

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**10:50AM** CHECKING THE AUTOMATED CONSTRUCTION OF FINITE ELEMENT SIMULATIONS FROM DIRICHLET BOUNDARY CONDITIONS  
Technical Paper Publication. IDETC2019-98000

*Kevin Chiu, University of Maryland, College Park, College Park, MD, United States, Mark Fuge, University of Maryland, College Park, MD, United States*

**11:10AM** USING BAYESIAN OPTIMIZATION WITH KNOWLEDGE TRANSFER FOR HIGH COMPUTATIONAL COST DESIGN- A CASE STUDY IN PHOTOVOLTAICS  
Technical Paper Publication. IDETC2019-98111

*Mine Kaya, Texas A&M University, College Station, TX, United States, Shima Hajimirza, MEOB 308, 3123 TAMU, College Station, TX, United States*

**11:30AM** DATA-DRIVEN DYNAMIC NETWORK MODELING FOR ANALYZING THE EVOLUTION OF PRODUCT COMPETITIONS  
Technical Paper Publication. IDETC2019-98385

*Jian Xie, Beijing Institute of Technology, Beijing, Beijing, China, Youyi Bi, Northwestern University, Evanston, IL, United States, Zhenghui Sha, University of Arkansas, Fayetteville, AR, United States, Mingxian Wang, Ford Motor Company, Dearborn, MI, United States, Yan Fu, Ford Motor Company, Bloomfield Hills, MI, United States, Noshir Contractor, Northwestern University, Evanston, IL, United States, lin gong, beijing institute of technology, beijing, China, Wei Chen, Northwestern University, Evanston, IL, United States*

**11:50AM** 3D Shape Synthesis for Conceptual Design and Optimization Using Variational Autoencoders  
Technical Paper Publication. IDETC2019-98525

*Wentai Zhang, Zhangsihao Yang, Haoliang Jiang, Suyash Nigam, Carnegie Mellon University, Pittsburgh, PA, United States, Soji Yamakawa, Carnegie Mellon Univ, Pittsburgh, PA, United States, Tomotake Furuhashi, Carnegie Mellon University, Pittsburgh, PA, United States, Kenji Shimada, CMU, Pittsburgh, PA, PA, United States, Levent Kara, Carnegie Mellon University, Pittsburgh, PA, United States*

# Technical Sessions

## DAC-5 DESIGN AND OPTIMIZATION OF SUSTAINABLE ENERGY SYSTEMS

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### Session DAC-5-1

#### Design and Optimization of Sustainable Energy Systems

**El Capitan B 10:50AM–12:10PM**

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**10:50AM** Sustainable Design of Residential Net-Zero Energy Buildings: A Multi-Phase and Multi-Objective Optimization Approach  
Technical Paper Publication. IDETC2019-97171

*Lan Lan*, Singapore University of Technology and Design, Singapore, Singapore, *Kristin Wood*, Singapore University of Technology and Design, Austin, TX, United States, *Chau Yuen*, Singapore University of Technology and Design, Singapore, Singapore

**11:10AM** Designing Optimal Arbitrage Policies for Distributed Energy Systems in Building Clusters Using Reinforcement Learning

Technical Paper Publication. IDETC2019-97190

*Philip Odonkor*, University at Buffalo, Buffalo, NY, United States, *Kemper Lewis*, University At Buffalo - SUNY, Buffalo, NY, United States

**11:30AM** OPTIMIZATION MODEL FOR OWNER-BASED MICROGRIDS USING LSTM PREDICTED DEMAND FOR GLOBAL DEVELOPMENT

Technical Paper Publication. IDETC2019-97964

*Anosh Amaria*, *Ryan Nguyen*, *Joshua Davison*, *Souma Chowdhury*, *John Hall*, University at Buffalo, Buffalo, NY, United States

**11:50AM** Self-Adapting Intelligent Battery Thermal Management System Via Artificial Neural Network Based Model Predictive Control

Technical Paper Publication. IDETC2019-98205

*Yuanzhi Liu*, *Jie Zhang*, The University of Texas at Dallas, Richardson, TX, United States

## DAC-10 DESIGN OF ENGINEERING MATERIALS AND STRUCTURES

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### Session DAC-10-1

#### Design of Engineering Materials and Structures

**Avila B 10:50AM–12:10PM**

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**10:50AM** Topology Optimization of Multi-Material Lattices for Maximal Bulk Modulus  
Technical Paper Publication. IDETC2019-97370

*Hesaneh Kazemi*, University of Connecticut, Storrs, CT, United States, *Ashkan Vaziri*, Northeastern University, Boston, MA, United States, *Julián Norato*, University of Connecticut, Storrs, CT, United States

**11:10AM** Generative Design of Multi-Material Hierarchical Structures via Concurrent Multi-Scale Topology Optimization and Conformal Geometry Method  
Technical Paper Publication. IDETC2019-97617

*Long Jiang*, SUNY Stony Brook University, Stony Brook, NY, United States, *Shikui Chen*, *Xianfeng David Gu*, State University of New York at Stony Brook, Stony Brook, NY, United States

**11:30AM** Topology Design with Conditional Generative Adversarial Networks  
Technical Paper Publication. IDETC2019-97833

*Conner Sharpe*, The University of Texas at Austin, Austin, TX, United States, *Carolyn C. Seepersad*, Univ Of Texas At Austin, Austin, TX, United States

**11:50AM** OPTIMIZING TOPOLOGY AND FIBER ORIENTATIONS WITH MINIMUM LENGTH SCALE CONTROL IN LAMINATED COMPOSITES

Technical Paper Publication. IDETC2019-98386

*Chuan Luo*, *James Guest*, Johns Hopkins University, Baltimore, MD, United States

## DAC-24 KEYNOTE

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### Session DAC-24-1

#### DAC Keynote

**California Ballroom B 2:10PM–3:45PM**

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## DAC-4

### DECISION MAKING IN ENGINEERING DESIGN

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#### Session DAC-4-1

#### Decision-Making in Engineering Design

**Avila A 4:10PM–5:50PM**

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**4:10PM** Investigating Optimal Communication Frequency in Multi-Disciplinary Engineering Teams Using Multi-Agent Simulation

Technical Paper Publication. IDETC2019-97301

*Mojtaba Arezoomand*, *Jesse Austin-Breneman*, University of Michigan, Ann Arbor, MI, United States

**4:30PM** Classification and Execution of Coupled Decisions Problems in Engineering Design for Exploration of Robust Design Solutions

Technical Paper Publication. IDETC2019-97372

*Gehendra Sharma*, University of Oklahoma, Norman, OK, United States, *Janet K. Allen*, Univ of Oklahoma, Norman, OK, United States, *Farrokh Mistree*, University of Oklahoma, Norman, OK, United States

# Technical Sessions

**4:50PM**      **Design of Composite Structures Through Decision Support Problem and Multiscale Design Approach**  
Technical Paper Publication. IDETC2019-97894

*Rizwan Khan Pathan, Soban Babu Beemaraj, Amit Salvi, Tata consultancy services, Pune, MAHARASHTRA, India, Gehendra Sharma, University of Oklahoma, Norman, OK, United States, Janet K. Allen, Univ of Oklahoma, Norman, OK, United States, Farrokh Mistree, University of Oklahoma, Norman, OK, United States*

**5:10PM**      **Quantum Mechanical Perspectives in Reliability Engineering and System Design**  
Technical Paper Publication. IDETC2019-98028

*Vijitashwa Pandey, Oakland University, Rochester, MI, United States*

**5:30PM**      **A Proposal for a Decision Support Framework to Solve Design Problems in the Automotive Industry**  
Technical Paper Publication. IDETC2019-98035

*Timothe M. Sissoko, CentraleSupélec and Renault, Gif-sur-Yvette, France, Marija Jankovic, CentraleSupélec, Gif-sur-Yvette, France, Christiaan J. J. Paredis, Clemson University, Greenville, SC, United States, Eric Landel, Renault, Guyancourt, France*

**DAC-9**

## **DESIGN OF COMPLEX SYSTEMS**

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**Session DAC-9-1**

**Design of Complex Systems**

**El Capitan B 4:10PM–5:50PM**

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**4:10PM**      **Integrated System Design and Control Optimization of Hybrid Electric Propulsion System Using a Bi-level, Nested Approach**  
Technical Paper Publication. IDETC2019-97456

*Li CHEN, University of Victoria, Victoria, BC, Canada, Huachao Dong, University of Victoria; Northwestern Polytechnical University, Victoria, BC, Canada, Zuomin DONG, University of Victoria, Victoria, BC, Canada*

**4:30PM**      **Structural Consequence Analysis: Towards the Quantification of Component Consequential Importance in System Architecture Design**  
Technical Paper Publication. IDETC2019-98393

*Hannah Walsh, Oregon State University, Corvallis, OR, United States, Mohammad Hejase, NASA Ames Research Center, Moffett Field, CA, United States, Daniel Hulse, Oregon State University, Corvallis, OR, United States, Guillaume P. Brat, NASA Ames Research Center, Moffett Field, CA, United States, Irem Y. Tumer, Oregon State University, Corvallis, OR, United States*

**4:50PM**      **An Excess Based Approach To Change Propagation**  
Technical Paper Publication. IDETC2019-98404

*Daniel Long, North Carolina State University, Raleigh, NC, United States, Scott Ferguson, North Carolina State University, Apex, NC, United States*

**5:10PM**      **Estimating the Value of Excess: A Case Study of Gaming Computers, Consoles and the Video Game Industry**  
Technical Paper Publication. IDETC2019-98428

*Darshan Yadav, Florida Institute of Technology, Melbourne, FL, United States, Daniel Long, North Carolina State University, Raleigh, NC, United States, Beshoy Morkos, Florida Institute of Technology, Florida, FL, United States, Scott Ferguson, North Carolina State University, Apex, NC, United States*

**5:30PM**      **Using Semantic Fluency Models Improves Network Reconstruction Accuracy of Tacit Engineering Knowledge**  
Technical Paper Publication. IDETC2019-98429

*Thurston Sexton, NIST, Gaithersburg, MD, United States, Mark Fuge, University of Maryland, College Park, MD, United States*

**DAC-10**

## **DESIGN OF ENGINEERING MATERIALS AND STRUCTURES**

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**Session DAC-10-2**

**Design of Engineering Materials and Structures**

**Avila B 4:10PM–5:50PM**

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**4:10PM**      **Thermomechanical Topology Optimization of Lattice Heat Transfer Structure Including Natural Convection and Design Dependent Heat Source**  
Technical Paper Publication. IDETC2019-97628

*Tong Wu, Purdue University, INDIANAPOLIS, IN, United States, Joel Najmon, IUPUI EDRL, Indianapolis, IN, United States, Andres Tovar, Indiana University-Purdue University Indianapolis, Indianapolis, IN, United States*

**4:30PM**      **A Framework of Multi-Fidelity Topology Design and Its Application to Optimum Design of Flow Fields in Battery Systems**  
Technical Paper Publication. IDETC2019-97675

*Kentaro Yaji, Shintaro Yamasaki, Shohji Tsushima, Kikuo Fujita, Osaka University, Suita, Osaka, Japan*

**4:50PM**      **STRESS-CONSTRAINED TOPOLOGY DESIGN OF FUNCTIONALLY GRADED LATTICE STRUCTURES WITH SPLINE-BASED DIMENSIONALITY REDUCTION**  
Technical Paper Publication. IDETC2019-97905

*Jenny Zhang, Autodesk, Toronto, ON, Canada, Conner Sharpe, The University of Texas at Austin, Austin, TX, United States, Carolyn C. Seepersad, Univ Of Texas At Austin, Austin, TX, United States*

# Technical Sessions

**5:10PM**            **Multimaterial Topology Optimization of Thermoelectric Generators**  
Technical Paper Publication. IDETC2019-97934

*Xiaoqiang Xu, Stony Brook University, Stony Brook, NY, United States, Yongjia Wu, Virginia Tech, Blacksburg, VA, United States, Shikui Chen, State University of New York at Stony Brook, Stony Brook, NY, United States*

**5:30PM**            **An Adaptive and Efficient Boundary Approach for Density-based Topology Optimization**  
Technical Paper Publication. IDETC2019-98463

*Reza Behrou, John Hopkins University(Department Of Civil Engineering), Baltimore, MD, United States, Reza Lotfi, Josephine Carstensen, James Guest, Johns Hopkins University, Baltimore, MD, United States*

## TUESDAY, AUGUST, 20

### DAC-11

#### ENGINEERING FOR GLOBAL DEVELOPMENT

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##### Session DAC-11-1

##### Engineering for Global Development

**Avila B**            **8:00AM–9:00AM**

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**8:00AM**            **Decision-Making in the Prescription of Orthotics and Prosthetics for Partial-Foot Amputees**  
Technical Paper Publication. IDETC2019-97470

*Pratima Saravanan, The Pennsylvania State University, State College, PA, United States, Jessica Menold, The Pennsylvania State University, University Park, PA, United States, Christopher McComb, The Pennsylvania State University, State College, PA, United States, Charity Hipple, Jingxin Wang, The Pennsylvania State University, University Park, PA, United States*

**8:20AM**            **An Agent-Based Modeling Approach for Clean Technologies Adoption using Theory of Planned Behavior Based Decision-Making**  
Technical Paper Publication. IDETC2019-97670

*Mohammad Hossein Pakravan, Nordica MacCarty, Oregon State University, Corvallis, OR, United States*

**8:40AM**            **Machine Learning for Evaluating the Social Impact of Engineered Products: A Framework**  
Technical Paper Publication. IDETC2019-98412

*Bryan Stringham, Daniel Smith, Christopher Mattson, Eric Dahlin, Brigham Young University, Provo, UT, United States*

### DAC-15

#### METAMODEL-BASED DESIGN OPTIMIZATION (MBDO)

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##### Session DAC-15-1

##### Metamodel-Based Design Optimization (MBDO)

**EI Capitan B**    **8:00AM–9:00AM**

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**8:00AM**            **Sequential Radial Basis Function based Optimization Method using Virtual Sample Generation**  
Technical Paper Publication. IDETC2019-97822

*Yifan Tang, Teng Long, Beijing Institute of Technology, Beijing, China, Renhe Shi, Tsinghua University, Beijing, China, Yufei Wu, Beijing Institute of Technology, Beijing, China, Gary Wang, Simon Fraser University, Surrey, BC, Canada*

**8:20AM**            **GLOBAL EMULATION THROUGH NORMATIVE DECISION MAKING AND THRIFTY ADAPTIVE BATCH SAMPLING**  
Technical Paper Publication. IDETC2019-98223

*Anton van Beek, Siyu Tao, Wei Chen, Northwestern University, Evanston, IL, United States*

**8:40AM**            **A STRATEGY FOR ADAPTIVE SAMPLING OF MULTI-FIDELITY GAUSSIAN PROCESS TO REDUCE PREDICTIVE UNCERTAINTY**

Technical Paper Publication. IDETC2019-98418

*Sayan Ghosh, General Electric Global Research, Niskayuna, NY, United States, Jesper Kristensen, General Electric Co, Niskayuna, NY, United States, Yiming Zhang, Waad Subber, GE Global Research, Niskayuna, NY, United States, Liping Wang, GE Corporate Res & Develop, Niskayuna, NY, United States*

### DAC-22

#### COMPUTATIONAL DESIGN FOR BIOMEDICAL

#### APPLICATIONS

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##### Session DAC-22-1

##### Computational Design for Biomedical Applications

**Avila A**            **8:00AM–9:00AM**

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**8:00AM**            **Computational Design Of a Personalized Artificial Spinal Disc With a Data-Driven Design Variable Linking Heuristic**  
Technical Paper Publication. IDETC2019-97777

*ZHIYANG YU, ETHZ, Zürich, Switzerland, Kristina Shea, ETH Zurich, Zurich, Switzerland, Tino Stankovic, Swiss Federal Institute of Technology Zurich (ETHZ), Zurich, Switzerland*

**8:30AM**            **DESIGN AND BIOLOGICAL SIMULATION OF 3D PRINTED LATTICES FOR BIOMEDICAL APPLICATIONS**  
Technical Paper Publication. IDETC2019-98190

*Paul Egan, Texas Tech University, Lubbock, TX, United States*

### DAC-8

#### DAC/CIE JOINT SYMPOSIUM: DESIGN FOR RESILIENCE AND FAILURE RECOVERY

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##### Session DAC-8-1

##### Design for Resilience and Failure Recovery

**Avila A**            **9:10AM–10:30AM**

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# Technical Sessions

**9:10AM** Post-Disruption Performance Recovery to Enhance Resilience of Interconnected Network Systems  
Technical Paper Publication. IDETC2019-97401

*Jiixin Wu, Pingfeng Wang, University of Illinois Urbana-Champaign, Urbana, IL, United States*

**9:30AM** Decomposing Incentives for Early Resilient Design: Method and Validation  
Technical Paper Publication. IDETC2019-97466

*Daniel Hulse, Christopher Hoyle, Irem Y. Tumer, Oregon State University, Corvallis, OR, United States, Kai Goebel, NASA Ames Research Center, Moffett Field, CA, United States*

**9:50AM** A Comparative Study of Formulations and Algorithms for Reliability-based Co-design Problems  
Technical Paper Publication. IDETC2019-98307

*Tonghui Cui, James T. Allison, University of Illinois at Urbana-Champaign, Urbana, IL, United States, Pingfeng Wang, University of Illinois Urbana-Champaign, Urbana, IL, United States*

**10:10AM** COMPUTATIONAL COGNITION FOR MISSION COMMAND AND CONTROL DECISIONS FACING RISK IN UNKNOWN ENVIRONMENTS  
Technical Paper Publication. IDETC2019-98483

*Ada-Rhodes Short, Bryony DuPont, Oregon State University, Corvallis, OR, United States*

## **DAC-11** **ENGINEERING FOR GLOBAL DEVELOPMENT**

Session DAC-11-2  
Engineering for Global Development  
**Avila B 9:10AM–10:30AM**

**9:10AM** Design and Testing of a Solar-Powered Bicycle in Nairobi, Kenya  
Technical Paper Publication. IDETC2019-98015

*Ignatius Maranga, Strathmore University, Kalimoni, Kenya, Grace Burleson, Engineering for Change, LLC., New York, NY, United States, Roger Christen, Solar E-Cycles Kenya Ltd, Nairobi, Kenya, Izael Da Silva, Strathmore University, Nairobi, Kenya*

**9:30AM** A Feasibility Study On The Benefits Of Feedback Aerator Control In Precision Aquaculture Applications For The Developing World  
Technical Paper Publication. IDETC2019-98087

*Francis Cedric Cruz, Kamran Mahmudov, University of Toronto, Toronto, ON, Canada, Andreas Marouchos, Commonwealth Scientific and Industrial Research Organisation, Hobart, Tasmania, Australia, Amy Bilton, University of Toronto, Toronto, ON, Canada*

**9:50AM** Feasibility of Pairing a Low-Cost Positive Displacement Pump with Low-Energy Pressure Compensating Drip Irrigation Emitters for Smallholder Farms in Africa  
Technical Paper Publication. IDETC2019-98128

*Seiji Engelkemier, Fiona Grant, Jordan Landis, Carolyn Sheline, Hannah Varner, Rebecca E Zubajlo, Julia Sokol, Amos G. Winter, V, Massachusetts Institute of Technology, Cambridge, MA, United States*

**10:10AM** Establishing Baseline Performance for Off-the-Shelf Nitrile Seals for the India Mark II Hand Pump System  
Technical Paper Publication. IDETC2019-98439

*Hans Ottosson, Thomas Naylor, Oliver Johnson, Christopher Mattson, Brigham Young University, Provo, UT, United States*

## **DAC-15**

### **METAMODEL-BASED DESIGN OPTIMIZATION (MBDO)**

Session DAC-15-2

Metamodel-Based Design Optimization (MBDO)

**El Capitan B 9:10AM–10:30AM**

**9:10AM** Construction Method of Generalized Regression Neural Network Surrogate Model Based on Kriging Fitting Deviation  
Technical Paper Publication. IDETC2019-97510

*Heju Tian, Guangdong University of Technology, Guangzhou, ???, China, Haiyan Li, Guangdong University of Technology, Guangzhou, China, Yunbao Huang, Guangdong University of Technology, Guangzhou, China, Jingliang Lin, Guangdong University of Technology, Guangdong, China*

**9:30AM** Parametric Optimization for Structural Design Problems  
Technical Paper Publication. IDETC2019-97860

*Krupakaran Ravichandran, Hartness Co., Greenville, SC, United States, Nafiseh Masoudi, Clemson University, Central, SC, United States, Georges Fadel, Clemson Univ, Clemson, SC, United States, Margaret Wiecek, Clemson University, Clemson, SC, United States*

**9:50AM** An efficient interval uncertainty optimization approach based on quasi-sparse response surface  
Technical Paper Publication. IDETC2019-97281

*Kefeng Wang, Guangdong University of Technology, Guangdong, China, Haiyan Li, Guangdong University of Technology, Guangzhou, China, Yunbao Huang, Hongjie Wang, Guangdong University of Technology, Guangzhou, China, Pu Li, Shaoguan University, Shaoguan, China*



# Technical Sessions

**10:10AM** A New Robustness Metric for Robust Design Optimization under Time- and Space-Dependent Uncertainty through Metamodeling  
Technical Paper Publication. IDETC2019-97611

*Xinpeng Wei*, Missouri University of Science and Technology, Rolla, MO, United States, *Xiaoping Du*, Indiana University - Purdue University Indianapolis, INDIANAPOLIS, IN, United States

## **DAC-8** **DAC/CIE JOINT SYMPOSIUM: DESIGN FOR RESILIENCE AND FAILURE RECOVERY**

**Session DAC-8-2**  
**Design for Resilience and Failure Recovery**  
**Avila A** **10:50AM–12:10PM**

**10:50AM** Exploiting Multi-Modal Sensing for Increased Detection Fidelity of Pipeline Leakage  
Technical Paper Publication. IDETC2019-97553

*Apeksha Lanjile*, *Mohamed Younis*, *Seung Jun Kim*, University of Maryland Baltimore County, Baltimore, MD, United States, *Soobum Lee*, UMBC, Baltimore, MD, United States

**11:16AM** On The Analysis Of A Compromised Additive Manufacturing System Using Spatio-Temporal Decomposition  
Technical Paper Publication. IDETC2019-97732

*Sakthi Prakash*, *Tobias Mahan*, Penn State University, University Park, PA, United States, *Glen Williams*, Penn State, State College, PA, United States, *Christopher McComb*, The Pennsylvania State University, State College, PA, United States, *Jessica Menold*, The Pennsylvania State University, Aston, PA, United States, *Conrad Tucker*, Penn State University, State College, PA, United States

**11:42AM** COLLISION-AVOIDANCE RELIABILITY ANALYSIS OF AUTONOMOUS VEHICLE BASED ON ADAPTIVE KRIGING SURROGATE MODELING  
Technical Paper Publication. IDETC2019-97490

*Yixuan Liu*, *Ying Zhao*, *Zhen Hu*, University of Michigan-Dearborn, Dearborn, MI, United States, *Zissimos Mourelatos*, *Dimitrios Papadimitriou*, Oakland University, Rochester, MI, United States

## **DAC-10** **DESIGN OF ENGINEERING MATERIALS AND STRUCTURES**

**Session DAC-10-3**  
**Design of Engineering Materials and Structures**  
**Avila B** **10:50AM–12:10PM**

**10:50AM** Design of Gradient Nanotwinned Metal Materials Using Adaptive Gaussian Process based Surrogate Models  
Technical Paper Publication. IDETC2019-97659

*Haofei Zhou*, Zhejiang University, Hangzhou, China, *Xin Chen*, *Yumeng Li*, University of Illinois at Urbana-Champaign, Urbana, IL, United States

**11:10AM** DISTRIBUTED DESIGN OF TWO-SCALE STRUCTURES WITH UNIT CELLS  
Technical Paper Publication. IDETC2019-97672

*Xingchen Liu*, International Computer Science Institute, Berkeley, CA, United States

**11:30AM** Computational Design of 4D Printed Shape Morphing Multi-State Lattice Structures  
Technical Paper Publication. IDETC2019-97774

*Thomas S. Lumpe*, *Kristina Shea*, ETH Zurich, Zurich, Switzerland

**11:50AM** Multi-Scale Design Of Meta-Materials With Offset Periodicity  
Technical Paper Publication. IDETC2019-98341

*Rushabh Sadiwala*, Clemson University, Clemson, SC, United States, *Georges Fadel*, Clemson Univ, Clemson, SC, United States

## **DAC-13** **GEOMETRIC MODELING AND ALGORITHMS FOR DESIGN AND MANUFACTURING**

**Session DAC-13-1**  
**Geometric Modeling and Algorithms for Design and Manufacturing**  
**El Capitan B** **10:50AM–12:10PM**

**10:50AM** AUTOMATING PARAMETRIC REDESIGN OF STRUCTURAL THIN-WALLED FRAMES  
Technical Paper Publication. IDETC2019-97087

*Lyang Suan Wang*, *Payam Haghghi*, *Satchit Ramnath*, The Ohio State University, Columbus, OH, United States, *Kurtis Horner*, Honda R&D Americas, Inc., Raymond, OH, United States, *Duane Detwiler*, Honda R & D Americas Inc, Raymond, OH, United States, *Jami Shah*, The Ohio State University, Columbus, OH, United States

**11:10AM** Clearance Measurement of 3D Objects Using Accessibility Cone  
Technical Paper Publication. IDETC2019-97226

*Masatomo Inui*, *Kouhei Nishimiya*, *Nobuyuki Umezu*, Ibaraki University, Hitachi, Ibaraki, Japan

**11:30AM** Automated Tradeoff Analysis of Cost versus Machinability for Design Feedback  
Technical Paper Publication. IDETC2019-97286

*Alan Grier*, *Matthew Campbell*, Oregon State University, Corvallis, OR, United States

**11:50AM** Making Trimmed B-Spline B-Reps Watertight With a Hybrid Representation  
Technical Paper Publication. IDETC2019-97485

*Yang Song*, University of Utah, Salt Lake City, UT, United States, *Elaine Cohen*, Univ Of Utah, Salt Lake City, UT, United States

# Technical Sessions

## DAC-10

### DESIGN OF ENGINEERING MATERIALS AND STRUCTURES

#### Session DAC-10-4

#### Design of Engineering Materials and Structures

**Avila B** 2:10PM–3:50PM

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#### 2:10PM Inverse Thermo-Mechanical Processing (ITMP)

##### Design of a Steel Rod during Hot Rolling Process

Technical Paper Publication. IDETC2019-97390

*Anand Nellippallil*, Mississippi State University, Starkville, MS, United States, *Pranav Mohan*, university of oklahoma, Norman, OK, United States, *Janet K. Allen*, Univ of Oklahoma, Norman, OK, United States, *Farrokh Mistree*, University of Oklahoma, Norman, OK, United States

#### 2:30PM Gaussian Process based Crack Initiation Modeling for Design of Battery Anode Materials

Technical Paper Publication. IDETC2019-97547

*Zhuoyuan Zheng*, University of Illinois at Urbana-Champaign, Urbana, IL, United States, *Yanwen Xu*, University of Illinois Urbana-Champaign, Urbana, IL, United States, *Bo Chen*, University of Illinois at Urbana-Champaign, Urbana, IL, United States, *Pingfeng Wang*, University of Illinois Urbana-Champaign, Urbana, IL, United States

#### 2:50PM Visualizing and Evaluating High-Dimensional Mappings of Sets of High Performance Designs

Technical Paper Publication. IDETC2019-97722

*Clinton B. Morris*, Palo Alto Research Center, Palo Alto, CA, United States, *Michael R. Haberman*, Applied Research Laboratories, The University of Texas At Austin, Austin, TX, United States, *Carolyn C. Seepersad*, Univ Of Texas At Austin, Austin, TX, United States

#### 3:10PM Bayesian Optimization of Equilibrium States in Elastomeric Beams

Technical Paper Publication. IDETC2019-98105

*David Yoo*, UES Inc, Beavercreek, OH, United States, *Carson Willey*, UES, Inc., Beavercreek, OH, United States, *Andrew Gillman*, *Vincent Chen*, UES, Inc, Beavercreek, OH, United States, *Abigail Juhl*, AFRL, WPAFB, OH, United States, *Philip Buskohl*, AFRL/RXAS, WPAFB, OH, United States

#### 3:30PM DATA-CENTRIC MIXED-VARIABLE BAYESIAN OPTIMIZATION FOR MATERIAL DESIGN

Technical Paper Publication. IDETC2019-98222

*Akshay Iyer*, *Yichi Zhang*, Northwestern University, Evanston, IL, United States, *Aditya Prasad*, Rensselaer Polytechnic Institute, Troy, NY, United States, *Siyu Tao*, *Yixing Wang*, Northwestern University, Evanston, IL, United States, *Linda Schadler*, University of Vermont, Burlington, VT, United States, *L. Catherine Brinson*, Duke University, Durham, NC, United States, *Wei Chen*, Northwestern University, Evanston, IL, United States

## DAC-20

### SIMULATION-BASED DESIGN UNDER UNCERTAINTY

#### Session DAC-20-1

#### Simulation-Based Design Under Uncertainty

**Avila A** 2:10PM–3:50PM

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#### 2:10PM Reliability Analysis of Nonlinear Vibratory Systems under Non-Gaussian Loads using a Sensitivity-Based Propagation of Moments

Technical Paper Publication. IDETC2019-97158

*Dimitrios Papadimitriou*, *Zissimos Mourelatos*, *Santosh Patil*, Oakland University, Rochester, MI, United States, *Zhen Hu*, University of Michigan-Dearborn, Dearborn, MI, United States, *Vasiliki Tsianika*, *Vasileios Geroulas*, Oakland University, Rochester, MI, United States

#### 2:30PM Robust Optimization with Mixed Interval and Probabilistic Parameter Uncertainties, Model Uncertainty, and Metamodeling Uncertainty

Technical Paper Publication. IDETC2019-97495

*Yanjun Zhang*, *Tingting Xia*, *Mian Li*, Shanghai Jiao Tong University, Shanghai, China

#### 2:50PM Second Order Reliability Method for Time-Dependent Reliability Analysis Using Sequential Efficient Global Optimization

Technical Paper Publication. IDETC2019-97541

*Zhangli Hu*, Missouri S&T, Rolla, MO, United States, *Xiaoping Du*, Indiana University - Purdue University Indianapolis, INDIANAPOLIS, IN, United States

#### 3:10PM RESOURCE ALLOCATION FOR SYSTEM RELIABILITY ANALYSIS USING ACCELERATED LIFE TESTING

Technical Paper Publication. IDETC2019-97616

*Kassem Moustafa*, *Zhen Hu*, University of Michigan-Dearborn, Dearborn, MI, United States, *Zissimos Mourelatos*, Oakland University, Rochester, MI, United States, *Igor Baseski*, CCDC Ground Vehicle Systems Center, Warren, MI, United States, *Monica Majcher*, US Army CCDC Ground Vehicle Systems Center, Warren, MI, United States

#### 3:30PM Confidence-Based Design Optimization Under Data Uncertainty Using Most Probable Point-Based Approach

Technical Paper Publication. IDETC2019-97718

*Yongsu Jung*, Korea Advanced Institute of Science and Technology, Daejeon, Korea (Republic), *Hyunkyoo Cho*, Mokpo National University, Mokpo, Korea (Republic), *Ikjin Lee*, Korea Advanced Institute of Science and Technology, Daejeon, Korea (Republic)

# Technical Sessions

## DAC-25 PANEL SESSION: DIGITAL ENGINEERING IN ADDITIVE MANUFACTURING

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Session DAC-25-1  
DAC Panel Session: Digital Engineering in Additive  
Manufacturing  
El Capitan B 2:10PM–3:50PM

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## DAC-6 DESIGN FOR ADDITIVE MANUFACTURING

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Session DAC-6-1  
Design for Additive Manufacturing  
Avila B 4:10PM–5:50PM

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4:10PM STRESS FIELD GUIDED LATTICE STRUCTURE  
DESIGN BASED ON HEXAHEDRAL MESH  
Technical Paper Publication. IDETC2019-97248

*Lingyun Liu, Yizhou Liao, Zhejiang University, Hangzhou, Zhejiang, China, Shuming Gao, Zhejiang Univ, Hangzhou, Zhejiang, China*

4:30PM But Will it Print? Assessing Student Use of Design  
for Additive Manufacturing and Exploring its Effect on Design  
Performance  
Technical Paper Publication. IDETC2019-97478

*Rohan Prabhu, Penn State University, State College, PA, United States, Scarlett Miller, The Pennsylvania State University, University Park, PA, United States, Timothy W. Simpson, Penn State University, University Park, PA, United States, Nicholas Meisel, Penn State, University Park, PA, United States*

4:50PM A Comparative Study of Virtual Reality  
and Computer-Aided Design to Evaluate Parts for Additive  
Manufacturing  
Technical Paper Publication. IDETC2019-97480

*John Ostrander, Lauren Ryan, Snehal Dhengre, The Pennsylvania State University, University Park, PA, United States, Christopher McComb, The Pennsylvania State University, State College, PA, United States, Timothy W. Simpson, Penn State University, University Park, PA, United States, Nicholas Meisel, Penn State, University Park, PA, United States*

5:10PM Computational Design of Active Lattice Structures  
for 4D Printed Pneumatic Shape Morphing  
Technical Paper Publication. IDETC2019-97775

*Cosima du Pasquier, Pascal Koller, ETH Zurich, Zurich, Zurich, Switzerland, Tino Stankovic, Swiss Federal Institute of Technology Zurich (ETHZ), Zurich, Switzerland, Kristina Shea, ETH Zurich, Zurich, Switzerland*

5:30PM A Design Modification System for Additive  
Manufacturing: Towards Feasible Geometry Development  
Technical Paper Publication. IDETC2019-97840

*Seyedeh Elaheh Ghiasian, University at Buffalo, Tonawanda, NY, United States, Prakhhar Jaiswal, University at Buffalo-SUNY, Buffalo, NY, United States, Rahul Rai, University at Buffalo, Fresno, CA, United States, Kemper Lewis, University At Buffalo - SUNY, Buffalo, NY, United States*

## DAC-7 DESIGN FOR MARKET SYSTEMS

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Session DAC-7-1  
Design for Market Systems  
El Capitan B 4:10PM–5:50PM

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4:10PM Designing the Customer Order Decoupling Point  
to Facilitate Mass Customization  
Technical Paper Publication. IDETC2019-97379

*Lin Guo, The University of Oklahoma, Norman, OK, United States, Suhao Chen, Oklahoma State University, Stillwater, OK, United States, Janet K. Allen, Univ of Oklahoma, Norman, OK, United States, Farrokh Mistree, University of Oklahoma, Norman, OK, United States*

4:30PM WORD-OF-MOUTH RECOMMENDATIONS IN AN  
AUTOMOBILE MARKET SYSTEM  
Technical Paper Publication. IDETC2019-97680

*Amineh Zadbood, Nicholas Russo, Steven Hoffenson, Stevens Institute of Technology, Hoboken, NJ, United States*

4:50PM Influence of Omitted Variables in Consumer  
Choice Models on Engineering Design Optimization Solutions  
Technical Paper Publication. IDETC2019-97835

*Waleed Gowharji, Kate Whitefoot, Carnegie Mellon University, Pittsburgh, PA, United States*

5:10PM Implications of Competitor Representation on  
Optimal Design  
Technical Paper Publication. IDETC2019-98114

*Arthur Yip, Jeremy Michalek, Kate Whitefoot, Carnegie Mellon University, Pittsburgh, PA, United States*

5:30PM The Impacts Of Consumer Preference  
Distributions on Dynamic Electricity Pricing in Residential Demand  
Response  
Technical Paper Publication. IDETC2019-98219

*Samuel Dunbar, North Carolina State University, Raleigh, NC, United States, Scott Ferguson, North Carolina State University, Apex, NC, United States*

# Technical Sessions

DAC-20

## **SIMULATION-BASED DESIGN UNDER UNCERTAINTY**

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Session DAC-20-2

Simulation-Based Design Under Uncertainty

Avila A 4:10PM–5:50PM

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**4:10PM** Towards Scalable Gaussian Process Modeling  
Technical Paper Publication. IDETC2019-97010

*Piyush Pandita*, GE Research, West Lafayette, IN, United States,  
*Jesper Kristensen*, General Electric Co, Niskayuna, NY, United States,  
*Liping Wang*, GE Corporate Res & Develop, Niskayuna, NY, United States

**4:30PM** Estimation Of Uncertainty Change Of Reliability In Adaptive Sampling Under Prediction Uncertainty Of Gaussian Process  
Technical Paper Publication. IDETC2019-97472

*Sangjune Bae, Nam H. Kim*, University of Florida, Gainesville, FL, United States

**4:50PM** A Comparison of Numerical Optimizers in Developing High Dimensional Surrogate Models  
Technical Paper Publication. IDETC2019-97499

*Yanwen Xu, Pingfeng Wang*, University of Illinois Urbana-Champaign, Urbana, IL, United States

**5:10PM** System Reliability Analysis Using Hybrid Gaussian Process Model  
Technical Paper Publication. IDETC2019-98173

*Meng Li, Mohammadkazem Sadoughi*, Iowa State University, Ames, IA, United States, *Zhen Hu*, University of Michigan-Dearborn, Dearborn, MI, United States, *Chao Hu*, Iowa State Univ., Ames, IA, United States

**5:30PM** System Reliability Analysis with Second Order Saddlepoint Approximation  
Technical Paper Publication. IDETC2019-97561

*Hao Wu*, Indiana University - Purdue University Indianapolis, Indianapolis, IN, INDIANAPOLIS, IN, United States, *Xiaoping Du*, Indiana University - Purdue University Indianapolis, INDIANAPOLIS, IN, United States

## WEDNESDAY, AUGUST, 21

DAC-6

## **DESIGN FOR ADDITIVE MANUFACTURING**

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Session DAC-6-2

Design for Additive Manufacturing

Avila B 8:00AM–9:40AM

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**8:00AM** SIMULATION-BASED PROCESS OPTIMIZATION OF METALLIC ADDITIVE MANUFACTURING UNDER UNCERTAINTY  
Technical Paper Publication. IDETC2019-97492

*Zhuo Wang*, Mississippi State University, Starkville, MS, United States, *Pengwei Liu*, Mississippi State University, Mississippi State, MS, United States, *Zhen Hu*, University of Michigan-Dearborn, Dearborn, MI, United States, *Lei Chen*, Mississippi State University, Mississippi State, MS, United States

**8:20AM** Digital Design Automation to Support In-Situ Embedding of Functional Components in Additive Manufacturing  
Technical Paper Publication. IDETC2019-97607

*Manoj Malviya, Swapnil Sinha*, The Pennsylvania State University, University Park, PA, United States, *Nicholas Meisel*, Penn State, University Park, PA, United States

**8:40AM** Optimization of Parts Consolidation for Minimum Production Costs and Time Using Additive Manufacturing  
Technical Paper Publication. IDETC2019-97649

*Zhenguo Nie, Sangjin Jung, Levent Kara, Kate Whitefoot*, Carnegie Mellon University, Pittsburgh, PA, United States

**9:00AM** Lattice Structure Design for Additive Manufacturing: Unit Cell Topology Optimization  
Technical Paper Publication. IDETC2019-97863

*Bradley Hanks*, Pennsylvania State University, University Park, PA, United States, *Mary Frecker, Ph.D.*, Pennsylvania State Univ, University Park, PA, United States

**9:20AM** Evaluating the Potential of Design for Additive Manufacturing Heuristic Cards to Stimulate Novel Product Redesigns  
Technical Paper Publication. IDETC2019-97865

*Alexandra Bloesch-Paidosh*, ETH Zurich, Zurich, Switzerland, *Saeema Ahmed-Kristensen*, Royal College of Art, London, United Kingdom, *Kristina Shea*, ETH Zurich, Zurich, Switzerland

DAC-17

## **MULTIDISCIPLINARY DESIGN OPTIMIZATION**

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Session DAC-17-1

Multidisciplinary Design Optimization

Avila A 8:00AM–9:40AM

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**8:00AM** A Literature Review: Solving Constrained Non-linear Bi-level Optimization Problems With Classical Methods  
Technical Paper Publication. IDETC2019-97192

*Arpan Biswas, Christopher Hoyle*, Oregon State University, Corvallis, OR, United States



# Technical Sessions

**8:20AM** A Goal-Oriented, Inverse Method for Multi-Component Product Design  
Technical Paper Publication. IDETC2019-97388

*Tate Fonville, Anand Nellippallil, Mississippi State University, Starkville, MS, United States, Mark Horstemeyer, Liberty University, Lynchburg, VA, United States, Janet K. Allen, Univ of Oklahoma, Norman, OK, United States, Farrokh Mistree, University of Oklahoma, Norman, OK, United States*

**8:40AM** Level Set Topology Optimization for Design Dependent Hydrostatic Loading Using the Reproducing Kernel Particle Method  
Technical Paper Publication. IDETC2019-97803

*Andreas Neofytou, Cardiff University, Cardiff, Wales, United Kingdom, Renato Picelli, University of Sao Paulo, Sao Paulo, Brazil, Jiun-Shyan Chen, Hyunsun Alicia Kim, University of California, San Diego, San Diego, CA, United States*

**9:00AM** Comparing Multifidelity Model Management Strategies for Multidisciplinary Design Optimization  
Technical Paper Publication. IDETC2019-97859

*Brian Chell, Steven Hoffenson, Mark R. Blackburn, Stevens Institute of Technology, Hoboken, NJ, United States*

**9:20AM** EXPLORATION OF LAYER SPECIFIC DIMENSIONAL MULTIPLIERS IN MODIFIED UNIT CELL SYNTHESIS METHOD META-MATERIALS FOR NONLINEAR APPLICATIONS  
Technical Paper Publication. IDETC2019-98464

*Samuel Franklin, Clemson University, Atlanta, GA, United States, Georges Fadel, Clemson Univ, Clemson, SC, United States, Nicole Coutris, Gang Li, Clemson University, Clemson, SC, United States, Matthew P. Castanier, US Army CCDC Ground Vehicle Systems Center, Warren, MI, United States*

## **DAC-6** **DESIGN FOR ADDITIVE MANUFACTURING**

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Session DAC-6-3

Design for Additive Manufacturing  
**Avila B 10:00AM–11:40AM**

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**10:00AM** An Optimal Quantity of Scheduling Model for Mass Customization-Based Additive Manufacturing  
Technical Paper Publication. IDETC2019-97913

*Yosep Oh, University At Buffalo, Buffalo, NY, United States, Sara Behdad, University At Buffalo, SUNY, Amherst, NY, United States*

**10:20AM** Design for Additive Manufacturing using a Master Model approach  
Technical Paper Publication. IDETC2019-97915

*Anton Wiberg, Johan Persson, Linköping University, Linköping, Östergötland, Sweden, Johan Olvander, Linköping University, Linköping, Sweden*

**10:40AM** MODEL TO DETERMINE ELASTIC MODULUS AND TENSILE STRENGTH OF 3D PRINTED CARBON FIBER REINFORCED NYLON  
Technical Paper Publication. IDETC2019-98024

*Kaiyue Deng, University at Buffalo, Buffalo, NY, United States, Hamid Khakpour Nejadkhaki, University at Buffalo, Amherst, NY, United States, Felipe Meneguzzo Pasquali, Anosh Amaria, Jason Armstrong, John Hall, University at Buffalo, Buffalo, NY, United States*

**11:00AM** Substrate Optimization for Hybrid Manufacturing  
Technical Paper Publication. IDETC2019-98068

*Brandon Massoni, Matthew Campbell, Oregon State University, Corvallis, OR, United States*

**11:20AM** Voxel-Based CAD Framework For Planning Functionally Graded and Multi-Step Fabrication Processes  
Technical Paper Publication. IDETC2019-98103

*Cole Brauer, Daniel M. Aukes, Arizona State University, Mesa, AZ, United States*

## **DAC-20**

### **SIMULATION-BASED DESIGN UNDER UNCERTAINTY**

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Session DAC-20-3

Simulation-Based Design Under Uncertainty

**Avila A 10:00AM–11:40AM**

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**10:00AM** TESTING DESIGN OPTIMIZATION FOR UNCERTAINTY REDUCTION IN GENERATING OFF-ROAD MOBILITY MAP  
Technical Paper Publication. IDETC2019-97685

*Zhen Hu, University of Michigan-Dearborn, Dearborn, MI, United States, Zissimos Mourelatos, Oakland University, Rochester, MI, United States, David Gorsich, U.S. Army CCDC-Ground Vehicle Systems Center, Warren, MI, United States, Paramsothy Jayakumar, U.S. Army TARDEC, Warren, MI, United States, Monica Majcher, US Army CCDC Ground Vehicle Systems Center, Warren, MI, United States*

**10:25AM** Determination Of The Number Of Input Data Through Bi-Objective Confidence-Based Design Optimization  
Technical Paper Publication. IDETC2019-97721

*Yongsu Jung, Korea Advanced Institute of Science and Technology, Daejeon, Korea (Republic), Hyunkyoo Cho, Mokpo National University, Mokpo, Korea (Republic), Zunyi Duan, Ikjin Lee, Korea Advanced Institute of Science and Technology, Daejeon, Korea (Republic)*

**10:50AM** A Novel Hierarchical Framework For Uncertainty Analysis Of Multiscale Systems Combined Vine Copula With Sparse PCE  
Technical Paper Publication. IDETC2019-97832

*Can Xu, Shanghai Jiao Tong University, Shanghai, Shanghai, China, Zhao Liu, Shanghai JiaoTong University, Shanghai, China, Wei Tao, Ping Zhu, Shanghai Jiao Tong University, Shanghai*

# Technical Sessions

**11:15AM**      **Second-Order Reliability Method based on Edgeworth expansion with application to Reliability-based Design Optimization**  
Technical Paper Publication. IDETC2019-97278

*Rami Mansour, Royal Institute of Technology (KTH), Stockholm, Sweden, Märten Olsson, Royal Institute of Technology, Stockholm, Sweden*

**16th International Conference on Design Education (DEC)**  
**MONDAY, AUGUST, 19**

**DEC-2**  
**RESEARCH METHODS & ASSESSMENT IN DESIGN EDUCATION**

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**Session DEC-2-1**  
**Research Methods & Assessment in Design Education**  
**Capistrano B 9:10AM–10:30AM**

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Session Organizer: **Beshoy Morkos**, Florida Institute of Technology, Florida, FL, United States  
Session Co-Organizer: **Jose Lugo**, University of Puerto Rico, Mayaguez, PR, United States

**9:10AM**      **Requirements Generation: Lecture Intervention Impact on Quantity**  
Technical Paper Publication. IDETC2019-97528

*Maria Vittoria Elena, Joshua Summers, Clemson University, Clemson, SC, United States*

**9:30AM**      **Critical Thinking In The Design Classroom: An Analysis Of Student Design Reflections**  
Technical Paper Publication. IDETC2019-97533

*Emmeline Evans, The Pennsylvania State University, University Park, PA, United States, Jessica Menold, The Pennsylvania State University, Aston, PA, United States, Christopher McComb, The Pennsylvania State University, State College, PA, United States*

**9:50AM**      **Can Process Metrics Predict Product Success? A Pilot Study of Student Design Teams**  
Technical Paper Publication. IDETC2019-97704

*Jennifer Bracken, Francis Xavier Glavin, The Pennsylvania State University, University Park, PA, United States, Daniel Henderson, The Pennsylvania State University, Irwin, PA, United States, Kathryn Jablokow, The Pennsylvania State University, Malvern, PA, United States, Neeraj Sonalkar, Stanford University, Stanford, CA, United States, Andrew Michael Erdman, The Pennsylvania State University, University Park, PA, United States*

**10:10AM**      **ENGINEERING DESIGN CONCEPT GENERATION: THE EFFECT OF CONCEPT COMBINATION AND CLASSIFICATION**  
Technical Paper Publication. IDETC2019-97819

*Saurabh Deo, Katja Holttä-Otto, Aalto University, Espoo, Espoo, Finland, Yogesh Bhalerao, Abhijeet Malge, MIT Academy of Engineering, Pune, India*

**DEC-6**  
**DEC KEYNOTE**

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**Session DEC-6-1**  
**What I Wish I Knew My First Year of Teaching - Engaging Students in Design**  
**California Ballroom B 10:50AM–12:10PM**

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**DEC-1**  
**DESIGN EDUCATION ACROSS THE CURRICULUM**

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**Session DEC-1-1**  
**Design Education Across the Curriculum**  
**Capistrano B 2:10PM–3:45PM**

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Session Organizer: **Jose Lugo**, University of Puerto Rico, Mayaguez, PR, United States

**2:10PM**      **Complex Solutions for Complex Problems? Exploring the Effects of Task Complexity on Student use of Design for Additive Manufacturing**  
Technical Paper Publication. IDETC2019-97474

*Rohan Prabhu, Penn State University, State College, PA, United States, Scarlett Miller, The Pennsylvania State University, University Park, PA, United States, Timothy W. Simpson, Penn State University, University Park, PA, United States, Nicholas Meisel, Penn State, University Park, PA, United States*

**2:29PM**      **Do Students Want To Dissect? A Survey Of Student Opinions On The Use Of Product Dissection In The Classroom**  
Technical Paper Publication. IDETC2019-97569

*Carolyn Riegel, Elizabeth M. Starkey, Sam Hunter, Scarlett Miller, The Pennsylvania State University, University Park, PA, United States*

**2:48PM**      **Designy: A Multimedia Platform for Supporting Student Prototyping in Product Design Education**  
Technical Paper Publication. IDETC2019-98364

*Joshua Ramos, David Wallace, MIT, Cambridge, MA, United States*

**3:07PM**      **Developing Interview Protocol for Engineering Capstone Design Course**  
Technical Paper Publication. IDETC2019-98365

*McKenzie Clark, Devanshi Shah, Elisabeth Kames, Florida Institute of Technology, Melbourne, FL, United States, Beshoy Morkos, Florida Institute of Technology, Florida, FL, United States*

# Technical Sessions

**3:26PM** Development of a Coding Scheme for Qualitative Analysis of Student Motivation in Senior Capstone Design Technical Paper Publication. IDETC2019-98423

*Devanshi Shah, Elisabeth Kames, McKenzie Clark, Florida Institute of Technology, Melbourne, FL, United States, Beshoy Morkos, Florida Institute of Technology, Florida, FL, United States*

## DEC-4

### OTHER TOPICS

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#### Session DEC-4-1

#### Other Topics in Design Education

**Capistrano B 4:10PM–5:50PM**

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Session Organizer: **Elizabeth M. Starkey**, *The Pennsylvania State University, University Park, PA, United States*

#### **4:10PM** THE IMPACT OF INDUSTRY EXPERIENCE ON ENGINEERING GRADUATE STUDENTS? FUNCTIONAL DESIGN MODELING

Technical Paper Publication. IDETC2019-97615

*Matt Bohm, Florida Polytechnic University, Lakeland, FL, United States, Hannah Ingram, University of South Florida, Lakeland, FL, United States, Dalton Reith, Florida Polytechnic University, Lakeland, FL, United States, Robert Nagel, James Madison University, Harrisonburg, VA, United States, Julie Linsey, Georgia Institute of Technology, Atlanta, GA, United States*

#### **4:30PM** A Conceptual Framework and a Research Roadmap towards Enhancing Team Working in Engineering Education

Technical Paper Publication. IDETC2019-97638

*Shun Takai, Northern Illinois University, DeKalb, IL, United States, Marcos Esterman, Rochester Inst Of Tech, Rochester, NY, United States*

#### **4:50PM** Embedding Cybersecurity into Design Education: Increasing Designers' Awareness to Cybersecurity throughout the Design Process

Technical Paper Publication. IDETC2019-97720

*Euiyoung Kim, University of California, Berkeley, Berkeley, CA, United States, Jieun Kwon, University of Minnesota, Minneapolis, MN, United States, Jungkyoon Yoon, Cornell University, Ithaca, NY, United States, Alice M. Agogino, University of California at Berkeley, Berkeley, CA, United States*

#### **5:10PM** FBS Model Towards Technical Design Specification Identification in Redesign of Technical Systems

Technical Paper Publication. IDETC2019-97858

*Ivan D. Montoya, Elizabeth Rendon-Velez, Juan A. Gallego-Sanchez, Eafit University, Medellin, Colombia*

**5:30PM** IISC DBOX: A GAME FOR CHILDREN TO LEARN DESIGN THINKING  
Technical Paper Publication. IDETC2019-98066

*Apoorv Naresh Bhatt, Rahul Bhaumik, Kumari MC, Amaresh Chakrabarti, Indian Institute of Science, Bengaluru, Karnataka, India*

## TUESDAY, AUGUST, 20

## DEC-5

### SHORT PAPERS: WORK IN PROGRESS

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#### Session DEC-5-1

#### Short Papers: Design Education Work in Progress

**Capistrano B 9:10AM–10:30AM**

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Session Organizer: **Daniela Faas**, *Olin College, Cambridge, MA, United States*

Session Co-Organizer: **Andrew Olewnik**, *University at Buffalo, Buffalo, NY, United States*

**9:10AM** Research Based and Design Based Education: Experiences in India, UK, and USA  
Technical Paper Publication. IDETC2019-97335

*Jyoti Prakash Naidu, JK Lakshmiipat University, Jaipur, Rajasthan, India, Siddharta Govindasamy, Olin College of Engineering, Needham, MA, United States, Mandayam A. Srinivasan, UCL, cs.ucl.ac.uk, United Kingdom*

**9:36AM** Short Paper: Thinking About Thinking: Toward Capturing Students' Metacognition in Solving Design Problems  
Technical Paper Publication. IDETC2019-98280

*Andrew Olewnik, Brian Stuhmiller, Randy Yerrick, University at Buffalo, Buffalo, NY, United States*

**10:02AM** Leveraging Animations to Enhance Learning Through Virtual Product Dissection  
Technical Paper Publication. IDETC2019-98285

*Kevin G. Kearney, The Pennsylvania State University, University Park, PA, United States, Elizabeth M. Starkey, Scarlett Miller, The Pennsylvania State University, University Park, PA, United States*

## DEC-5

### SHORT PAPERS: WORK IN PROGRESS

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#### Session DEC-5-2

#### Short Papers: Design Education Work in Progress

**Capistrano B 10:50AM–12:10PM**

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Session Organizer: **Daniela Faas**, *Olin College, Cambridge, MA, United States*

Session Co-Organizer: **Andrew Olewnik**, *University at Buffalo, Buffalo, NY, United States*

# Technical Sessions

**10:50AM** Effect of Obesity on Human Squat Exercise  
Technical Presentation. IDETC2019-98094

*Dumitru Caruntu, Simon Vasquez, Jennifer Ramos, Jose Galarza, University Of Texas Rio Grande Valley, Edinburg, TX, United States*

**11:16AM** Do Capstone Students Really Understand the Needs of the Customer? Observations on Students' Blind Spots Left By Early Program Curriculum  
Technical Paper Publication. IDETC2019-98431

*Matthew Goodson, Carl Sorensen, Brigham Young University, Provo, UT, United States, michael anderson, usafa, usafa, CO, United States, Christopher Mattson, Brigham Young University, Provo, UT, United States*

**11:42AM** The Development of a Product Performance Index to Compare the Outcomes of Multidisciplinary Team Performance  
Technical Paper Publication. IDETC2019-98507

*Marcos Esterman, Rochester Inst Of Tech, Rochester, NY, United States, Varun Sharma, Rochester Institute of Technology, Rochester, NY, United States*

## **DEC-2** **RESEARCH METHODS & ASSESSMENT IN DESIGN** **EDUCATION**

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**Session DEC-2-2**  
**Research Methods & Assessment in Design Education**  
**Capistrano B 2:10PM–3:50PM**

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Session Organizer: **Beshoy Morkos**, Florida Institute of Technology, Florida, FL, United States

Session Co-Organizer: **Jose Lugo**, University of Puerto Rico, Mayaguez, PR, United States

**2:10PM** Evaluating Idea Quantity and Variety When Using Digital Collaboration Tools to Support Brainstorming in Non-Collocated Teams  
Technical Paper Publication. IDETC2019-98203

*Dorcus Kaweesa, The Pennsylvania State University, University Park, PA, United States, Christopher McComb, The Pennsylvania State University, State College, PA, United States, Jessica Menold, The Pennsylvania State University, Aston, PA, United States, Sarah Ritter, Nicholas Meisel, Penn State, University Park, PA, United States*

**2:35PM** Students' Decision-making in a Product Design Process: An Observational Study  
Technical Paper Publication. IDETC2019-98216

*Murtuza Shergadwala, Jitesh Panchal, Purdue University, west lafayette, IN, United States, Karthik Ramani, Purdue University, W Lafayette, IN, United States*

**3:00PM** Factors Leading to Sustainable Social Impact on the Affected Communities of Engineering Service Learning Projects  
Technical Paper Publication. IDETC2019-98407

*Andrew Armstrong, Christopher Mattson, Randy Lewis, Brigham Young University, Provo, UT, United States*

**3:25PM** Benefits of a Short-term Engineering Study Abroad: A Survey of Students over the Past 15 Years  
Technical Paper Publication. IDETC2019-98419

*Jacob Hunter, Christopher Mattson, Brigham Young University, Provo, UT, United States, Spencer Magleby, Brigham Young Univ, Provo, UT, United States*

## **24th Design for Manufacturing and the Life Cycle Conference (DFMLC)** **MONDAY, AUGUST, 19**

### **DFMLC-2** **ENABLING RECYCLING, REPAIR, DURABILITY, AND END-OF-LIFE RECOVERY**

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**Session DFMLC-2-1**  
**Enabling Recycling, Repair, Durability and End-of-Life Recovery**  
**Oceanside 9:10AM–10:30AM**

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**9:10AM** Addressing Information Gaps In Household Waste Sorting Using A Mobile Application  
Student Competition Poster. IDETC2019-97385

*Kelvin Pagels, Mikkel Rasmussen, Devarajan Ramanujan, Aarhus University, Aarhus C, Denmark*

**9:30AM** Exploring Design Trades to Extend Useful Life of Platform Terminal Transmitters on Sea Turtles  
Technical Paper Publication. IDETC2019-97473

*Bethany Kelly, Kenny Nguyen, Zach Miles, University of West Florida, Pensacola, FL, United States, Salvador Mayoral, California State University Fullerton, Fullerton, CA, United States, Susan Piacenza, Cheng Zhang, Joseph Piacenza, University of West Florida, Pensacola, FL, United States*

**9:50AM** Framing Product Circularity Performance For Optimized Green Profit  
Technical Paper Publication. IDETC2019-98390

*Michael Saidani, Department of Industrial and Enterprise Systems Engineering, U of Illinois at Urbana-Champaign, Urbana, IL, United States, Harrison Kim, University Of Illinois, Urbana, IL, United States, Bernard Yannou, Yann Leroy, François Cluzel, Laboratoire Genie Industriel, CentraleSupélec, Université Paris-Saclay, Gif-sur-Yvette, France*



# Technical Sessions

**10:10AM REUSE POTENTIAL OF USED TEXTILES FOR AMERICAN INDUSTRIES**  
Technical Paper Publication. IDETC2019-98521

*Asad Bashir, UMDuluth, Duluth, MN, United States, Abigail Clarke-Sather, University of Minnesota Duluth, Duluth, MN, United States*

**DFMLC-3**  
**CONCEPTUAL DESIGN AND ANALYSIS OF SUSTAINABILITY**  
Session DFMLC-3-1  
Conceptual Design and Analysis of Sustainability  
Oceanside **10:50AM–12:10PM**

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**10:50AM Overview of the Development and Enforcement of Process-Driven Manufacturability Constraints in Product Design**  
Technical Paper Publication. IDETC2019-97384

*Albert Patterson, University of Illinois At Urbana-Champaign, Urbana, IL, United States, Yong Hoon Lee, University of Illinois at Urbana-Champaign, Savoy, IL, United States, James T. Allison, University of Illinois at Urbana-Champaign, Urbana, IL, United States*

**11:10AM Modeling Known Design Concepts and Managing Their Functional Coupling Modules to Balance Upstream Objectives and Downstream Constraints for New Product Development**  
Technical Paper Publication. IDETC2019-97573

*Chu-Yi Wang, University of Southern California, Los Angeles, CA, United States, Stephen Lu, USC, California, CA, United States*

**11:30AM A Graph Coloring Technique for Identifying The Minimum Number of Parts for Physical Integration in Product Design**  
Technical Paper Publication. IDETC2019-98251

*Praveen Kumare Gopalakrishnan, University at Buffalo, Buffalo, NY, United States, Jeffery Cavallaro, Sogol Jahanbekam, San Jose State University, San Jose, CA, United States, Sara Behdad, University At Buffalo, SUNY, Amherst, NY, United States*

**11:50AM Reconciling Co-Evolving Engineering and Customer Requirements With a Looped Bayesian Model**  
Technical Paper Publication. IDETC2019-97524

*Christopher Slon, Oakland University, Beverly Hills, MI, United States, Vijitashwa Pandey, Oakland University, Rochester, MI, United States*

**DFMLC-1**  
**DESIGN AND ANALYSIS FOR ADDITIVE MANUFACTURING**  
Session DFMLC-1-1  
Design and Analysis for Additive Manufacturing  
Oceanside **2:10PM–3:45PM**

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**2:10PM Localised pre-heating to improve inter-layer delamination strength in fused deposition modelling**  
Technical Paper Publication. IDETC2019-97416

*Andrew Aitchison, Qing Wang, Durham University, DURHAM, — Select One —, United Kingdom*

**2:29PM A Comparative Study of Metal Additive Manufacturing Processes for Elevated Sustainability**  
Technical Paper Publication. IDETC2019-97436

*Wenbo Min, Sheng Yang, Ying Zhang, Yaoyao Fiona Zhao, McGill University, Montreal, QC, Canada*

**2:48PM A PROPOSED HYBRID LASER QUENCHING PROCESS, AND INVESTIGATION OF ITS THREE-DIMENSIONAL FORMING ERROR**  
Technical Paper Publication. IDETC2019-97723

*Hikomichi Nishida, Yuki Manabe, Doshisha University, Kyoto, Japan, Toshiki Hirogaki, Eiichi Aoyama, Doshisha Univ, Kyotanabe-shi, Japan*

**3:07PM A Blockchain Platform for Protecting Intellectual Property: Implications for Additive Manufacturing**  
Technical Paper Publication. IDETC2019-98293

*Behzad Esmaeili, WNEU, Springfield, MA, United States, Angshuman Deka, University at Buffalo, Rochester, NY, United States, Sara Behdad, University At Buffalo, SUNY, Amherst, NY, United States*

**3:26PM Direct Energy Deposition 3D Printing of Thermoelectric Powders: Simulation and Experiments**  
Student Competition Poster. IDETC2019-98396

*Kan Sun, Yongjia Wu, Virginia Tech, Blacksburg, VA, United States, Huan Qi, Zhiwei Wu, Nanjing Huirui Photoelectric Technology Co., Ltd., Nanjing, Jiangsu, China, Lei Zuo, Virginia Tech, Blacksburg, VA, United States*

**DFMLC-1**  
**DESIGN AND ANALYSIS FOR ADDITIVE MANUFACTURING**  
Session DFMLC-1-2  
Design and Analysis for Additive Manufacturing  
Oceanside **4:10PM–5:50PM**

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**4:10PM Design Principle Cards: Toolset to Support Innovations with Additive Manufacturing**  
Technical Paper Publication. IDETC2019-97231

*Carlye Lauff, SUTD-MIT International Design Centre, Singapore, Singapore, K. Blake Perez, nTopology Inc., New York, NY, United States, Bradley Camburn, SUTD-MIT International Design Centre, Singapore, Singapore, Kristin Wood, Singapore University of Technology and Design, Austin, TX, United States*

**4:30PM A PROPOSAL FOR DIGITAL IMAGING AND COMMUNICATION IN PRODUCT ENGINEERING USING CT DATA**  
Technical Paper Publication. IDETC2019-97355

*Dirk Hofmann, Philipp Sembdner, Stefan Holtzhausen, Ralph Stelzer, Dresden University of Technology, Dresden, Saxony, Germany*

# Technical Sessions

**4:50PM**      **Additive Manufacture of Fibre-Reinforced Structures: Design Process and Principles**  
Technical Paper Publication. IDETC2019-97398

*Bradley Camburn*, Singapore University of Technology and Design, Singapore, Singapore, *Elyud Ismail*, Commonwealth Center for Advanced Manufacturing, Disputanta, VA, United States, *K. Blake Perez*, nTopology, New York, NY, United States, *Carlye Lauff*, SUTD-MIT International Design Centre, Singapore, Singapore, *Kristin Wood*, Singapore University of Technology and Design, Austin, TX, United States

**5:10PM**      **A Fully Automated Design Pipeline for Mass Customisation of Personal Equipment via Additive Manufacture**  
Technical Presentation. IDETC2019-97804

*Shiya Li*, *Stefanos Zafeiriou*, *Connor Myant*, Imperial College London, London, United Kingdom

**5:30PM**      **The effect of internal structure on the shape memory effect of shape memory polymers**  
Technical Presentation. IDETC2019-97970

*Jiwoo Choi*, Dyson School of Design Engineering, Imperial College London, London, United Kingdom, *Connor Myant*, Imperial College London, London, United Kingdom

## TUESDAY, AUGUST, 20

**DFMLC-6**  
**DESIGN AND ANALYSIS OF ENERGY STORAGE AND CONVERSION SYSTEMS**

Session DFMLC-6-1  
**Design and Analysis of Energy Storage, Conversion, and Agriculture Systems**  
Oceanside      **8:00AM–9:00AM**

**8:00AM**      **Bio-Oil Upgrading Via Micro-Emulsification And Ultrasound Treatment: Examples For Analysis And Discussion**  
Technical Paper Publication. IDETC2019-97182

*Sam Hansen*, University of Idaho, Idaho Falls, ID, United States, *Amin Mirkouei*, University of Idaho-Idaho Falls, Idaho Falls, ID, United States

**8:30AM**      **LIFE CYCLE ASSESSMENT OF PYROLYSIS-DERIVED BIOCHAR FROM ORGANIC WASTES AND ADVANCED FEEDSTOCKS**  
Technical Paper Publication. IDETC2019-97896

*Benjamin Hersh*, University of Idaho, Idaho Falls, ID, United States, *Amin Mirkouei*, University of Idaho-Idaho Falls, Idaho Falls, ID, United States

**DFMLC-8**  
**ENVIRONMENTAL LIFE CYCLE ANALYSIS AND DECISION MAKING**

Session DFMLC-8-1  
**Life Cycle Analysis and Decision Making**  
Oceanside      **10:50AM–12:10PM**

**10:50AM**      **A Conceptual Framework for Using Videogrammetry in Blockchain Platforms for Food Supply Chain Traceability**  
Technical Paper Publication. IDETC2019-97527

*Praveen Kumare Gopalakrishnan*, University at Buffalo, Buffalo, NY, United States, *Sara Behdad*, University At Buffalo, SUNY, Amherst, NY, United States

**11:10AM**      **Lifetime Prediction Considering Nonlinearity in Degradation Progression**  
Technical Paper Publication. IDETC2019-97593

*Rosmawati Jihin*, *Dirk Söffker*, University of Duisburg-Essen, Duisburg, Germany

**11:30AM**      **Health State Assessment and Lifetime Prediction Based On Unsupervised State Estimation**  
Technical Paper Publication. IDETC2019-97641

*Rosmawati Jihin*, *Dirk Söffker*, University of Duisburg-Essen, Duisburg, Germany

**11:50AM**      **ENVIRONMENTAL AND ECONOMIC EVALUATION OF THE SHEET METAL STAMPING PROCESS USING ALTERNATIVE LUBRICANTS**  
Technical Paper Publication. IDETC2019-97783

*Daniele Landi*, *Michele Germani*, Università Politecnica delle Marche, Ancona, Italy, *Marco Marconi*, Università degli Studi della Tuscia, Viterbo, Italy, *Claudio Favi*, Università di Parma, Parma, Italy, *Marco Mandolini*, Università Politecnica Delle Marche, Ancona, OO, Italy

**DFMLC-7**  
**DESIGN, MODELING AND AUTOMATION OF MANUFACTURING AND ASSEMBLY PROCESSES**

Session DFMLC-7-1  
**Design, Modeling, and Automation of Manufacturing and Assembly**  
Oceanside      **2:10PM–3:50PM**

**2:10PM**      **TO IDENTIFY KEY GEOMETRIC ERRORS OF 3-AXIS NC MACHINE TOOL BY MACHINING ACCURACY FAILURE MODE ANALYSIS**  
Technical Paper Publication. IDETC2019-97016

*Baobao Qi*, *Qiang Cheng*, *Zhifeng Liu*, *Dongyang Sun*, Beijing University of Technology, Beijing, China

# Technical Sessions

**2:30PM** Integrative Design of Product Architecture and Assembly Process Plan  
Technical Paper Publication. IDETC2019-97338

*Masato Toi, Kana Sawai, Masahide Kobayashi, Yutaka Nomaguchi, Kikuo Fujita, Osaka University, Suita, Osaka, Japan*

**2:50PM** Generation and Mapping of Minimally-Restrictive Manufacturability Constraints for Mechanical Design Problems  
Technical Paper Publication. IDETC2019-97386

*Albert Patterson, James T. Allison, University of Illinois At Urbana-Champaign, Urbana, IL, United States*

**3:10PM** Manufacturing processes re-engineering for cost reduction: the investment casting case study  
Technical Paper Publication. IDETC2019-97532

*Marco Mandolini, Universit Politecnica Delle Marche, Ancona, OO, Italy, Federico Campi, Università Politecnica delle Marche, Ancona, Italy, Claudio Favi, Università di Parma, Parma, Italy, Michele Germani, Università Politecnica delle Marche, Ancona, Italy*

**3:30PM** Novel State Estimation Method of Surface Chatter Pattern via Image Processing After End Milling  
Technical Paper Publication. IDETC2019-97805

*Nobutoshi Ozaki, Doshisha Univ, Kyotanabe-shi, Japan, Shota Matsui, Doshisha Univ, Kyotanade-shi, Japan, Toshiki Hirogaki, Eiichi Aoyama, Doshisha Univ, Kyotanabe-shi, Japan*

## DFMLC-10

### **SPECIAL SESSION: DESIGN TOOL SHOWCASE**

#### Session DFMLC-10-1

#### Design Tool Showcase Presentations

**Oceanside 4:10PM–5:50PM**

**4:10PM** Will It Print? Interactive Manufacturability Toolbox for 3D Printing  
Poster Paper Presentation. IDETC2019-97371

*Hannah Budinoff, Yilin Sun, Sara McMains, University of California, Berkeley, Berkeley, CA, United States*

**4:21PM** BetterWaster: A Mobile Application For Addressing Information Gaps In Household Waste Sorting  
Technical Presentation. IDETC2019-97584

*Mikkel Rasmussen, Kelvin Pagels, Devarajan Ramanujan, Aarhus University, Aarhus C, Denmark*

**4:32PM** Additive Manufacturing (AM) Design Principle Cards  
Technical Presentation. IDETC2019-98262

*Carlye Lauff, SUTD-MIT International Design Centre, Singapore, Singapore, K. Blake Perez, nTopology Inc., New York, NY, United States, Bradley Camburn, SUTD-MIT International Design Centre, Singapore, Singapore, Kristin Wood, Singapore University of Technology and Design, Austin, TX, United States*

**4:43PM** Prototyping Canvas: Tool for Intentional Prototyping Practice  
Technical Presentation. IDETC2019-98264

*Carlye Lauff, SUTD-MIT International Design Centre, Singapore, Singapore, Jessica Menold, The Pennsylvania State University, Aston, PA, United States, Kristin Wood, Singapore University of Technology and Design, Austin, TX, United States*

**4:54pm** Shape Structuralizer: Design, Fabrication, and User-driven Iterative Refinement of 3D Mesh Models  
Technical Presentation. IDETC2019-98287

*Yunbo Zhang, Rochester Institute of Technology, Rochester, NY, United States*

**5:05PM** Mini-Map: Mixed-Initiative Mind-Mapping with AI-Collaborator  
Technical Presentation. IDETC2019-98367

*Ting-Ju Chen, Sai Ganesh Subramanian, Vinayak R. Krishnamurthy, Texas A&M University, College Station, TX, United States*

**5:16PM** Diffusion Based Material Model for Kinesthetic Feedback in Virtual Sculpting: Preliminary Exploration  
Technical Presentation. IDETC2019-98380

*Ronak Ranjtkumar Mohanty, Bruce Tai, Mathew Kuttolamadom, Vinayak R. Krishnamurthy, Texas A&M University, College Station, TX, United States*

**5:27PM** C-Indicators: A Web-Based Platform To Monitor And Improve The Circularity Potential Of Products  
Technical Presentation. IDETC2019-98397

*Michael Saidani, Department of Industrial and Enterprise Systems Engineering, U of Illinois at Urbana-Champaign, Urbana, IL, United States, Harrison Kim, University Of Illinois, Urbana, IL, United States, Bernard Yannou, Yann Leroy, François Cluzel, Laboratoire Genie Industriel, CentraleSupélec, Université Paris-Saclay, Gif-sur-Yvette, France*

**5:38PM** TACT - Tractor Analysis and Comparison Tool  
Technical Presentation. IDETC2019-98461

*Guillermo F Diaz Lanckenau, Amos G. Winter, V, MASSACHUSETTS INSTITUTE OF TECHNOLOGY, Cambridge, MA, United States*

# Technical Sessions

## 31st International Conference on Design Theory and Methodology (DTM) MONDAY, AUGUST, 19

### DTM-11

#### DESIGN DECISION MAKING

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##### Session DTM-11-1

#### Laguna A 8:00AM–9:00AM

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**8:00AM** Conducting non-Adaptive Experiments in a Live Setting: A Bayesian Approach to Determining Optimal Sample Size  
Technical Paper Publication. IDETC2019-98335

*Nandan Sudarsanam, Ramya Chandran, Indian Institute of Technology Madras, Chennai, Tamil Nadu, India, Daniel Frey, Massachusetts Institute of Technology, Cambridge, MA, United States*

**8:20AM** Investigating Information: A Qualitative Analysis of Expert Designers? Information Representation and Structuring Behaviors  
Technical Paper Publication. IDETC2019-98362

*Nicole Damen, UNO, Omaha, NE, United States, Christine Toh, University of Nebraska at Omaha, Omaha, NE, United States*

**8:40AM** Should It Stay Or Should It Go? A Case Study Of Concept Screening In Engineering Design Industry  
Technical Paper Publication. IDETC2019-97564

*Xuan Zheng, Penn State University, University Park, PA, United States, Scarlett Miller, The Pennsylvania State University, University Park, PA, United States*

### DTM-10

#### NEW & REVISITING DIRECTIONS

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##### Session DTM-10-1

#### Lightning Talks on New and Revisiting Directions in DTM

#### Laguna A 9:10AM–10:30AM

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**9:10AM** A New Set of Metrics for Design Process: Revitalizing the Neglected “P” of Design Research  
Technical Presentation. IDETC2019-98614

*Daniel Henderson, The Pennsylvania State University, Irwin, PA, United States, Thomas Booth, The Pennsylvania State University, University Park, PA, United States, Kathryn Jablow, The Pennsylvania State University, Malvern, PA, United States, Neeraj Sonalkar, Stanford University, Stanford, CA, United States, Jennifer Bracken, The Pennsylvania State University, University Park, PA, United States, Stephen Harris, Air University, Montgomery, AL, United States*

**9:15AM** A Proposed Metric to Assess the Overall Innovative Potential of Conceptual Designs  
Technical Presentation. IDETC2019-98606

*Joshua Gyory, Carnegie Mellon University, Pittsburgh, PA, United States, Kosa Goucher-Lambert, University of California, Berkeley, Berkeley, CA, United States, Kenneth Kotovsky, Carnegie Mellon University, Pittsburgh, PA, United States, Jonathan Cagan, Carnegie Mellon Univ, Pittsburgh, PA, United States*

**9:20AM** Calibrating Novelty Metrics Using Human Raters: A Case Study  
Technical Presentation. IDETC2019-98604

*Sharath Kumar Ramachandran, The Pennsylvania State University, University Park, PA, United States, Faez Ahmed, Mark Fuge, University of Maryland, College Park, MD, United States, Sam Hunter, Scarlett Miller, The Pennsylvania State University, University Park, PA, United States*

**9:25AM** EMPATHIC ACCURACY: A REAPPRAISAL OF ?EMPATHY? IN DESIGN  
Technical Presentation. IDETC2019-98685

*Alvaro Mario Chang Arana, Antti Surma-aho, Katja Holttä-Otto, Aalto University, Espoo, Finland*

**9:30AM** What'd You Say? A Survey of the State of the Art in Automated Audio Transcription Services  
Technical Presentation. IDETC2019-98607

*Elizabeth M. Starkey, The Pennsylvania State University, University Park, PA, United States, Xuan Zheng, Penn State University, University Park, PA, United States, Sharath Kumar Ramachandran, The Pennsylvania State University, State College, PA, United States, Scarlett Miller, The Pennsylvania State University, University Park, PA, United States*

**9:35AM** Data mining association rules using a Design Repository to enhance data-driven design decisions  
Technical Presentation. IDETC2019-98628

*Katherine Edmonds, Alex Mikes, Robert Stone, Bryony DuPont, Oregon State University, Corvallis, OR, United States*

**9:40AM** Presenting an iterative product design framework perceived for resource-constrained society  
Technical Presentation. IDETC2019-98630

*BIBHUTI RANJAN BHATTACHARJYA, CENTRE FOR RURAL TECHNOLOGY, GUWAHATI, Assam, India*

**9:45AM** Constructal Design of Flying Wing Aircraft: Flow of Stresses and Aeroelastic Stability  
Technical Presentation. IDETC2019-97959

*Pezhman Mardanpour, Ehsan Izadpanahi, Florida International University, Miami, FL, United States, Adrian Bejan, Duke Univ, Durham, NC, United States*



# Technical Sessions

**9:50AM AN APPROACH TO IMPROVE MODULARIZATION THROUGH FUNCTIONAL MODELLING: COMMON MODULAR ARCHITECTURE - AN AUTOMOTIVE APPLICATION**  
Technical Presentation. IDETC2019-98324

*Timo Kero*, Volvo GTT, Göteborg, Sweden, *Dag Raudberget*, Chalmers University of Technology, Gothenburg, Västra Götaland, Sweden, *Christoffer Levandowski*, QRTECH AB, Gothenburg, VG, Sweden, *Hans Johannesson*, Chalmers University of Technology, Gothenburg, Sweden, *Lars-Göran Tunvald*, Volvo GTT, Gothenburg, VG, Sweden, *Ola Isaksson*, Chalmers University of Technology, Gothenburg, VG, Sweden

**DTM-6**

## **HUMAN BEHAVIOR IN DESIGN**

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Session DTM-6-1

**Laguna A 10:50AM–12:10PM**

**10:50AM Collaborative Mind-Mapping: A Study of Patterns, Strategies, and Evolution of Maps Created by Peer-Pairs**  
Technical Paper Publication. IDETC2019-98125

*Ting-Ju Chen*, *Ronak Ranjtkumar Mohanty*, *Miguel A. Hoffmann Rodriguez*, *Vinayak R. Krishnamurthy*, Texas A&M University, College Station, TX, United States

**11:10AM Prediction of design team performance on a conceptual design task using an automatable, topic-independent analysis of language use**  
Technical Paper Publication. IDETC2019-98199

*David M. Cannon*, NASA Langley Research Center, Hampton, VA, United States, *Jonathan A. Edelman*, Hasso Plattner Institute, Potsdam, Germany

**11:30AM Effect of Team Size on Problem-solving and Solution Quality: An Empirical Study**  
Technical Paper Publication. IDETC2019-97719

*Seth Hamilton Jacobs*, *Matthew Conor Pfarr*, *Mohammad Fazelpour*, *Abdul Kingsongo Koroma*, *Tseday Abeba Mesfin*, University of Maryland, College Park, MD, United States

**11:50AM Application of a Protocol to Observe Leadership Behaviors in Engineering Design Teams**  
Technical Paper Publication. IDETC2019-97632

*James Righter*, *Joshua Summers*, *Chase Wentzky*, Clemson University, Clemson, SC, United States

**DTM-7**

## **ENTREPRENEURSHIP & TEAMS IN DESIGN**

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Session DTM-7-1

**Laguna A 2:10PM–3:45PM**

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**2:10PM The Trajectory Of Psychological Safety In Engineering Teams: A Longitudinal Exploration In Engineering Design Education**  
Technical Paper Publication. IDETC2019-97562

*Scarlett Miller*, The Pennsylvania State University, University Park, PA, United States, *Jacqueline Marhefka*, *Katie Heininger*, The Pennsylvania State University, State College, PA, United States, *Susan Mohammed*, Penn State, University Park, PA, United States, *Kathryn Jablokow*, The Pennsylvania State University, Malvern, PA, United States, *Sarah Ritter*, Penn State, University Park, PA, United States

**2:30PM Collaborating with Style: Using an Agent-Based Model to Simulate Cognitive Style Diversity in Problem Solving Teams**  
Technical Paper Publication. IDETC2019-97932

*Samuel Lapp*, The Pennsylvania State University, Pittsburgh, PA, United States, *Kathryn Jablokow*, The Pennsylvania State University, Malvern, PA, United States, *Christopher McComb*, The Pennsylvania State University, State College, PA, United States

**2:50PM BUILD YOUR FIRM WITH STRANGERS? LONGITUDINAL STUDIES ON OPEN SOURCE HARDWARE FIRM DEVELOPMENT**  
Technical Paper Publication. IDETC2019-97618

*Zhuoxuan Li*, Massachusetts Institute of Tehnology, Cambridge, MA, United States, *Warren Seering*, Massachusetts Inst Of Tech, Cambridge, MA, United States

**3:10PM The Prototyping Behaviors of Startups: Exploring the Relationship Between Prototyping Behavior and the Financial Success of Startups**  
Technical Paper Publication. IDETC2019-97475

*Jacob Nelson*, *Tobias Mahan*, Penn State University, University Park, PA, United States, *Christopher McComb*, The Pennsylvania State University, State College, PA, United States, *Jessica Menold*, The Pennsylvania State University, Aston, PA, United States

**3:30PM Manufacturing Vulnerability: How Resource Scarcity Hinders Team Coordination in Manufacturing-Led Development in Nigerian Factories**  
Technical Paper Publication. IDETC2019-97820

*Abisola Kusimo*, *Sheri Sheppard*, Stanford University, Stanford, CA, United States

**DTM-6**

## **HUMAN BEHAVIOR IN DESIGN**

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Session DTM-6-2

**Laguna A 4:10PM–5:50PM**

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# Technical Sessions

**4:10PM** Understanding the Design Neurocognition of Mechanical Engineers when Designing and Problem-solving.  
Technical Paper Publication. IDETC2019-97838

*Sonia Vieira*, INEGI-Institute of Science and Innovation in Mechanical a Faculty of Engineering University of Porto, Porto, Portugal, *John S. Gero*, University of North Carolina at Charlotte and George Mason University, Charlotte, NC, United States, *Jessica Delmoral*, Institute of Science and Innovation in Mechanical and Industrial Engineering, University of Porto, Porto, *Valentin Gattol*, Austrian Institute of Technology, Vienna, *Carlos Fernandes*, Saint John Hospital, Porto, *Marco Parente*, *Antonio Fernandes*, Faculty of Engineering University of Porto, Porto, Portugal

**4:30PM** The Effects of Locus of Control and Big Five Personality Traits on Collaborative Engineering Design Tasks with Negotiation  
Technical Paper Publication. IDETC2019-97311

*Alkim Avsar*, *Ambrosio Valencia-Romero*, Stevens Institute of Technology, Hoboken, NJ, United States, *Paul Grogan*, Stevens Institute of Technology, New York, NY, United States

**4:50PM** Antecedents and Outcomes of Designer Empathy ? A Retrospective Interview Study  
Technical Paper Publication. IDETC2019-97483

*Antti Surma-aho*, Aalto University, Espoo, Finland, *Claudia Chen*, Massachusetts Institute of Technology, Cambridge, MA, United States, *Katja Holttä-Otto*, Aalto University, Espoo, Finland, *Maria C. Yang*, Massachusetts Institute of Technology, Belmont, MA, United States

**5:10PM** Analysis of Designer Emotions in Collaborative and Traditional Computer-Aided Design  
Technical Paper Publication. IDETC2019-98516

*Jinxuan Zhou*, University of Toronto, Richmond Hill, ON, Canada, *Vrushank Phadnis*, Massachusetts Institute of Technology, Cambridge, MA, United States, *Alison Olechowski*, University of Toronto, Toronto, ON, Canada

**5:30PM** It Rings A Bell! Memory's Impact On Information Utilization By Novice Designers In The Early Design Process  
Technical Paper Publication. IDETC2019-97699

*Attakias Mertens*, *Christine Toh*, University of Nebraska at Omaha, Omaha, NE, United States

## TUESDAY, AUGUST, 20

### DTM-8

#### DESIGN OF COMPLEX SYSTEMS

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Session DTM-8-1

Laguna A 8:00AM–9:00AM

**8:00AM** Designing Self-Organizing Systems with Deep Multiagent Reinforcement Learning  
Technical Paper Publication. IDETC2019-98268

*Hao Ji*, University of Southern California, Los Angeles, CA, United States, *Yan Jin*, USC, Los Angeles, CA, United States

**8:20AM** A Differential Game Approach to Dynamic Competitive Decisions Toward Human-Computer Collaboration  
Technical Paper Publication. IDETC2019-97619

*Alparslan Emrah Bayrak*, Stevens Institute of Technology, Hoboken, NJ, United States, *Christopher McComb*, The Pennsylvania State University, State College, PA, United States, *Jonathan Cagan*, Carnegie Mellon Univ, Pittsburgh, PA, United States, *Kenneth Kotovsky*, Carnegie Mellon University, Pittsburgh, PA, United States

**8:40AM** Towards Consistent Value Orientation in Release Planning  
Technical Paper Publication. IDETC2019-98185

*Tarik Sahin*, *David Inkermann*, *Thomas Vietor*, Technische Universität Braunschweig, Braunschweig, Germany

### DTM-13

#### SUSTAINABILITY IN DESIGN

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Session DTM-13-1

DTM/DFMLC joint session on Design for Sustainable Product Use and User Behavior?

Laguna A 9:10AM–10:30AM

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**9:10AM** Exploring the Effectiveness of Providing Structured DfE Design Strategies during Conceptual Design  
Technical Paper Publication. IDETC2019-98286

*Donovan Ross*, *Vincenzo Ferrero*, *Bryony DuPont*, Oregon State University, Corvallis, OR, United States

**9:30AM** A Wizard-Of-Oz Experiment To Demonstrate Water Reduction And User Training With An ?Autonomous? Faucet  
Technical Paper Publication. IDETC2019-98468

*William Jou*, *Samantha M. Beaulieu*, *Adrienne K. Lim*, *Erin F. MacDonald*, Stanford University, Stanford, CA, United States

**9:50AM** Situational Factors And Attitudes Affecting Sustainable Electric Kettle Usage  
Technical Paper Publication. IDETC2019-97658

*Kimberly Elisabeth Engelking*, *Kanako Irie*, *Rasmus Velling Thorup*, *Devarajan Ramanujan*, Aarhus University, Aarhus C, Select State/ Province, Denmark

# Technical Sessions

**10:10AM** Promoting Energy-efficient Driving Using Associative Graphical Displays: Can a Cup of Coffee Encourage You to Drive More Smoothly?  
Technical Paper Publication. IDETC2019-97296

*Julian Potvin-Bernal, University of Toronto, Toronto, ON, Canada, L.H. Shu, Univ Of Toronto, Toronto, ON, Canada*

## DTM-5

### TRENDS IMPACTING DESIGN PROCESSES

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#### Session DTM-5-1

**Laguna A 10:50AM–12:10PM**

**10:50AM** Towards an Information Archetypes Framework: Exploring the Types of Information Used in Open Source Design Engagements  
Technical Paper Publication. IDETC2019-97956

*Sue J. Yi, Kevin Lumbard, University of Nebraska at Omaha, Omaha, NE, United States, Nicole Damen, UNO, Omaha, NE, United States, Matt Germonprez, Christine Toh, University of Nebraska at Omaha, Omaha, NE, United States*

**11:10AM** Predicting Multi-Disciplinary Design Performance Utilizing Automated Topic Discovery  
Technical Paper Publication. IDETC2019-97189

*Zachary Ball, University At Buffalo, SUNY, Amherst, NY, United States, Kemper Lewis, University At Buffalo - SUNY, Buffalo, NY, United States*

**11:30AM** Successes and Challenges in Implementing Lean Product Development  
Technical Paper Publication. IDETC2019-98078

*Hrushikesh Godbole, Rochester Institute of Technology, Rochester, NY, United States, Marcos Esterman, Rochester Inst Of Tech, Rochester, NY, United States, Shridhar Palekar, Rochester Institute of Technology, Rochester, NY, United States, Alvaro Rojas Arciniegas, Universidad Autónoma de Occidente, Cali, Valle del Cauca, Colombia*

**11:50AM** Design Innovation with Additive Manufacturing: A Methodology  
Technical Paper Publication. IDETC2019-97400

*K. Blake Perez, nTopology Inc., New York, NY, United States, Carlye Lauff, Bradley Camburn, SUTD-MIT International Design Centre, Singapore, Singapore, Kristin Wood, Singapore University of Technology and Design, Austin, TX, United States*

## DTM-9

### CREATIVITY AND IDEATION

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#### Session DTM-9-1

**Laguna A 2:10PM–3:50PM**

**2:10PM** Evaluating Crowdsourced Design Concepts with Machine Learning  
Technical Paper Publication. IDETC2019-97285

*Bradley Camburn, Yuejun He, Sujithra Raviselvam, Jianxi Luo, Singapore University of Technology and Design, Singapore, Singapore, Kristin Wood, Singapore University of Technology and Design, Austin, TX, United States*

**2:30PM** Measuring, Learning and Optimizing Design Variety using Herfindahl Index  
Technical Paper Publication. IDETC2019-97778

*Faez Ahmed, University of Maryland, College Park, MD, United States, Sharath Kumar Ramachandran, The Pennsylvania State University, State College, PA, United States, Mark Fuge, University of Maryland, College Park, MD, United States, Sam Hunter, Scarlett Miller, The Pennsylvania State University, University Park, PA, United States*

**2:50PM** Interpreting Measures of Rarity and Novelty: Investigating Correlations Between Relative Infrequency and Perceived Ratings  
Technical Paper Publication. IDETC2019-97828

*Morgan Weaver, Benjamin Caldwell, Vicki Sheaffer, LeTourneau University, Longview, TX, United States*

**3:10PM** The Sketch Quality Bias: Evaluating Descriptions of Product Ideas With and Without Visuals  
Technical Paper Publication. IDETC2019-97232

*Jieun Kwon, Barry Kudrowitz, University of Minnesota, Minneapolis, MN, United States*

**3:30PM** To Classify Or Combine: The Effects Of Idea Generation Mechanisms On the Novelty And Quantity Of Ideas  
Technical Paper Publication. IDETC2019-97141

*Senni Kirjavainen, Katja Holttä-Otto, Aalto University, Espoo, Finland*

## DTM-4

### PROTOTYPING & DESIGN REPRESENTATION

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#### Session DTM-4-1

**Laguna A 4:10PM–5:50PM**

**4:10PM** From Idea to Production: A Retrospective and Longitudinal Case Study of Prototypes and Prototyping Strategies  
Technical Paper Publication. IDETC2019-98398

*Camilla Arndt Hansen, Technical University of Denmark, Kgs. Lyngby, Denmark, Ali Gürçan Özkil, Technical University of Denmark, Lyngby, Denmark*

# Technical Sessions

**4:30PM** Contabat ? Designing and prototyping an attachable sports analytics device that provides ball-bat impact location for performance enhancement  
Technical Paper Publication. IDETC2019-98517

*Umair Sarwar, Kamran A Cheema, Purdue University, West Lafayette, IN, United States, Tahira Reid, Purdue University, W Lafayette, IN, United States*

**4:50PM** COMPUTATIONAL PROTOTYPING METHODS TO DESIGN HUMAN CENTERED PRODUCTS OF HIGH AND LOW LEVEL HUMAN INTERACTIONS  
Technical Paper Publication. IDETC2019-98450

*Salman Ahmed, Lukman Irshad, H. Onan Demirel, Oregon State University, Corvallis, OR, United States*

**5:10PM** ARCHIE: An Automated Data Collection Method for Physical Prototyping Efforts in Authentic Design Situations  
Technical Paper Publication. IDETC2019-97444

*Jacob Nelson, Andrew Berlin, Penn State University, University Park, PA, United States, Jessica Menold, The Pennsylvania State University, Aston, PA, United States*

**5:30PM** Similarity in Engineering Design: A Knowledge-Based Approach  
Technical Paper Publication. IDETC2019-98272

*Ashish Chaudhari, Ilias Bilionis, Jitesh Panchal, Purdue University, West Lafayette, IN, United States*

## WEDNESDAY, AUGUST, 21

### DTM-14

#### AGILE/ SCRUM FOR HARDWARE

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Session DTM-14-1

**DTM-14: Agile/ Scrum for Hardware and DTM-3: Computation and Big Data in Design**

**Laguna A 8:00AM–9:40AM**

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**8:00AM** Prototype Design in Agile Product Development Processes for Technical Systems  
Technical Paper Publication. IDETC2019-97008

*Michael Riesener, Laboratory for Machine Tools and Production Engineering (WZL) of RWTH Aachen University, Aachen, Germany, Christian Doelle, Sebastian Schloesser, Günther Schuh, Laboratory For Machine Tools and Production Engineering WZL RWTH Aachen, Aachen, Germany*

**8:25AM** How the Design of a 3D Printer Bridged Engineering Design Processes and the Agile Software Manifesto  
Technical Paper Publication. IDETC2019-97261

*Steven Lindberg, Matthew Campbell, Oregon State University, Corvallis, OR, United States*

**8:50AM** An Association Rule Approach for identifying physical system-user interactions and potential human error Using a Design Repository  
Technical Paper Publication. IDETC2019-98424

*Nicolas Soria Zurita, Melissa Anne Tensa, Vincenzo Ferrero, Robert Stone, Bryony DuPont, H. Onan Demirel, Irem Y. Tumer, Oregon State University, Corvallis, OR, United States*

**9:15AM** A RADIAL BASIS FUNCTION-BASED MULTI-FIDELITY SURROGATE MODEL REFERRING TO CANONICAL CORRELATION ANALYSIS  
Technical Paper Publication. IDETC2019-97208

*Liye Lv, Xueguan Song, Chao Zhang, Wei Sun, Dalian University of Technology, Dalian, China*

### DTM-9

#### CREATIVITY AND IDEATION

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Session DTM-9-2

**Laguna A 10:00AM–11:40AM**

**10:00AM** Does Visual Fixation Affect Functional Fixedness?  
Technical Paper Publication. IDETC2019-98276

*E. Kwon, University of Toronto, Toronto, ON, Canada, Jennifer Ryan, Rotman Research Institute, Toronto, ON, Canada, Aimy Bazylak, University of Toronto, Toronto, Ontario, ON, Canada, L.H. Shu, Univ Of Toronto, Toronto, ON, Canada*

**10:20AM** Informing Design Defixation Using Interventions for Psychiatric Disorders  
Technical Paper Publication. IDETC2019-98277

*Kayla Pedret, University of Toronto, Toronto, ON, Canada, L.H. Shu, Univ Of Toronto, Toronto, ON, Canada*

**10:40AM** DIMENSIONS OF PRODUCT SIMILARITY IN DESIGN BY ANALOGY: AN EXPLORATORY STUDY  
Technical Paper Publication. IDETC2019-98252

*Amaninder Singh Gill, Florida Institute of Technology, Melbourne, FL, United States, Arnold Tsoka, Florida Institute of Technology, Melbourne, FL, United States, Chiradeep Sen, Florida Institute of Technology, Melbourne, FL, United States*

**11:00AM** Computationally Derived Adaptive Inspirational Stimuli For Real-Time Design Support During Concept Generation  
Technical Paper Publication. IDETC2019-98188

*Kosa Goucher-Lambert, University of California, Berkeley, Berkeley, CA, United States, Joshua Gyory, Kenneth Kotovsky, Carnegie Mellon University, Pittsburgh, PA, United States, Jonathan Cagan, Carnegie Mellon Univ, Pittsburgh, PA, United States*



# Technical Sessions

**11:20AM**      **An Extreme User Approach To Identify Latent Needs: Adaptation And Application In Medical Device Design**  
Technical Paper Publication. IDETC2019-98266

*Sujithra Raviselvam, Singapore University of Technology and Design, Singapore, Singapore, Kristin Wood, Singapore University of Technology and Design, Austin, TX, United States, Katja Holttä-Otto, Aalto University, Espoo, Finland, Karupppasamy Subburaj, Singapore University of Technology and Design, Singapore, Singapore*

## DTM-6

### HUMAN BEHAVIOR IN DESIGN

#### Session DTM-6-3

**Laguna A**      **1:15PM–2:55PM**

**1:15PM**      **Requirements Culture: A Case Study on Product Development and Requirement Perspectives**  
Technical Paper Publication. IDETC2019-97017

*Maria Vittoria Elena, Chase Wentzky, Joshua Summers, Clemson University, Clemson, SC, United States*

**1:35PM**      **Motivations for users participating in co-innovation communities: a case study of Local Motors**  
Technical Paper Publication. IDETC2019-97471

*Qing Zheng, SouthWest Jiaotong University, Chengdu, China, Wei Guo, Tianjin University, Tianjin, China*

**1:55PM**      **Risk Perception and Product Safety in User-Centered Design**  
Technical Paper Publication. IDETC2019-98371

*Mingzhi Cai, University of Michigan-Shanghai Jiao Tong University Joint Institute, Shanghai, China, Erin N. Seligsohn, Georgia Institute of Technology, Atlanta, GA, United States, Zhinan Zhang, Shanghai Jiao Tong University, Shanghai, China, Yan Wang, Georgia Institute of Technology, Atlanta, GA, United States*

**2:15PM**      **Manipulating Trust of Autonomous Products with Affective Priming**  
Technical Paper Publication. IDETC2019-98395

*Ting Liao, Erin F. MacDonald, Stanford University, Stanford, CA, United States*

**2:35PM**      **Influencing The Tangibility of Digital Payments Through Product Design**  
Technical Paper Publication. IDETC2019-97873

*Yanling Li, Nanyang Technological University, Singapore, Singapore, Weston L. Baxter, Imperial College London, London, United Kingdom*

## DTM-12

### **DESIGN POTPOURRI: BIOLOGICALLY INSPIRED DESIGN AND HUMAN MEMORY**

#### Session DTM-12-1

**DTM-12: Design Potpourri: Biologically Inspired Design and Human Memory**

**Laguna A**      **3:15PM - 4:55PM**

**3:15PM**      **Current State Of The Art: Problem-Driven Multi-functional Bio-inspired Designs**  
Technical Paper Publication. IDETC2019-97455

*Devesh Bhasin, Daniel McAdams, Texas A&M University, College Station, TX, United States*

**3:35PM**      **Bio-inspired modeling approaches for human networks with link dissipation**  
Technical Paper Publication. IDETC2019-98171

*Varuneswara Panyam, Astrid Layton, Texas A&M University, College Station, TX, United States*

**3:55PM**      **Bio-Inspired Human Network Design: A Multi-Currency Robustness Metric Inspired By Ecological Network Analysis**  
Technical Paper Publication. IDETC2019-98235

*Abheek Chatterjee, J. Mike Walker '66 Department of Mechanical Engineering, Texas A&M University, College Station, TX, United States, Astrid Layton, Texas A&M University, College Station, TX, United States*

**4:15PM**      **Graduate Students' Mental Models: An Investigation into the Role of Function in Systems Understanding**  
Technical Paper Publication. IDETC2019-98383

*Alexander R. Murphy, Georgia Institute of Technology, Atlanta, GA, United States, Henry D. Banks, Robert Nagel, James Madison University, Harrisonburg, VA, United States, Julie Linsey, Georgia Institute of Technology, Atlanta, GA, United States*

**4:35PM**      **Assessing The Impact Of Cognitive Assistants On Mental Workload In Simple Tasks**  
Technical Paper Publication. IDETC2019-97543

*Torsten Maier, The Pennsylvania State University, State College, PA, United States, Vincent Donghia, Chaoran Chen, The Pennsylvania State University, University Park, PA, United States, Jessica Menold, The Pennsylvania State University, Aston, PA, United States, Christopher McComb, The Pennsylvania State University, State College, PA, United States*

# Technical Sessions

## 43rd Mechanisms and Robotics Conference (MR) MONDAY, AUGUST, 19

### MR-4

#### ORIGAMI-BASED ENGINEERING DESIGN

##### Session MR-4-1

#### Origami-Based Engineering Design - Keynote California Ballroom A 8:00AM–9:00AM

Session Organizer: **Mary Frecker, Ph.D.**, Pennsylvania State Univ,  
University Park, PA, United States

Session Co-Organizer: **Zhong You**, University of Oxford, Oxford, United  
Kingdom

### MR-11

#### STUDENT MECHANISM AND ROBOT DESIGN COMPETITION

##### Session MR-11-1

#### SMRDC I

#### Santa Monica 8:00AM–9:00AM

Session Organizer: **Vishesh Vikas**, University of Alabama, Tuscaloosa,  
AL, United States

Session Co-Organizer: **Brian J. Slaboch**, Middle Tennessee State  
University, Murfreesboro, TN, United States

### MR-3

#### COMPLIANT MECHANISMS (A. MIDHA SYMPOSIUM)

##### Session MR-3-1

#### Compliant Mechanisms - Fast forward and Interactive Presentations I

#### California Ballroom A 9:10AM–10:30AM

Session Organizer: **Girish Krishnan**, UIUC, Urbana, IL, United States

**9:10AM** Design of a new fully compliant translational joint  
via straight-line motion mechanism based method  
Technical Paper Publication. IDETC2019-97091

**Sonia C. Garcia, Juan A. Gallego-Sanchez**, Eafit University, Medellin,  
Colombia

**9:16AM** On the geometry of stiffness and compliance  
under concatenation  
Technical Paper Publication. IDETC2019-97161

**Charles Kim**, Bucknell Univ, Lewisburg, PA, United States

**9:22AM** Efficient Development of Continuum/Compliant  
Planar Linkage Mechanisms  
Technical Paper Publication. IDETC2019-97299

**Woo Rib Suh**, University of California, Irvine, Irvine, CA, United States,  
**J. Michael McCarthy**, Univ Of California, Irvine, CA, United States,  
**Edwin Peraza Hernandez**, University of California, Irvine, Irvine, CA,  
United States

**9:28AM** The performance comparison of typical notched  
flexure hinges  
Technical Paper Publication. IDETC2019-97403

**Rongqi Wang**, Jilin University, Changchun, Jilin, China, **Xiaoqin Zhou**,  
School of Mech Science and Engg, Jilin Univ, Changchun, Jilin, China,  
**Guangwei Meng**, Jilin University, Changchun, Jilin, China

**9:34AM** Topology optimization of compliant mechanisms  
based on interpolation meshless method and geometric nonlinearity  
Technical Paper Publication. IDETC2019-97412

**Yonghong Zhang, Zhenfei Zhao, Yaqing Zhang, Wenjie Ge**,  
Northwestern Polytechnical University, Xi'an City, Shaanxi Province,  
China

**9:40AM** Shape Optimization Framework For The Path Of  
The Primary Compliance Vector In Compliant Mechanisms  
Technical Paper Publication. IDETC2019-97450

**Hylke Kooistra**, Delft University of Technology, Delft, Netherlands,  
**Charles Kim**, Bucknell Univ, Lewisburg, PA, United States, **Werner van  
de Sande**, Delft University of Technology, Delft, Netherlands, **Justus  
Herder**, Delft University of Technology, Rotterdam, Netherlands

**9:46AM** DESIGN OF COMPLIANT MECHANISMS WITH  
SINGLE-ROTATION CONSTRAINTS  
Technical Paper Publication. IDETC2019-97517

**Haiyang Li**, Northeastern University, China, Shenyang, China,  
**Guangbo Hao**, University College Cork, Cork, Ireland, **Shujun Li**,  
**Yunpeng Gong, Yungong Li, Yong Zhao**, Northeastern University,  
China, Shenyang, China

**9:52AM** Deploying Euler Spiral Connectors (DESCs)  
Technical Paper Publication. IDETC2019-97546

**Collin Ynchausti**, Brigham Young University, PROVO, UT, United  
States, **Spencer Magleby**, Brigham Young Univ, Provo, UT, United  
States, **Anton Bowden**, Brigham Young University, Lindon, UT, United  
States, **Larry L. Howell**, Brigham Young Univ, Provo, UT, United States

**9:58AM** Programmable Logic Gates Based on Tunable  
Multistable Mechanisms  
Technical Paper Publication. IDETC2019-97647

**Mohamed Zanaty, Hubert Schneegans, Ilan Vardi, Simon Henein**,  
EPFL, Neuchatel, Switzerland

**10:04AM** Modeling and Analysis of Leaf Spring Based  
Double Parallel-guiding Mechanism Considering Thermal Effect  
Technical Paper Publication. IDETC2019-97690

**Shuaishuai Lu, Peng Yan**, Shandong University, Jinan, Shandong,  
China

# Technical Sessions

**10:10AM** Optimization of A 2DOF Positioning Stage Using Corrugated Flexure Units under Stress Constraints  
Technical Paper Publication. IDETC2019-97758

*Nianfeng Wang, Fan Yue, Canran Li, Xianmin Zhang, South China University of Technology, Guangzhou, China*

**10:16AM** An improved unified solution for a vibration equation of tension-stiffening beam using extended rayleigh energy method  
Technical Paper Publication. IDETC2019-97767

*Zhijun Yang, Guangdong Provincial Key Laboratory of Micro-Nano Manufacturing Technology and Equipment, Guangzhou, China, Ruiqi Li, Youdun Bai, Guangdong University of Technology, Guangzhou, China*

**10:22AM** DESIGN AND SIMULATION OF IMPACT-RESISTANT SIX-BAR TENSEGRITY ROBOTS  
Technical Presentation. IDETC2019-98702

*Alan Zhang, University of California, Berkeley, CA, United States*

## MR-11 STUDENT MECHANISM AND ROBOT DESIGN COMPETITION

Session MR-11-2

SMRDC II

**Santa Monica 9:10AM–10:30AM**

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Session Organizer: **Vishesh Vikas**, University of Alabama, Tuscaloosa, AL, United States

Session Co-Organizer: **Brian J. Slaboch**, Middle Tennessee State University, Murfreesboro, TN, United States

## MR-2 THEORETICAL & COMPUTATIONAL KINEMATICS (A.T. YANG SYMPOSIUM)

Session MR-2-1

Theoretical & Computational Kinematics - Fast forward and Interactive Presentations

**Santa Monica 10:50AM–12:10PM**

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Session Organizer: **Leila Notash**, Queen's University, Kingston, ON, Canada

Session Co-Organizer: **Jingjun Yu**, Beihang University/Robotics Institute, Beijing, China

**10:50AM** Topological Reconfigurations based on a Concatenation of Bennett and RPRP Mechanisms  
Technical Paper Publication. IDETC2019-97033

*Kuan-Lun Hsu, National Taiwan University, Taipei, Taiwan, Kwun-Lon Ting, Tennessee Technological Univ, Cookeville, TN, United States*

**10:57AM** Deflection Maps of Elastic Catenary Cable-Driven Robots  
Technical Paper Publication. IDETC2019-97083

*Leila Notash, Queen's University, Kingston, ON, Canada*

**11:04AM** EXTENDED CAMUS THEORY AND HIGHER ORDER CONJUGATED CURVES  
Technical Paper Publication. IDETC2019-97104

*Cody Chan, Tennessee Technological University, Cookeville, TN, United States, Kwun-Lon Ting, Tennessee Technological Univ, Cookeville, TN, United States*

**11:11AM** Design Of High-Speed Lower-Mobility Parallel Robot By Kinematic Index Based On Power Efficiency  
Technical Paper Publication. IDETC2019-97337

*NGUYEN DUC SANG, Tokyo Institute of Technology, Ota-ku, Tokyo, Japan, Yukio Takeda, Tokyo Institute of Technology, Tokyo 152-8552, Japan*

**11:18AM** A NEW LOOK TO THE THREE AXES THEOREM  
Technical Paper Publication. IDETC2019-97443

*Juan Ignacio Valderrama-Rodríguez, Universidad de Guanajuato, Salamanca, Guanajuato, Guanajuato, Mexico, Jose Rico, Universidad de Guanajuato, Celaya, Guanajuato Mexico, Mexico, J. Jesús Cervantes-Sánchez, Fernando Tomás Pérez-Zamudio, Universidad de Guanajuato, Salamanca, Guanajuato, Guanajuato, Mexico*

**11:25AM** A Fourier Descriptor Approach to Integrated Type and Dimensional Synthesis of Coupled Serial Mechanism for Motion Generation  
Technical Paper Publication. IDETC2019-97599

*Hao Lv, Yuanfei Han, Xiangyun Li, Southwest Jiaotong University, Chengdu, China, Liuxian Zhu, Sichuan Provincial Engineering Laboratory of Super Alloy Cutting Technology, Deyang, China*

**11:32AM** Improving the Method for Kinematic Analysis of Mechanisms that was based on Parametric Polynomial System with Gröbner Cover  
Technical Paper Publication. IDETC2019-97679

*Keisuke Arikawa, Kanagawa Institute of Technology, Atsugi, Kanagawa, Japan*

**11:39AM** Mechanism Singularities revisited from an algebraic point view point  
Technical Paper Publication. IDETC2019-97742

*Andreas Mueller, Johannes Kepler University, Institute of Robotics, Linz, Select State/Province, Austria, Zijia Li, Research Institute for Symbolic Computation, Johannes Kepler University, Linz, Austria*

# Technical Sessions

**11:46AM** Classification of a Class of 3-RER Parallel Manipulators Using Grobner Cover and Prime Decomposition of Ideals  
Technical Paper Publication. IDETC2019-98057

*Xianwen Kong, Heriot-Watt University, Edinburgh, United Kingdom*

**11:53AM** Synthesis of Stephenson III Timed Curve Generators Using a Probabilistic Continuation Method  
Technical Paper Publication. IDETC2019-98136

*Aravind Baskar, Mark Plecnik, University of Notre Dame, Notre Dame, IN, United States*

**12:00PM** Research on minimum pressure angle of Bennett linkage  
Technical Paper Publication. IDETC2019-98232

*Lele Bai, Lubin Hang, Xiaobo Huang, Mingyuan Wang, Ziyu Liu, Shanghai University Of Engineering Science, Shanghai, Shanghai, China*

## MR-3

### COMPLIANT MECHANISMS (A. MIDHA SYMPOSIUM)

#### Session MR-3-2

#### Compliant Mechanisms - Fast forward and Interactive Presentations II

**California Ballroom A 10:50AM–12:10PM**

Session Organizer: **Girish Krishnan, UIUC, Urbana, IL, United States**

**10:50AM** A Novel Reconfigurable Wheel-Legged Mobile Mechanism  
Technical Paper Publication. IDETC2019-97785

*Hongchuan Zhang, Xianmin Zhang, Yanjiang Huang, Junjie Du, Benliang Zhu, South China University of Technology, Guangzhou, China*

**10:57AM** Analyzing the Effect of Prestressing Forces on Selective Compliant Mechanisms - A Case Study  
Technical Paper Publication. IDETC2019-97799

*Kristian Mauser, Chemnitz University of Technology, Chemnitz, Germany, Jan Friese, Friedrich-Alexander University Erlangen-Nuremberg, Erlangen, Germany, Alexander Hasse, Chemnitz University of Technology, Chemnitz*

**11:04AM** DESIGN OF A TRIAD-POD KINEMATIC FLEXURE MOUNT FOR A PRIMARY MIRROR IN SPACE TELESCOPE AT CRYOGENIC TEMPERATURE  
Technical Paper Publication. IDETC2019-97812

*Tonglong Huo, Beihang University, Beijing, China, Jingjun Yu, Beihang University/Robotics Institute, Beijing, China, Hongzhe Zhao, Beihang University, Beijing, China*

**11:11AM** Large-Stroke Compliant Constant-Force Mechanisms Utilizing Second Bending Mode of Flexible Beams: Evaluation Metrics and Design Formulas  
Technical Paper Publication. IDETC2019-97813

*Fulei Ma, Xidian University, Xi'an, Shaanxi, China, Guimin Chen, Xi'an Jiaotong University, Xi'an 710049, Shaanxi, China, Haitian Wang, Xidian University, Xi'an, Shaanxi, China*

**11:18AM** Hybrid Fabrication of a Soft Bending Actuator With Casting and Additive Manufacturing  
Technical Paper Publication. IDETC2019-97842

*Marcos Oliveira, Northeastern University, Northborough, MA, United States, Alexander Lurie, David Ewen, Philip Long, Taskin Padir, Samuel Felton, Northeastern University, Boston, MA, United States*

**11:25AM** Design and Analysis of Synchronous Joint for SAR Antenna Deployable Mechanism  
Technical Paper Publication. IDETC2019-97845

*Duanling Li, Kaijie Dong, Beijing University of Posts and Telecommunications, Beijing, Xingze Wang, Biao Li, Zhou Su, Beijing General Design Department of Space Vehicles, Beijing, China*

**11:32AM** Additive Manufacturing Of A Bistable Mechanism Using Fused Deposition Modeling: Experimental And Theoretical Characterization  
Technical Paper Publication. IDETC2019-97872

*Mouna Ben Salem, LIRMM - University of Montpellier, Montpellier, France, Guillaume Aiche, Yassine Haddab, LIRMM-University of Montpellier, Montpellier, France, Lennart Rubbert, ICube - University of Strasbourg, Strasbourg, France, Pierre RENAUD, University of Strasbourg, Strasbourg, OO, France*

**11:39AM** A Methodology for Determining Static Mode Shapes of A Compliant Mechanism Using the Pseudo-Rigid-Body Model (PRBM) Concept and the Degrees-of-Freedom Analysis  
Technical Paper Publication. IDETC2019-98497

*Sushrut G. Bapat, Missouri S&T, MAE Department, Rolla, MO, United States, Pratheek Bagivalu Prasanna, Missouri University of Science and Technology, Rolla, MO, United States, Ashok Midha, Missouri Univ of Science and Tech, Rolla, MO, United States*

**11:46AM** Stiffness based stability enhancement in human-robot collaboration  
Technical Paper Publication. IDETC2019-98506

*Sri Sadhan Jujjavarapu, University at Buffalo, Buffalo, NY, United States, Ehsan T Esfahani, State University of New York At Buffalo, Buffalo, NY, United States*



# Technical Sessions

**11:53AM** Load-Flow Based Design of Compliant Mechanisms With Embedded Soft Actuators  
Technical Paper Publication. IDETC2019-98514

*Sree Kalyan Patiballa*, University of Illinois, Urbana Champaign, Urbana, IL, United States, *Sreeshankar Satheeshbabu*, University of Illinois At Urbana Champaign, Urbana, IL, United States, *Girish Krishnan*, UIUC, Urbana, IL, United States

**12:00PM** Classification of Compliant Mechanisms and Determination of the Degrees of Freedom Using the Concepts of Compliance Number and Pseudo-Rigid-Body Model  
Technical Paper Publication. IDETC2019-98522

*Pratheek Bagivalu Prasanna*, Missouri University of Science and Technology, Rolla, MO, United States, *Ashok Midha*, Missouri Univ of Science and Tech, Rolla, MO, United States, *Sushrut G. Bapat*, Missouri S&T, MAE Department, Rolla, MO, United States

**MR-1**

## **MECHANISM SYNTHESIS & ANALYSIS**

**Session MR-1-1**

**Mechanism Synthesis & Analysis - Fast forward and Interactive Presentations**

**Santa Monica 2:10PM–3:45PM**

Session Organizer: **Dongming Gan**, Khalifa Univ. of Sci Tech & Res., Abu Dhabi

Session Co-Organizer: **Elias Brassitos**, Lebanese American University, O, Lebanon

**2:10PM** Solution region synthesis methodology of planar eight-bar linkages for four specified positions of a 4R chain  
Technical Paper Publication. IDETC2019-97006

*Guangzhen Cui*, Zhengzhou University of Light Industry, Zhengzhou, China, *Jianyou Han*, University of Science and Technology Beijing, Beijing, China

**2:17PM** Automatic Mobility Analysis of Parallel Mechanisms: An algorithm approach based on position and orientation characteristic equations  
Technical Paper Publication. IDETC2019-97007

*Xiaorong Zhu*, Changzhou University, Changzhou, China, *Huiping Shen*, Changzhou University, Changzhou City, China, *Chengqi Wu*, Changzhou University, Changzhou, China, *Damien Chablat*, Cnrs/ls2n/Ecole Centrale De Nantes, Nantes, France, *Ting-li Yang*, Changzhou University, Changzhou, China

**2:24PM** Algorithm for Computing the Connectivity in Planar Kinematic Chains and Its Application  
Technical Paper Publication. IDETC2019-97140

*Wenjian Yang*, China University of Geosciences, Wuhan, Hubei, China, *Huafeng Ding*, China University of Geosciences (wuhan), Wuhan, OO, China

**2:31PM** Determining the Number of Distinct Solutions in Planar Mechanism Design  
Technical Paper Publication. IDETC2019-97360

*Lawrence Funke*, *Jonathan Raney*, Ohio Northern University, Ada, OH, United States, *Cyler Caldwell*, FlexArm Inc, Wapakoneta, OH, United States

**2:38PM** On the end point deflection of Static Balanced Manipulators with various spring configurations  
Technical Paper Publication. IDETC2019-97411

*Chi-Shiun Jhuang*, *Dar-zen Chen*, National Taiwan University, Taipei, Taipei, Taiwan

**2:45PM** KINEMATIC ANALYSIS OF THE EXECHEON ROBOT ACCOUNTING OFFSETS IN THE JOINT AXES  
Technical Paper Publication. IDETC2019-97423

*Pablo C. Lopez-Custodio*, King's College London, Informatics Department, London, United Kingdom, *Jian S. Dai*, Kings College- Univ Of London, London, United Kingdom, *Rao Fu*, *Yan Jin*, Queen's University Belfast, Belfast, United Kingdom

**2:52PM** Design and analysis of a tensegrity mechanism for a bio-inspired robot  
Technical Paper Publication. IDETC2019-97544

*Swaminath Venkateswaran*, *Matthieu Furet*, Centrale Nantes, Nantes, Pays de la Loire, France, *Damien Chablat*, Cnrs/ls2n/Ecole Centrale De Nantes, Nantes, France, *Philippe Wenger*, CNRS / LS2N, Nantes, France

**2:59PM** KINEMATIC OPTIMIZATION OF A 2-DOF U, 2PSS PARALLEL WRIST DEVICE  
Technical Paper Publication. IDETC2019-98108

*Neil Bajaj*, *Aaron Dollar*, Yale University, New Haven, CT, United States

**3:06PM** A Cable-Driven Parallel Robot with an Embedded Tilt-Roll Wrist  
Technical Paper Publication. IDETC2019-98146

*Saman Lessanibahri*, Ecole Centrale De Nantes, Nantes, France, *Philippe Cardou*, Laboratoire de robotique, Département de génie mécanique, Université Laval, Quebec, QC, Canada, *Stéphane Caro*, CNRS - LS2N, Nantes, France

**3:13PM** Computational Creativity via Assisted Variational Synthesis of Mechanisms using Deep Generative Models  
Technical Paper Publication. IDETC2019-98193

*Shrinath Deshpande*, *Anurag Purwar*, Stony Brook University, Stony Brook, NY, United States

# Technical Sessions

**3:20PM** Using Point-Line-Plane Representation for Unified Simulation of Planar and Spherical Mechanisms  
Technical Paper Publication. IDETC2019-98194

*Shashank Sharma, Anurag Purwar, Stony Brook University, Stony Brook, NY, United States*

**3:27PM** Design of Four-, Six-, and Eight-Bar Linkages for Rectilinear Movement  
Technical Paper Publication. IDETC2019-98389

*Xueao Liu, Beihang University, Beijing, Beijing, China, Jeffrey Glabe, University of California, Irvine, Irvine, CA, United States, Hongyu Wu, Tsinghua University, Beijing, Beijing, China, Chunjie Wang, Beihang University, Beijing, Beijing, China, J. Michael McCarthy, Univ Of California, Irvine, CA, United States*

## MR-4

### ORIGAMI-BASED ENGINEERING DESIGN

#### Session MR-4-2

#### Origami-Based Engineering Design - Fast forward and Interactive Presentations I

**California Ballroom A 2:10PM–3:45PM**

Session Organizer: **Mary Frecker, Ph.D.**, Pennsylvania State Univ, University Park, PA, United States

**2:10PM** Geometric Simulation for Thick Origami  
Technical Paper Publication. IDETC2019-97094

*Tsz Ho Kwok, Concordia University, Montreal, QC, Canada*

**2:15PM** Coupled Origami Tubes for Stiff Deployable Cantilevers  
Technical Paper Publication. IDETC2019-97096

*Evgueni Filipov, University of Michigan, Ann Arbor, MI, United States, Tomohiro Tachi, The University of Tokyo, Tokyo, Japan, Glaucio H. Paulino, Georgia Institute of Technology, Atlanta, GA, United States*

**2:20PM** Numerical Analysis of Quasi-static out-of-plane Compression of Miura-ori Patterned Sheets  
Technical Paper Publication. IDETC2019-97113

*Xinmei Xiang, Guangzhou University, Guangzhou, China, Guoxing Lu, Swinburne University of Technology, Melbourne, Australia*

**2:25PM** Simulating Compliant Crease Origami with a Bar and Hinge Model  
Technical Paper Publication. IDETC2019-97119

*yi zhu, University of Michigan, Department of Civil and Environmental Engineering, Ann Arbor, MI, United States, Evgueni Filipov, University of Michigan, Ann Arbor, MI, United States*

**2:30PM** Dynamics Analysis of the Deployment of Miura-Origami Sheets  
Technical Paper Publication. IDETC2019-97136

*Yutong Xia, Kon-Well Wang, University of Michigan, Ann Arbor, MI, United States*

**2:35PM** Analysis of Static and Dynamic Behavior of Thick-Walled PALEO elements  
Technical Paper Publication. IDETC2019-97155

*Yves Klett, Institute of Aircraft Design Uni Stuttgart, Stuttgart, OO, Germany, Fabian Muhs, Univ. Stuttgart - Institute of Aircraft Design, Stuttgart, Germany, Peter Middendorf, Institute of Aircraft Design Uni Stuttgart, Stuttgart, Germany*

**2:40PM** Regular 2D and 3D Linkage-Based Origami Tessellations  
Technical Paper Publication. IDETC2019-97354

*Alden Yellowhorse, Delft University of Technology, Delft, Netherlands, Larry L. Howell, Brigham Young Univ, Provo, UT, United States*

**2:45PM** Exploiting the Asymmetric Energy Barrier in Multi-Stable Origami to Enable Mechanical Diode Behavior In Compression  
Technical Paper Publication. IDETC2019-97420

*Nasim Baharisangari, Suyi Li, Clemson University, Clemson, SC, United States*

**2:50PM** On the Deployment of Multistable Kresling Origami-Inspired Structures  
Technical Paper Publication. IDETC2019-97427

*Narayanan Kidambi, Kon-Well Wang, University of Michigan, Ann Arbor, MI, United States*

**2:55PM** Dynamic Transformation of Origami String Using Stacked-Miura Cell  
Technical Paper Publication. IDETC2019-97435

*Chang Liu, Zwe Min Htet Aung, Samuel Felton, Northeastern University, Boston, MA, United States*

**3:00PM** Wave Dynamics in Reconfigurable Tristable Mechanical Metamaterials  
Technical Paper Publication. IDETC2019-97452

*Hiromi Yasuda, Lucia M. Korpas, Jordan R. Raney, University of Pennsylvania, Philadelphia, PA, United States*

**3:05PM** Integrated Origami-String System  
Technical Paper Publication. IDETC2019-97486

*Ke Liu, California Institute of Technology, Pasadena, CA, United States, Madelyn Kosednar, Georgia Institute of Technology, Scottsdale, AZ, United States, Tomohiro Tachi, The University of Tokyo, Tokyo, Japan, Glaucio H. Paulino, Georgia Institute of Technology, Atlanta, GA, United States*

# Technical Sessions

**3:10PM Programmable Kirigami: Cutting and Folding In Science, Technology and Architecture**  
Technical Paper Publication. IDETC2019-97557

*Jingyang Liu, Carnegie Mellon University, Pittsburgh, PA, United States, Grace Chuang, Hun Chun Sang, Jenny E. Sabin, Cornell University, Ithaca, NY, United States*

**3:15PM Rigidly Foldable Thick Origami Using Designed-Offset Linkages**  
Technical Paper Publication. IDETC2019-97621

*Robert J. Lang, Robert J. Lang Origami, Altadena, CA, United States, Nathan Brown, Brigham Young University, Provo, UT, United States, Brian Ignaut, Degrees of Freedom LLC, Venice, CA, United States, Spencer Magleby, Larry L. Howell, Brigham Young Univ, Provo, UT, United States*

**3:20PM An Origami Crease Pattern Generating Methodology For "Origami 3D Printer"**  
Technical Paper Publication. IDETC2019-97715

*Yang Yang, Meiji University, Tokyo, Japan, Ichiro Hagiwara, Meiji University, Kanagawa 247, Japan, Luis Diago, Junichi Shinoda, Meiji University, Tokyo, Select State/Province, Japan*

**3:25PM Designing and Manufacturing a Super Excellent and Ultra-Cheap Energy Absorber By Origami Engineering**  
Technical Paper Publication. IDETC2019-97725

*Xilu Zhao, Saitama Institute of Technology, Saitama, Japan, Ichiro Hagiwara, Meiji University, Kanagawa 247, Japan*

## MR-4

### ORIGAMI-BASED ENGINEERING DESIGN

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#### Session MR-4-3

**Origami-Based Engineering Design - Fast forward and Interactive Presentations II**

**California Ballroom A 4:10PM–5:50PM**

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Session Organizer: **Mary Frecker, Ph.D.**, Pennsylvania State Univ, University Park, PA, United States

Session Co-Organizer: **Zhong You**, University of Oxford, Oxford, United Kingdom

**4:10PM Characteristics Of Truss Core By Creation Of Origami Forming Method**  
Technical Paper Publication. IDETC2019-97740

*Aya Abe, Meiji University, Tokyo, Japan, Kosuke Terada, National Institute of Technology, Nara College, Nara, Japan, Haruki Yashiro, Meiji University, Tokyo, Japan, Ichiro Hagiwara, Meiji University, Kanagawa 247, Japan*

**4:15PM In-Plane Compressive Strength Analysis of Novel Folded Honeycomb Material**  
Technical Paper Publication. IDETC2019-97821

*Ruijun Ma, Jianguo Cai, Yutao Wang, Jian Feng, Southeast University, Nanjing, China*

**4:20PM Graded Origami Honeycomb Tube**  
Technical Paper Publication. IDETC2019-97898

*Leo de Waal, Zhong You, University of Oxford, Oxford, United Kingdom*

**4:25PM Thick Folding Through Regionally-Sandwiched Compliant Sheets**  
Technical Paper Publication. IDETC2019-97899

*Jared Butler, Brigham Young University Mechanical Engineering, Provo, UT, United States, Nathan A. Pehrson, BYU Mechanical Engineering, Provo, UT, United States, Spencer Magleby, Brigham Young Univ, Provo, UT, United States*

**4:30PM Compactly Folding Rigid Panels with Uniform Thickness Through Origami and Kirigami**  
Technical Paper Publication. IDETC2019-97946

*Jingyi Yang, Zhong You, University of Oxford, Oxford, United Kingdom*

**4:35PM Constructing Scissor-like Structures and Parallelogram Linkages with 4-Crease Single-Vertex Flat-Foldable Rigid Origami and Their Thick-Panel Versions**  
Technical Paper Publication. IDETC2019-97983

*David Xing, Oxford University, Oxford, United Kingdom, Zhong You, University of Oxford, Oxford, United Kingdom*

**4:40PM Kirigami-Based Deployable Transcrease Hard Stop Models Usable in Origami Patterns**  
Technical Paper Publication. IDETC2019-98056

*David W. Andrews, Brigham Young University, Provo, UT, United States, Alex Avila, Brigham Young University, Highland, UT, United States, Jared Butler, Brigham Young University, Provo, UT, United States, Spencer Magleby, Larry L. Howell, Brigham Young Univ, Provo, UT, United States*

**4:45PM Electromagnetic and Mechanical Analysis of an Origami Helical Antenna Encapsulated By Fabric**  
Technical Paper Publication. IDETC2019-98072

*Constantinos Zekios, FIU, Miami, FL, United States, Xueli Liu, Mojtaba Moshtaghzadeh, Ehsan Izadpanahi, Hamid Reza Radnezhad, Pezhman Mardanpour, Stavros Georgakopoulos, Florida International University, Miami, FL, United States*

# Technical Sessions

**4:50PM** An origami-inspired printable controller for autonomous control of robots  
Poster Paper Presentation. IDETC2019-98656

*Wenzhong Yan, Yunchen Yu, Ankur Mehta, UCLA, Los Angeles, CA, United States*

**4:55PM** Experimental Study on Folding Patterns and Deployability of Inflatable Structures  
Technical Paper Publication. IDETC2019-98107

*Sachiko Ishida, Hakimi Azuri, Meiji University, Kawasaki, Japan*

**5:00PM** ON THE UNFOLDING PROCESS OF TRIANGULAR RESCH PATTERNS: A FINITE PARTICLE METHOD INVESTIGATION  
Technical Paper Publication. IDETC2019-98121

*Ying Yu, Georgia Institute of Technology, Atlanta, GA, Georgia, Yan Chen, Tianjin University, Tianjin, China, Glaucio H. Paulino, Georgia Institute of Technology, Atlanta, GA, United States*

**5:05PM** Characteristics of Self-Deploying In Origami-Based Systems  
Technical Paper Publication. IDETC2019-98126

*Mary Wilson, Brigham Young University, Provo, UT, United States, Spencer Magleby, Larry L. Howell, Brigham Young Univ, Provo, UT, United States, Anton Bowden, Brigham Young University, Lindon, UT, United States*

**5:10PM** Conceptualizing Stable States in Origami-Based Devices Using an Energy Visualization Approach  
Technical Paper Publication. IDETC2019-98168

*Alex Avila, Jacob R. Greenwood, Brigham Young University, Provo, UT, United States, Spencer Magleby, Larry L. Howell, Brigham Young Univ, Provo, UT, United States*

**5:15PM** A Two-stage Optimization Procedure For The Design Of An EAP-actuated Soft Gripper  
Technical Paper Publication. IDETC2019-98169

*WEI ZHANG, Pennsylvania State University, State College, PA, United States, Mary Frecker, Ph.D., Pennsylvania State Univ, University Park, PA, United States, Zoubeida Ounaies, Penn State Univ, University Park, PA, United States, Saad Ahmed, Intel Corporation, Hillsboro, OR, United States, Jonathan Hong, The Pennsylvania State University, Mechanicsburg, PA, United States*

**5:20PM** Design of Deployable Origami Mechanisms Using Inflatable Panels  
Technical Paper Publication. IDETC2019-98214

*Dina Joy Abulon, University of California, Irvine, Irvine, CA, United States, J. Michael McCarthy, Univ Of California, Irvine, CA, United States*

**5:25PM** Exploiting origami shape reconfiguration in noise control applications  
Technical Paper Publication. IDETC2019-98368

*Hongbin Fang, Fudan University, Shanghai, Shanghai, China, Xiang Yu, A\*STAR, Singapore, Singapore, Li Cheng, The Hong Kong Polytechnic University, Hong Kong, China*

**5:30PM** Design of a Two DOF Laminate Leg Transmission For Creating Walking Robot Platforms  
Technical Paper Publication. IDETC2019-98100

*Benjamin Shuch, Taha Shafa, Eric Rogers, Daniel M. Aukes, Arizona State University, Mesa, AZ, United States*

**MR-8**

## **MOBILE ROBOTICS**

### **Session MR-8-1**

**Mobile Robotics - Fast forward and Interactive Presentations Santa Monica 4:10PM–5:50PM**

Session Organizer: **Taskin Padir**, Northeastern University, Boston, MA, United States

Session Co-Organizer: **Samuel Felton**, Northeastern University, Boston, MA, United States

**4:10PM** Kalman Filter Based Sensor Fusion For a Mobile Manipulator  
Technical Paper Publication. IDETC2019-97241

*Barnaba Ubezio, Politecnico Di Tornio, Turin, Italy, Shashank Sharma, KUKA Roboter GmbH, Augsburg, Germany, Guglielmo Van der Meer, KUKA Deutschland GmbH, Augsburg, Germany, Michele Taragna, Politecnico Di Tornio, Turin, Italy*

**4:19PM** A Collaborative Visual Localization Scheme for a Low-Cost Heterogeneous Robotic Team with Non-Overlapping Perspectives  
Technical Paper Publication. IDETC2019-97377

*Benjamin Abruzzo, US ARMY ARDEC, picatinny arsenal, NJ, United States, David Cappelleri, Purdue University, West Lafayette, IN, United States, Philippos Mordohai, Stevens Institute of Technology, Hoboken, NJ, United States*

**4:28PM** Autonomous Door Opening with the Interacting-BoomCopter UAV  
Technical Paper Publication. IDETC2019-97397

*Daniel McArthur, Purdue University, Lafayette, IN, United States, Arindam Chowdhury, David Cappelleri, Purdue University, West Lafayette, IN, United States*



# Technical Sessions

**4:37PM** Study of a Biomimetic Energy-Efficient Thruster for Underwater Vehicles  
Technical Paper Publication. IDETC2019-97451

*Giacomo Palmieri, Massimo Callegari, Daniele Costa, Matteo C. Palpacelli, David Scaradozzi, Polytechnic University of Marche, ancona, Italy*

**4:46PM** Image-Based Motion Analysis for Self-Reconfigurable Mobile Robots with Integrated Docking  
Technical Paper Publication. IDETC2019-97530

*Shubhdildeep Singh Sohal, Pinhas Ben-Tzvi, Virginia Tech, Blacksburg, VA, United States*

**4:55PM** Mobile Robot Obstacle Avoidance Based on Deep Reinforcement Learning  
Technical Paper Publication. IDETC2019-97536

*Shumin Feng, Hailin Ren, Xinran Wang, Pinhas Ben-Tzvi, Virginia Tech, BLACKSBURG, VA, United States*

**5:04PM** ACTUATED DUAL-SLIP MODEL OF PLANAR SLOPE WALKING  
Technical Paper Publication. IDETC2019-97601

*Raul Lema Galindo, University of Texas at Austin, Austin, TX, United States, Elise Weimholt, James Schmiedeler, University of Notre Dame, Notre Dame, IN, United States*

**5:13PM** Robotics Simulator for Top-Down Development and Verification of Swarm Robotic Behaviors  
Technical Paper Publication. IDETC2019-97622

*Christopher Kitts, Santa Clara University, Burlingame, CA, United States, Nathan Metzger, Santa Clara University, San Jose, CA, United States, Shae T Hart, Maximilian E Reese, Santa Clara University, Santa Clara, CA, United States, Michael Neumann, Santa Clara University, Oakland, CA, United States, Robert McDonald, Santa Clara University, Santa Clara, CA, United States*

**5:22PM** Integrating Dry Adhesives and Compliant Suspension for Track-Type Climbing Robots  
Technical Paper Publication. IDETC2019-98012

*Matthew Powelson, Southwest Research Institute, San Antonio, TX, United States, Wesley Demirjian, Stephen Canfield, Tennessee Technological University, Cookeville, TN, United States*

**5:31PM** Design of an Underactuated Legged Robot with Prismatic Legs for Passive Adaptability to Terrain  
Technical Paper Publication. IDETC2019-98118

*Seonghoon Noh, Aaron Dollar, Yale University, New Haven, CT, United States*

**5:40PM** Position Estimate Comparison Combining Different IMUs with Odometry in an Extended Kalman Filter  
Technical Paper Publication. IDETC2019-98184

*Kevin Carey, United States Military Academy, West Point, NJ, United States, Benjamin Abruzzo, US ARMY ARDEC, picatinny arsenal, NJ, United States, david p harvie, christopher korpela, United States Military Academy, West Point, NJ, United States*

## TUESDAY, AUGUST, 20

### MR-5 MOTION PLANNING, DYNAMICS, AND CONTROL OF ROBOTS

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#### Session MR-5-1

Motion Planning, Dynamics, and Control of Robots - Fast forward Presentations

**California Ballroom A 8:00AM–9:00AM**

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Session Organizer: **Andreas Mueller**, Johannes Kepler University, Institute of Robotics, Linz, Select State/Province, Austria  
Session Co-Organizer: **Joo H. Kim**, New York University, Brooklyn, NY, United States

**8:00AM** An Analytical and Modular Software Workbench for Solving Kinematics and Dynamics of Series-Parallel Hybrid Robots  
Technical Paper Publication. IDETC2019-97115

*Shivesh Kumar, DFKI GmbH, Bremen, Bremen, Germany, Andreas Mueller, Johannes Kepler University, Institute of Robotics, Linz, Select State/Province, Austria*

**8:03AM** QUADROTOR SINGULARITY FREE MODELING AND ACROBATIC MANEUVERING  
Technical Paper Publication. IDETC2019-97205

*Haowen Liu, University of Southern California, Los Angeles, CA, United States, Bingen (ben) Yang, Univ Of Southern California, Los Angeles, CA, United States*

**8:06AM** Sliding Mode Set-Point Control of a Three-DOF Cable-Suspended Parallel Robot with Uncertain Mass and Disturbances  
Technical Paper Publication. IDETC2019-97275

*Ping Ren, Xu Sheng, Ocean University of China, Qingdao, Shandong, China*

**8:09AM** TOWARDS DYNAMIC SIMULATION GUIDED DESIGN OF TUMBLING MICROROBOTS  
Technical Paper Publication. IDETC2019-97306

*Jiayin xie, Stonybrook University, Stonybrook, NY, United States, Chenghao Bi, David Cappelleri, Purdue University, West Lafayette, IN, United States, Nilanjan Chakraborty, Stony Brook University, Stony Brook, NY, United States*

# Technical Sessions

**8:12AM** The Design of Robust Phase Oscillator for Wearable Robotic Systems  
Technical Paper Publication. IDETC2019-97453

*Juan De La Fuente, Susheelkumar Cherangara Subramanian, PRUDHVI TEJ CHINIMILLI, Arizona State University, Mesa, AZ, United States, Sangram Redkar, Arizona State University, Measa, AZ, United States, Thomas Sugar, ASU, Mesa, AZ, United States*

**8:15AM** Improving hole-searching accuracy for peg-in-hole assembly with manipulators harmonic drive uncertainty  
Technical Paper Publication. IDETC2019-97503

*Poyu Chen, Nation Taiwan University, Taipei, Taiwan, Kuei-Yuan Chan, National Taiwan University, Taipei, Taiwan*

**8:18AM** Powered Ankle-Foot Prostheses: Survey on Sensing Systems and Control Strategies  
Technical Paper Publication. IDETC2019-97511

*Erik A. Chumacero-Polanco, Texas Tech University, Lubbock, TX, United States, James Yang, Texas Tech University - Dept of Mechanical Engineering, Lubbock, TX, United States*

**8:21AM** Semi-Autonomous Teleoperation, Guidance, and Obstacle Avoidance with Path Adherence  
Technical Paper Publication. IDETC2019-97529

*Daniel Budolak, Raghuraj Chauhan, Pinhas Ben-Tzvi, Virginia Tech, Blacksburg, VA, United States*

**8:24AM** MODELLING AND EVALUATION OF THE FRICTION IN ROBOTIC JOINTS CONSIDERING THERMAL EFFECTS  
Technical Paper Publication. IDETC2019-97545

*Giovanni Legnani, giovanni incerti, Roberto Pagani, Matteo Gheza, University of Brescia, Brescia, Italy*

**8:27AM** Playing a Musical Saw With a Humanoid Robot : Investigation For Industrial Automation  
Technical Paper Publication. IDETC2019-97731

*Akira Mishima, Doshisha University, Kyotanabe-shi, Kyoto, Japan, Toshiki Hirogaki, Eiichi Aoyama, Doshisha Univ, Kyotanabe-shi, Japan, Yusuke Fuke, Atsuyuki Miura, Doshisha University, Kyotanabe-shi, Japan*

**8:30AM** Dynamic Analysis of the 3-rRPS Metamorphic Parallel Mechanism Based on Instantaneous Screw Axis  
Technical Paper Publication. IDETC2019-97851

*Latifah Nurahmi, Institut Teknologi Sepuluh Nopember, Surabaya, Indonesia, Dongming Gan, Khalifa Univ. of Sci Tech & Res., Abu Dhabi*

**8:33AM** COMPUTING ROBUST INVERSE KINEMATICS UNDER UNCERTAINTY  
Technical Paper Publication. IDETC2019-97945

*Anirban Sinha, Nilanjan Chakraborty, Stony Brook University, Stony Brook, NY, United States*

**8:36AM** MODELING, VALIDATION AND PROTOTYPE DEVELOPMENT OF ELECTRIC SAIL TETHER DEPLOYMENT SYSTEMS FOR CUBESATS  
Technical Paper Publication. IDETC2019-97952

*Benjamin E. Hargis, Benjamin F Brandt, Stephen Canfield, Tennessee Technological University, Cookeville, TN, United States, Michael Tinker, NASA Marshall Space Flight Center, Huntsville, AL, United States*

**8:39AM** Energetically-Optimal Discrete and Continuous Stabilization of the Rimless Wheel with Torso  
Technical Paper Publication. IDETC2019-97955

*Wankun Sirichotiyakul, Boise State University, Boise, ID, United States, Eric S. Sanchez, University of Texas at San Antonio, San Antonio, TX, United States, Pranav Bhounsule, The University of Texas at San Antonio, San Antonio, TX, United States, Aykut SATICI, Boise State University, Boise, ID, United States*

**8:42AM** Whole-Body Balancing Criteria for Biped Robots in Sagittal Plane  
Technical Paper Publication. IDETC2019-98036

*Carlotta Mummolo, New Jersey Institute of Technology, Newark, NJ, United States, William Peng, Joo H. Kim, New York University, Brooklyn, NY, United States*

**8:45AM** Online Trajectory Optimization for Legged Robotics Incorporating Vision For Dynamically Efficient and Safe Footstep Locations  
Technical Paper Publication. IDETC2019-98039

*Joshua Hooks, University of California Los Angeles, Los Angeles, CA, United States, Min Sung Ahn, University of California: Los Angeles, Los Angeles, CA, United States, Dennis Hong, UCLA, Santa Monica, CA, United States*

**8:48AM** Design, Modeling, and Optimization of a Hopping Robot Platform  
Technical Paper Publication. IDETC2019-98109

*Jacob Knaup, Daniel M. Aukes, Arizona State University, Mesa, AZ, United States*

**8:51AM** Modeling, Control and Planning for Multiple Mobile Microrobots  
Technical Paper Publication. IDETC2019-98392

*Benjamin Johnson, David Cappelleri, Purdue University, West Lafayette, IN, United States*

# Technical Sessions

## MR-7

### **SHAPE MORPHING AND RECONFIGURABLE MECHANISMS**

#### Session MR-7-1

Shape Morphing and Reconfigurable Mechanisms - Fast forward and Interactive Presentations

**Santa Monica 8:00AM–9:00AM**

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Session Organizer: **James Joo**, AFRL, WPAFB, OH, United States  
Session Co-Organizer: **David Myszka**, Univ Of Dayton, Dayton, OH, United States

**8:00AM** Cylindrical Developable Mechanisms for Minimally Invasive Surgical Instruments  
Technical Paper Publication. IDETC2019-97202

*Kendall Seymour, Jacob Sheffield, Brigham Young University, Provo, UT, United States, Spencer Magleby, Larry L. Howell, Brigham Young Univ, Provo, UT, United States*

**8:12AM** Topology optimization of cable-actuated, shape-changing, tensegrity systems for path generation  
Technical Paper Publication. IDETC2019-97367

*David Myszka, Univ Of Dayton, Dayton, OH, United States, James Joo, AFRL, WPAFB, OH, United States, Daniel Woods, Air Force Research Laboratory, WPAFB, OH, United States, Andrew Murray, University Of Dayton, Dayton, OH, United States*

**8:24AM** A Novel 1-DOF Deployable Mechanism for Parabolic Cylindrical Surface Approximation  
Technical Paper Publication. IDETC2019-97806

*Hang Xiao, Shengnan Lu, Xilun Ding, Beihang University, Beijing, China*

**8:36AM** Synthesizing Mechanical Chains for Morphing Between Spatial Curves  
Technical Paper Publication. IDETC2019-98250

*Yucheng Li, Andrew Murray, University of Dayton, Dayton, OH, United States, David Myszka, Univ Of Dayton, Dayton, OH, United States*

**8:48AM** Design and Tensorial Characterization of Harmonic Shape-Morphing Mechanism Arrays  
Technical Paper Publication. IDETC2019-98292

*Craig Lusk, The University of South Florida, Lutz, FL, United States*

## MR-5

### **MOTION PLANNING, DYNAMICS, AND CONTROL OF ROBOTS**

#### Session MR-5-2

Motion Planning, Dynamics, and Control of Robots - Interactive Presentations

**California Ballroom A 9:10AM–10:30AM**

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Session Organizer: **Andreas Mueller**, Johannes Kepler University, Institute of Robotics, Linz, Select State/Province, Austria  
Session Co-Organizer: **Joo H. Kim**, New York University, Brooklyn, NY, United States

## MR-6

### **MEDICAL & REHABILITATION ROBOTS**

#### Session MR-6-1

Medical & Rehabilitation Robots - Fast forward and Interactive Presentations

**Santa Monica 9:10AM–10:30AM**

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Session Organizer: **Nina Robson**, California State University, Fullerton, Fullerton, CA, United States

Session Co-Organizer: **Abbas Fattah**, Widener University, Chester, PA, United States

#### **9:10AM DESIGN OF A ROBOTIC CANNULA FOR ROBOTIC LUMBER DISCECTOMY**

Technical Paper Publication. IDETC2019-97365

*Yang Ding, Benjamin Johnson, David Cappelleri, Purdue University, West Lafayette, IN, United States*

#### **9:18AM CREATING ROBUST PASSIVE MULTI-LOOP WEARABLE HAND DEVICES**

Technical Paper Publication. IDETC2019-97623

*Nina Robson, Bin Yun Chen, California State University, Fullerton, Fullerton, CA, United States, Jong Seob Won, Jeonju University, Jeonju, Korea (Republic), Gim Song Soh, Singapore University of Technology, Singapore, Singapore*

#### **9:26AM An Automatic Transformation Method for the Walking Assistive Device to Walk between Flat Ground and Stairs Safely**

Technical Paper Publication. IDETC2019-97796

*Bo-Rong YANG, Yu-Cheng ZHANG, Hee-Hyol LEE, Eiichiro TANAKA, Graduate School of Information, Production and Systems, Waseda University, Kita-Kyushu, Japan*

# Technical Sessions

**9:34AM** Design And Kinematics of a Modular Robot for Assistive Tasks for the Disabled  
Technical Paper Publication. IDETC2019-98011

*Carl Nelson, University of Nebraska, Lincoln, NE, United States, Mitchell A. Bruckner, Jay S. Chae, University of Nebraska-Lincoln, Lincoln, NE, United States, Judith M. Burnfield, Thad W. Buster, Guilherme M. Cesar, Chase M. Pfeifer, Madonna Rehabilitation Hospitals, Lincoln, NE, United States, Prithviraj Dasgupta, University of Nebraska at Omaha, Omaha, NE, United States*

**9:42AM** TIME INVARIANT MOTION CONTROLLER FOR PHYSICAL HUMAN ROBOT INTERACTION  
Technical Paper Publication. IDETC2019-98031

*Juan D. Muñoz Osorio, KUKA Germany GmbH, Germany, Bayern, Germany, Felipe Castaneda, Felix Allmendinger, Uwe E. Zimmermann, KUKA Robotics GmbH, Augsburg, BAYERN, Germany*

**9:50AM** UPPER LIMB REHABILITATION AND MOBILITY ASSISTANCE USING ROBOTIC DEVICES: A REVIEW  
Technical Paper Publication. IDETC2019-98063

*Amirhossein Majidirad, Yimesker Yihun, Wichita State University, Wichita, KS, United States*

**9:58AM** DESIGN AND MAKING OF A HAND-HELD SPILLAGE-FREE SPECIMEN RETRIEVAL ROBOT FOR LAPAROSCOPIC SURGERY  
Technical Paper Publication. IDETC2019-98134

*FARID Tavakkolmoghaddam, Krishnanand Kaipa, siqin Dong, Michel Audette, Old Dominion University, NORFOLK, VA, United States, Tomaz Mesar, Eric Feliberti, EVMS, Norfolk, VA, United States*

**10:06am** Machine Learning Driven Individualized Gait Rehabilitation: Classification, Prediction, and Mechanism Design  
Technical Paper Publication. IDETC2019-98434

*Amol Loya, Shrinath Deshpande, Anurag Purwar, Stony Brook University, Stony Brook, NY, United States*

**10:14AM** MOTOR TENDON ACTUATED EXOSUIT GLOVE WITH FLEXION AND EXTENSION CAPABILITY  
Technical Paper Publication. IDETC2019-98467

*Georgia Patterson, Tyler Zell, David Parker, John Grieve, Samuel Watson, Vishesh Vikas, The University of Alabama, Tuscaloosa, AL, United States*

**MR-12**

## **MECHANISMS AND ROBOTICS KEYNOTE**

**Session MR-12-1**

**Humanlike robots - the ultimate challenge to biomimetics**  
**California Ballroom B 10:50AM–12:10PM**

Session Organizer: **Pinhas Ben-Tzvi**, Virginia Tech, Blacksburg, VA, United States

**MR-9**

## **NOVEL MECHANISMS, ROBOTS & APPLICATIONS**

**Session MR-9-1**

**Novel Mechanisms, Robots & Applications - Fast forward and Interactive Presentations I**

**Santa Monica 2:10PM–3:50PM**

Session Organizer: **Reza Fotouhi**, Univ Of Saskatchewan, Saskatoon, SK, Canada

**2:10PM** Topological Design and Analysis of a Novel 3-Translational Parallel Mechanism with Analytical Direct Position Solutions and Partial Motion Decoupling  
Technical Paper Publication. IDETC2019-97077

*Huiping Shen, Changzhou University, Changzhou City, China, Damien Chablat, Cnrs/Is2n/Ecole Centrale De Nantes, Nantes, France, Boxiong Zeng, Ting-li Yang, Changzhou University, Changzhou, China*

**2:19PM** NOVEL DESIGN OF A 3T2R 5-DOF PARALLEL MANIPULATOR  
Technical Paper Publication. IDETC2019-97088

*Zhongxing Yang, Dan Zhang, York University, Toronto, ON, Canada*

**2:28PM** Wireless Power & SIMO Control Based on Magnetic Coupling Resonance Using in Parallel Robot  
Student Competition Poster. IDETC2019-97174

*Jue Wang, Shanghai Jiaotong University, Shanghai, Shanghai, China, Genliang Chen, Shanghai Jiao Tong University, Shanghai, China, Shanghai,, Shanghai, China, Hao Wang, Shanghai Jiao Tong University, Shanghai, Shanghai*

**2:37PM** Topology Design and Position Analysis of a Reconfigurable Modular Hybrid-Parallel Manipulator  
Technical Paper Publication. IDETC2019-97179

*Rajashekhar V S, Tentacles Robotic Foundation, Kanchipuram, Tamil Nadu, India*

**2:46PM** A Highly Manoeuvrable and Untethered Under-Actuated Legged Piezoelectric Miniature Robot  
Technical Paper Publication. IDETC2019-97353

*Hassan H. Hariri, Rafik Hariri University, Mechref, Lebanon, Gim Song Soh, Singapore University of Technology, Singapore, Singapore, Shaohui Foong, Singapore University of Technology & Design, Singapore, Singapore, Kristin Wood, Singapore University of Technology and Design, Austin, TX, United States*

**2:55PM** A NEW ROBOTIC HAND FOR AUTOMOTIVE SHEET PANELS

Technical Paper Publication. IDETC2019-97359

*Dalong Gao, General Motors, Rochester, MI, United States, Ninja Huang, Lance Ransom, General Motors, Warren, MI, United States, Richard Janis, General Motors, Warren, MI, United States*



# Technical Sessions

**3:04PM** **Eliminating Peak Impact Forces by Customizing the Passive Foot Dynamics of Legged Robots**  
Technical Paper Publication. IDETC2019-97484

*Jesse Rond, Michael Cardani, Matthew Campbell, Jonathan Hurst, Oregon State University, Corvallis, OR, United States*

**3:13PM** **Design and Simulation of a Novel High-Speed Omnidirectional Fully-Actuated Underwater Propulsion Mechanism**  
Technical Paper Publication. IDETC2019-97534

*Taylor Njaka, Stefano Brizzolara, Pinhas Ben-Tzvi, Virginia Tech, Blacksburg, VA, United States*

**3:22PM** **Design, Analysis, and Optimization of a New Two-DOF Articulated Multi-link Robotic Tail**  
Technical Paper Publication. IDETC2019-97537

*Yujiong Liu, Pinhas Ben-Tzvi, Virginia Tech, Blacksburg, VA, United States*

**3:31PM** **A Gear-Slider Gravity Compensation Mechanism: Design and Experimental Study**  
Technical Paper Publication. IDETC2019-97602

*Nguyen Vu Linh, National Taiwan University of Science and Technology, Taipei, Taipei, Taiwan, Chin-Hsing Kuo, University of Wollongong, NSW 2522, Australia*

**3:40PM** **On The Kinematic Performance of A Novel 5-DOF Reconfigurable Hybrid Manipulator With Ultra Large Workspace For Automatic Perfusion of A Large-Scale Spherical Honeycomb Structure**  
Technical Paper Publication. IDETC2019-97678

*Hui Yang, Hairong Fang, Beijing Jiaotong University, Beijing, China, Qiaode Jeffrey Ge, Stony Brook University, Stony Brook, NY, United States, Yuefa Fang, Beijing Jiaotong University, Beijing, China*

**MR-10**

## **MECHANISM-BASED METAMATERIALS**

**Session MR-10-1**

**Mechanism-based Metamaterials - Fast forward and Interactive Presentations I**

**California Ballroom A 2:10PM–3:50PM**

Session Organizer: **Jonathan Hopkins**, University of California, Los Angeles, Los Angeles, CA, United States

Session Co-Organizer: **Lorenzo Valdevit**, University Of California, Irvine, Irvine, CA, United States

**2:10PM** **Designing Lightweight Tensegrity-Based Structures and Materials of Tailorable Thermal Expansion**  
Technical Paper Publication. IDETC2019-97304

*Rochelle Silverman, Edwin Peraza Hernandez, University of California, Irvine, Irvine, CA, United States*

**2:15PM** **Bi-material Re-entrant Triangle Structures Incorporating Tailorable Thermal Expansion and Tunable Poisson's Ratio**  
Technical Paper Publication. IDETC2019-97686

*Xiaobing He, Yan Xie, Beihang University, Beijing, Beijing, China, Jingjun Yu, Beihang University/Robotics Institute, Beijing, China*

**2:20PM** **Design and Actuation of DNA Origami mechanisms for Functional Bionanomaterials**  
Technical Presentation. IDETC2019-98116

*Hai-Jun Su, The Ohio State University, Columbus, OH, United States*

**2:25PM** **Continuous-range tunable multilayer frequency selective surfaces using origami and inkjet printing**  
Technical Presentation. IDETC2019-98543

*Larissa S. Novelino, Syed Abdullah Nauroze, Manos M. Tentzeris, Glaucio H. Paulino, Georgia Institute of Technology, Atlanta, GA, United States*

**2:30PM** **Compliant Rolling-contact Architected Materials**  
Technical Presentation. IDETC2019-98648

*Samira Chizari, Lucas Shaw, Matthew Dotson, Yuanping Song, UCLA, Los Angeles, CA, United States, Jonathan Hopkins, University of California, Los Angeles, Los Angeles, CA, United States*

**2:35PM** **Multiphysics and Multimaterial Topology Optimization for Programmable Ferromagnetic Soft Active Structures**  
Technical Presentation. IDETC2019-98637

*JIawei Tian, State University of New York at Stony Brook, Stony Brook, NY, United States, Xuanhe Zhao, MIT, Cambridge, MA, United States, Shikui Chen, State University of New York at Stony Brook, Stony Brook, NY, United States*

**2:40PM** **Generative Design of Origami Structures Using Level-Set-Based Topology Optimization**  
Technical Presentation. IDETC2019-98639

*Shikui Chen, State University of New York at Stony Brook, Stony Brook, NY, United States, Qian Ye, Stony Brook University, Port Jefferson Station, NY, United States, Xianfeng David Gu, State University of New York at Stony Brook, Stony Brook, NY, United States*

**2:45PM** **Metamaterial with Fluctuating Poisson's Ratios**  
Technical Presentation. IDETC2019-98649

*Amin Farzaneh, Nikhil Pawar, UCLA, Los Angeles, CA, Carlos Portela, Caltech, Pasadena, CA, United States, Julia Greer, California Institute of Technology, Pasadena, CA, United States, Jonathan Hopkins, University of California, Los Angeles, Los Angeles, CA, United States*

# Technical Sessions

**2:50PM**      **Multiscale Design and Fabrication of a Reliably Manufacturable Negative Stiffness Metamaterial**  
Technical Presentation. IDETC2019-98646

*Clinton B. Morris*, Palo Alto Research Center, Palo Alto, CA, United States, *Logan Bekker*, *Christopher Spadaccini*, Lawrence Livermore National Laboratory, Livermore, CA, United States, *Michael R Haberman*, University of Texas at Austin, Austin, TX, United States, *Carolyn C. Seepersad*, Univ Of Texas At Austin, Austin, TX, United States

**2:55PM**      **Tuning of Elastic Wave Propagation for Formation of Mechanical Vibration Bandgaps in Three-Dimensional Metamaterials**  
Technical Presentation. IDETC2019-98610

*Wael Elmadih*, University of Nottingham, NG8 1BB, Nottinghamshire, United Kingdom, *Wahyudin Syam*, *Ian Maskery*, *Richard Leach*, UNIVERSITY OF NOTTINGHAM, Nottingham, Nottinghamshire, United Kingdom

**3:00PM**      **Design of high strain hardened and recoverable intertwined mechanical metamaterials**  
Technical Presentation. IDETC2019-98642

*Zacharias Vangelatos*, University of California, Berkeley, Berkeley, CA, United States, *John Spanos*, Institute of Electronic Structure and Laser (IESL), Foundation of Research and Technology, Hellas (, Heraklion, Greece, *Maria Farsari*, Institute of the Electronic Structure and Laser, Foundation for Research and Technology-Hellas, Heraklion, Greece, *Kyriakos Komvopoulos*, *Costas P. Grigoropoulos*, UC Berkeley, Berkeley, CA, United States

**3:05PM**      **Automated Three-dimensional Microgranular Crystal Fabrication**  
Technical Presentation. IDETC2019-98650

*Samira Chizari*, *Miles Lim*, *Sydney Austin*, *Lucas Shaw*, UCLA, Los Angeles, CA, United States, *Jonathan Hopkins*, University of California, Los Angeles, Los Angeles, CA, United States

**3:10PM**      **Iso-tiled Metamaterials: Auxetic in Compression and not in Tension**  
Technical Presentation. IDETC2019-98660

*Craig Lusk*, The University of South Florida, Lutz, FL, United States

**3:15PM**      **Mechatronic Metamaterials that Achieve Programmable Properties**  
Technical Presentation. IDETC2019-98652

*Chenyang Lou*, University of Texas at Austin, Austin, TX, United States, *Yuanping Song*, UCLA, Los Angeles, CA, *Cheng Zhao*, *Ian Ladner*, University of Texas at Austin, Austin, TX, United States, *Jonathan Hopkins*, University of California, Los Angeles, Los Angeles, CA, United States, *Michael Cullinan*, University of Texas at Austin, Austin, TX, United States

**3:20PM**      **Micromechanics of Hardening in 3D Fiber Composite Architectures**  
Technical Presentation. IDETC2019-98654

*Lucas Meza*, University of Washington, Seattle, WA, United States, *Jim Schormans*, Code Product Solutions, Eindhoven, Netherlands, *Karthikeyan Kandan*, De Montfort University, Leicester, United Kingdom, *Joris Remmers*, Eindhoven University of Technology, Eindhoven, Netherlands, *Vikram Deshpande*, Cambridge Univ, Cambridge, United Kingdom

**3:25PM**      **Transition waves in multistable architected soft materials**  
Technical Presentation. IDETC2019-98655

*Hiromi Yasuda*, *Lucia M. Korpas*, *Jordan R. Raney*, University of Pennsylvania, Philadelphia, PA, United States

**3:30PM**      **Mechanical Characterization and Manufacturability Analysis of Metal Additively Manufactured Compliant Metamaterial**  
Technical Presentation. IDETC2019-98657

*Jivtesh Khurana*, *Carrie McCartney*, *Lourdes D. Bobbio*, *Cole Britt*, Pennsylvania State University, University Park, PA, United States, *Mary Frecker*, *Ph.D.*, Pennsylvania State Univ, University Park, PA, United States, *Allison Beese*, Pennsylvania State University, University Park, PA, United States

**3:35PM**      **A Highly-Compressible Metamaterial Utilizing Euler Spiral Flexures**  
Technical Presentation. IDETC2019-98659

*Collin Ynchausti*, *Jacob R. Greenwood*, *Jared Butler*, *David Andrews*, Brigham Young University, PROVO, UT, United States, *Larry L. Howell*, *Spencer Magleby*, Brigham Young Univ, Provo, UT, United States

**3:40PM**      **Metamaterials that Learn their Properties**  
Technical Presentation. IDETC2019-98651

*Ryan Lee*, UCLA, Los Angeles, CA, United States, *Jonathan Hopkins*, University of California, Los Angeles, Los Angeles, CA, United States

**MR-9**

**NOVEL MECHANISMS, ROBOTS & APPLICATIONS**

**Session MR-9-2**

**Novel Mechanisms, Robots & Applications - Fast forward and Interactive Presentations II**

**Santa Monica 4:10PM–5:50PM**

Session Organizer: *Reza Fotouhi*, Univ Of Saskatchewan, Saskatoon, SK, Canada

**4:10PM**      **Design Of A Totally Robotic Solution For Sampling In Pharmaceutical Industry**  
Technical Paper Publication. IDETC2019-97734

*Mariapaola D'Imperio*, *Ferdinando Cannella*, Istituto Italiano Di Tecnologia, Genova, Italy

# Technical Sessions

**4:19PM**            **A SHAPE MEMORY ALLOY DRIVEN CRAWLING ROBOT UTILIZING A BISTABLE MECHANISM**  
Technical Paper Publication. IDETC2019-97755

*Lingda Meng, Rongjie Kang, Tianjin University, Tianjin, China, Dongming Gan, Khalifa Univ. of Sci Tech & Res., Abu Dhabi, Guimin Chen, Xi'an Jiaotong University, Xi'an, China, Jian S. Dai, Kings College-Univ Of London, London, United Kingdom*

**4:28PM**            **Using Inertial Control to Improve Maneuverability of Propeller-Assisted Flapping Wing Aerial Vehicle**  
Technical Paper Publication. IDETC2019-97854

*Alex Holness, Hannah Solheim, University of Maryland, College Park, College Park, MD, United States, Hugh Bruck, Univ of Maryland, College Park, MD, United States, Satyandra K. Gupta, University of Southern California, Los Angeles, CA, United States*

**4:37PM**            **Improved Surgical Robot Design using a Novel Compliant Rolling-Contact Joint**  
Technical Paper Publication. IDETC2019-97981

*Carl Nelson, University of Nebraska, Lincoln, NE, United States, Cole A. Dempsey, Ethan R. Brush, University of Nebraska-Lincoln, Lincoln, NE, United States, M. Amine Laribi, Institut PPRIME, Département Génie Mécanique et Systèmes Complexes, CNRS - Université de Poitiers, Poitiers, France*

**4:46PM**            **Calibration of Reconfigurable Stewart-Gough Platform for Mobile Machining Application**  
Technical Paper Publication. IDETC2019-98137

*Andreas Bennekov Hansen, Jørgen Møberg Laursen, Sebastian Theis Henriksen, Aarhus University, Aarhus, Denmark, Kasper Ringgaard, Aarhus University, Aarhus C, Denmark, Morten Rydahl-Haastруп, Ole Balling, Aarhus University, Aarhus, Denmark*

**4:55PM**            **FEASIBILITY STUDY OF AN AERIAL LIFTING DEVICE USING AERODYNAMIC DRAG FOR ASCENT**  
Technical Paper Publication. IDETC2019-98138

*Xuan Lin, Gabriel Ikaika Fernandez, Sepehr Ghassemi, UCLA, Los Angeles, CA, United States, Dennis Hong, UCLA, Santa Monica, CA, United States*

**5:04PM**            **A Variable Stiffness Compliant Robotic Gripper Based on Layer Jamming**  
Technical Paper Publication. IDETC2019-98294

*Yuan Gao, The Ohio State University, Columbus, OH, United States, Xiguang Huang, North China University of Technology, Beijing, China, Ishan S. Mann, Hai-Jun Su, The Ohio State University, Columbus, OH, United States*

**5:13PM**            **Conceptual Design & Prototype Development of a Solar-powered Ground Robot for Energy-autonomous Operation**  
Technical Paper Publication. IDETC2019-98361

*Amir Behjat, University at Buffalo, Buffalo, NY, United States, Leighton Collins, SUNY University at Buffalo, Amherst, NY, United States, Andrew Hoffman, Sharat Chidambaram, Maulikkumar Dhameliya, Souma Chowdhury, University at Buffalo, Buffalo, NY, United States*

**5:22PM**            **Lightweight long-reach 5-dof robot arm for farm application**  
Technical Paper Publication. IDETC2019-98366

*Qianwei Zhang, University of Saskatchewan, Saskatoon, SK, Canada, Reza Fotouhi, Univ Of Saskatchewan, Saskatoon, SK, Canada, Joshua Cote, Majid Khak Pour, University of Saskatchewan, Saskatoon, SK, Canada*

**5:31PM**            **Development and Experimental Evaluation of a Quad-Tilt-Wing Flying Robot Platform**  
Technical Paper Publication. IDETC2019-98500

*Abudula Aihaitijiang, Cagdas Onal, Worcester Polytechnic Institute, Worcester, MA, United States*

**5:40PM**            **Compact Tensegrity Robots Capable Of Locomotion Through Mass-Shifting**  
Technical Paper Publication. IDETC2019-98513

*Tyler Rhodes, Vishesh Vikas, The University of Alabama, Tuscaloosa, AL, United States*

## MR-10

### MECHANISM-BASED METAMATERIALS

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#### Session MR-10-2

**Mechanism-based Metamaterials - Fast forward and Interactive Presentations II**

**California Ballroom A 4:10PM–5:50PM**

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Session Organizer: **Jonathan Hopkins**, University of California, Los Angeles, Los Angeles, CA, United States

Session Co-Organizer: **Lorenzo Valdevit**, University Of California, Irvine, Irvine, CA, United States

**4:10PM**            **Design of three-dimensional tunable mechanical metamaterials**  
Technical Presentation. IDETC2019-98661

*Sree Kalyan Patiballa, University of Illinois, Urbana Champaign, Urbana, IL, United States, Girish Krishnan, UIUC, Urbana, IL, United States*

# Technical Sessions

**4:15PM**      **3D-Printed Microrobots with Integrated Structural Color for Identification and Tracking**  
Technical Presentation. IDETC2019-98662

*Cara Koepele, Purdue University, West Lafayette, IN, United States, Maria Guix, Barcelona Institute of Science and Technology, Barcelona, Spain, Chenghao Bi, Georges Adam, David Cappelleri, Purdue University, West Lafayette, IN, United States*

**4:20PM**      **Material Logic: Mechanical Metamaterials that Compute**  
Technical Presentation. IDETC2019-98663

*Andrew Pascall, Lawrence Livermore National Laboratory, Livermore, CA, United States, Yuanping Song, UCLA, Los Angeles, CA, Robert M. Panas, LLNL, Livermore, CA, United States, Samira Chizari, Lucas Shaw, UCLA, Los Angeles, CA, United States, Julie Jackson, Logan Bekker, Frederick Sun, Lawrence Livermore National Laboratory, Livermore, CA, United States, Jonathan Hopkins, University of California, Los Angeles, Los Angeles, CA, United States*

**4:25PM**      **Additively Manufactured Ceramic Nanolattices**  
Technical Presentation. IDETC2019-98664

*Cameron Crook, Anna Guell Izard, Jens Bauer, Lorenzo Valdevit, University of California, Irvine, Irvine, CA, United States*

**4:30PM**      **Additively Manufactured Plate-Based Ceramic Nanoarchitected Materials**  
Technical Presentation. IDETC2019-98665

*Cameron Crook, Anna Guell Izard, Jens Bauer, Lorenzo Valdevit, University of California, Irvine, Irvine, CA, United States*

**4:35PM**      **Additively Manufactured Materials with Spinodal Nano-Shell Architectures**  
Technical Presentation. IDETC2019-98666

*Anna Guell Izard, Cameron Crook, Meng-Ting Hsieh, Jens Bauer, Lorenzo Valdevit, University of California, Irvine, Irvine, CA, United States*

**4:40PM**      **Achieving Dilation of General Surfaces**  
Technical Presentation. IDETC2019-98667

*Freek Broeren, Delft, University of Technology, Delft, Netherlands, Netherlands, Werner van de Sande, Delft University of Technology, Delft, Netherlands, Volkert van der Wijk, Just Herder, Delft, University of Technology, Delft, Netherlands*

**4:45PM**      **Mechanical Response of Hierarchical Net-like 3D Lattice Architectures**  
Technical Presentation. IDETC2019-98668

*Widianto Moestopo, California Institute of Technology, Pasadena, CA, United States, Carlos Portela, Arturo Mateos, Caltech, Pasadena, CA, United States, Julia Greer, California Institute of Technology, Pasadena, CA, United States*

**4:50PM**      **Fracture of three-dimensional nano to microscale lattice architectures**  
Technical Presentation. IDETC2019-98669

*Bryce Edwards, Julia Greer, California Institute of Technology, Pasadena, CA, United States*

**4:55PM**      **Exploiting the 3MF Specification to Enable Hierarchical Features in Architected Materials**  
Technical Presentation. IDETC2019-98670

*Zheng Jie Tan, Massachusetts Institute of Technology, Cambridge, MA, United States, Nicholas Fang, MIT, Cambridge, MA, United States*

**5:00PM**      **Three-dimensional printing of piezoelectric materials with designed anisotropy and their applications**  
Technical Presentation. IDETC2019-98671

*Huachen Cui, Desheng Yao, Ryan Hensleigh, Xiaoyu Zheng, Virginia Tech, Blacksburg, VA, United States*

**5:05PM**      **Negative Stiffness-based Three Spring Devices for Tailored Shock Attenuation**  
Poster Paper Presentation. IDETC2019-98672

*Christopher Henry, Hrl Laboratories Llc, Malibu, CA, United States, David W. Shahan, HRL Laboratories, Malibu, CA, United States*

**5:10PM**      **A Micro-Architected Mechanism-Based Optical Surface**  
Technical Presentation. IDETC2019-98673

*Robert M. Panas, Jordan J. Karburn, Kenneth G. Enstrom, Vu Nguyen, LLNL, Livermore, CA, United States, James Simonelli, UCLA, Livermore Los Angeles, CA, United States, Jonathan Hopkins, University of California, Los Angeles, Los Angeles, CA, United States*

**5:15PM**      **Topological Pumping in Spatially Modulated Elastic Media**  
Technical Presentation. IDETC2019-98674

*Matheus Rosa, Georgia Institute of Technology, Atlanta, GA, United States, Raj Kumar Pal, California Institute of Technology, Pasadena, CA, United States, Emanuele Riva, Politecnico di Milano, Milano, MI, Italy, Massimo Ruzzene, Georgia Institute Of Tech, Atlanta, GA, United States*

**5:20PM**      **Architected shells with temporally-programmed reconfigurability**  
Technical Presentation. IDETC2019-98676

*Ruslan Guseinov, Institute of Science and Technology Austria, Klosterneuburg, Austria, Connor McMahan, California Institute of Technology, Pasadena, CA, United States, Jesus Perez, Institute of Science and Technology Austria, Klosterneuburg, Austria, Chiara Daraio, California Institute of Technology, Pasadena, CA, United States, Bernd Bickel, Institute of Science and Technology Austria, Klosterneuburg, Austria*



# Technical Sessions

**5:25PM** Extreme mechanical resilience via self-assembly geometries  
Technical Presentation. IDETC2019-98679

*Carlos Portela, Caltech, Pasadena, CA, United States, Vidyasagar A., Caltech, Pasadena, CA, United States, Sebastian Krodel, Tamara Weissenbach, ETH Zurich, Zurich, Switzerland, Daryl Yee, Caltech, Pasadena, CA, United States, Julia Greer, California Institute of Technology, Pasadena, CA, United States, Dennis Kochmann, ETH Zurich, Zurich, Switzerland*

**5:30PM** Topologically Optimized Light Stiff Lattice Structures with Improved Stability  
Technical Presentation. IDETC2019-98681

*Mazdak Tootkaboni, University of Massachusetts Dartmouth, Dartmouth, MA, United States, Alireza Asadpoure, Univ. of Massachusetts Dartmouth, North Dartmouth, MA, United States, Lorenzo Valdevit, University Of California, Irvine, Irvine, CA, United States*

**5:35PM** Design and experimental validation on acoustic valley Hall edge states in reconfigurable phononic elastic waveguides  
Technical Presentation. IDETC2019-98691

*Ting-Wei Liu, Fabio Semperlotti, Purdue University, West Lafayette, IN, United States*

## 13th International Conference on Micro- and Nanosystems (MNS) MONDAY, AUGUST, 19

### MNS-3 BIO MEMS/NEMS

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Session MNS-3-1  
MNS-3-1  
Laguna B 8:00AM–9:00AM

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**8:00AM** GENETICALLY MODIFIED SOYBEAN DETECTION USING A BIOSENSOR ELECTRODE WITH SELF-ASSEMBLED GOLD NANOPARTICLES ON A MICRO HEMISPHERE ARRAY  
Technical Paper Publication. IDETC2019-97112

*Ying-Ting Lin, National Chung-Hsing University, Taichung, Taiwan, Iren Kuznetsova, Russian Academy of Science, Moscow, Russia, Gou-Jen Wang, National Chung Hsing Univ, Taichung, Taiwan*

**8:20AM** DIRECT LABEL FREE DETECTION OF ORCHID VIRUS USING A MICRO/NANO HYBRID STRUCTURED BIOSENSOR  
Technical Paper Publication. IDETC2019-97198

*Wei-Jhen Wang, Chia-Hwa Lee, National Chung-Hsing University, Taichung, Taiwan, Chin-Wen Li, Stephen Liao, Phoenix Silicon International Corporation, Hsinchu, Taiwan, Fuh-Jyh Jan, National Chung-Hsing University, Taichung, Taichung, Taiwan, Gou-Jen Wang, National Chung Hsing Univ, Taichung, Taiwan*

**8:40AM** DEVELOPMENT OF THREE-DIMENSIONAL MEMS BIOCHEMICAL SENSORS FOR LOW CONCENTRATION AQUEOUS SOLUTIONS  
Technical Paper Publication. IDETC2019-98071

*Mohammad Shavezipur, Roya Mazrouei, Bryan Kier, Southern Illinois University, Edwardsville, Edwardsville, IL, United States*

### MNS-6 MEMS SENSORS AND ACTUATORS

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Session MNS-6-2  
Modal Engineering  
Capistrano A 8:00AM–9:00AM

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**8:00AM** MODAL FILTERING AND AUTORESONANCE IN AFM SENSING  
Technical Presentation. IDETC2019-97811

*Izhak Bucher, Technion, Haifa, OO, Israel, Eyal Rubin, Solomon Davis, Mechanical Engineering, Haifa, Israel*

**8:20AM** Mode Localization In Two Coupled Nearly Identical MEMS Cantilevers For Mass Sensing  
Technical Paper Publication. IDETC2019-97841

*Toky Harrison RABENIMANANA, Vincent Walter, University of Franche Comte, Besançon, France, Najib Kacem, Univ. Bourgogne Franche-Comté, FEMTO-ST Institute, Besancon, France, Patrice Le Moal, Gilles Bourbon, Joseph Lardiès, University of Franche Comte, Besançon, France*

**8:40AM** A Sensitive Resonant Gas Sensor Based on Multimode Excitation of a Buckled Beam  
Technical Paper Publication. IDETC2019-98148

*Amal Z Hajjaj, King Abdullah University of Science and Technology, Thuwal, Select State/Province, Saudi Arabia, Nizar R. Jaber, King Abdullah University of Science & Technology, Thuwal, Saudi Arabia, Nouha Alcheikh, King Abdullah University of Science and Technology, Jeddah, Saudi Arabia, Mohammad Younis, King Abdullah University of Science and Technology, Thuwal, Saudi Arabia*

MNS-3  
BIO MEMS/NEMS  
Session MNS-3-2  
MNS-3-2  
Laguna B 9:10AM–10:30AM

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# Technical Sessions

**9:10AM** Weakly Coupled Resonators for Highly Sensitive Mechanical Sensors  
Technical Presentation. IDETC2019-97128

*Honglong Chang, Northwestern Polytechnical University, Xi'an, Shannxi, China*

**9:30AM** Tunable Silver Nanoparticle Arrays for Surface-Enhanced Raman Scattering  
Technical Presentation. IDETC2019-97118

*Chu-Yu Huang, National Chung Hsing University, Taichung, Taiwan, Ming-Shiuan Tsai, National Chung Hsing University, Taichung City, Taiwan*

**9:50AM** Biosensing Mechanism Using Amplitude Voltage Response of Superharmonic Resonance of Fourth Order of Electrostatically Actuated MEMS Cantilever Resonators  
Technical Paper Publication. IDETC2019-98073

*Dumitru Caruntu, Christopher I. Reyes, University Of Texas Rio Grande Valley, Edinburg, TX, United States*

**10:10AM** Insights on shear deformation impacts on the performance of carbon nanotube-based mass sensors  
Technical Presentation. IDETC2019-98212

*Brian Saunders, New Mexico State University, Las Cruces, NM, United States, Samantha Ceballes, New Mexico State University, Alamogordo, NM, United States, Abdessattar Abdelkefi, New Mexico State University, Las Cruces, NM, United States*

## MNS-3

### BIO MEMS/NEMS

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#### Session MNS-3-3

##### MNS-3-3

**Laguna B** 10:50AM–12:10PM

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**10:50AM** A parallel and multicolor microflow cytometer  
Technical Presentation. IDETC2019-97212

*Yu-Jui Fan, Biomedical Engineering, Taipei Medical University, Taipei, Taiwan, Horn-Jiunn Sheen Yu-Jui Fan, National Taiwan University, Taipei, Taiwan*

**11:16AM** Vibratory analysis of size-dependent shell models for carbon nanotube-based targeted drug delivery applications  
Technical Presentation. IDETC2019-97992

*Samantha Ceballes, New Mexico State University, Alamogordo, NM, United States, Abdessattar Abdelkefi, New Mexico State University, Las Cruces, NM, United States*

**11:42AM** Fabrication and Testing of a MEMS System for Injection of DNA into Plant Cells  
Technical Paper Publication. IDETC2019-98019

*Talyor Brown, Sandra Hope, Brian Jensen, Brigham Young University, Provo, UT, United States*

## MNS-6

### MEMS SENSORS AND ACTUATORS

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#### Session MNS-6-1

##### Pressure Sensing Applications

**Capistrano A** 10:50AM–12:10PM

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**10:50AM** Modeling and performance analysis of MEMS arch resonator for pressure sensing applications  
Technical Presentation. IDETC2019-97150

*Fehmi Najjar, Tunisia Polytechnic School, Tunis, Tunisia, Mehdi Ghommem, American University of Sharjah, Sharjah, Abdessattar Abdelkefi, New Mexico State University, Las Cruces, NM, United States*

**11:10AM** Explosive Testing of SOI-DRIE MEMS Pressure Sensor for Traumatic Brain Injury Applications  
Technical Presentation. IDETC2019-97462

*Oliver Barham, US DoD, Washington, DC, United States*

**11:30AM** A CAPACITIVE MEMS PRESSURE SENSOR WITH WAVY MEMBRANE AND LINEAR CAPACITANCE-PRESSURE RESPONSE

Technical Paper Publication. IDETC2019-98021

*Mohammad Shavezipur, Stephen Oke, Southern Illinois University, Edwardsville, Edwardsville, IL, United States*

**11:50AM** Wide range highly sensitive pressure sensor based on heated micromachined arch beam  
Technical Paper Publication. IDETC2019-97995

*Nouha Alcheikh, King Abdullah University of Science and Technology, Jeddah, Saudi Arabia, Amal Z Hajjaj, Mohammad Younis, King Abdullah University of Science and Technology, Thuwal, Select State/Province, Saudi Arabia*

## MNS-1

### KEYNOTE LECTURES

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#### Session MNS-1-1

##### MNS-1-1 Keynote speaker 1

**Capistrano A** 2:10PM–3:45PM

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Session Organizer: **Yong Shi, Stevens Inst Of Tech, Hoboken, NJ, United States**

Session Co-Organizer: **Gou-Jen Wang, National Chung Hsing Univ, Taichung, Taiwan**

# Technical Sessions

## MNS-6

### **MEMS SENSORS AND ACTUATORS**

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#### Session MNS-6-3

#### Micro and Nano-Technology Applications

#### Capistrano A 4:10PM–5:50PM

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#### 4:10PM INVESTIGATION OF THE EFFECT OF LONG-TERM CONTACT ON ADHESION FORCE IN POLYCRYSTALLINE MEMS DEVICES

Technical Paper Publication. IDETC2019-97839

*Mohammad Shavezpur, Mazen Othayq, Southern Illinois University, Edwardsville, Edwardsville, IL, United States, Nino Giganti, Southern Illinois University, Edwardsville, IL, United States*

#### 4:35PM Simulation of a Micro-Electro-Mechanical System for Generating Electrical Power from Pressurized Gas

Technical Paper Publication. IDETC2019-97923

*Andrew Cunningham, Brian Jensen, Brigham Young University, Provo, UT, United States*

#### 5:00PM Characterization of nanosensors with random mass distribution: theory and experiments

Technical Presentation. IDETC2019-97994

*Daniel Furth, New Mexico State University, Las Cruces, NM, United States, Samantha Ceballes, New Mexico State University, Alamogordo, NM, United States, Abdessattar Abdelkefi, New Mexico State University, Las Cruces, NM, United States*

#### 5:25PM Model and Position Control of a Two-Axis Gimbaled Circular Micro Mirror Actuated by Multiple Close-gap Electrodes

Technical Presentation. IDETC2019-98051

*Slava Krylov, Tel Aviv University, Tel Aviv, Israel*

## TUESDAY, AUGUST, 20

## MNS-2

### **DYNAMICS OF MEMS AND NEMS (MNS/VIB)**

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#### Session MNS-2-1

#### MEMS Resonators

#### Capistrano A 8:00AM–9:00AM

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Session Organizer: *Slava Krylov, Tel Aviv University, Tel Aviv, Israel*  
Session Co-Organizer: *Mohammad Younis, King Abdullah University of Science and Technology, Thuwal, Saudi Arabia*

#### 8:00AM Tuning Internal Resonance in a MEMS Resonator

Technical Presentation. IDETC2019-98077

*Jun Yu, Hanna Cho, Hatem Brahmî, The Ohio State University, Columbus, OH, United States*

#### 8:20AM Mode localization in mechanically coupled MEMS resonators

Technical Presentation. IDETC2019-98541

*Saad Ilyas, King Abdullah Univ of Science & Tech, Thuwal, Select State/Province, Saudi Arabia, Mohammad Younis, King Abdullah University of Science and Technology, Thuwal, Saudi Arabia*

#### 8:40AM Piezoelectric based sensors for simultaneous viscosity and density measurement

Technical Presentation. IDETC2019-98696

*Haifeng Zhang, University of North Texas, Denton, TX, United States*

## MNS-7

### **MEMS/NEMS NEURAL AND DIGITAL COMPUTING**

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#### Session MNS-7-1

#### MNS-7-1

#### Capistrano A 9:10AM–10:30AM

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#### 9:10AM Multi-Inputs and Multi-Outputs MEMS Resonator for Complex Logic Operations

Technical Presentation. IDETC2019-98009

*Sherif Tella, King Abdullah University of Science and Technology, Makkah Province, Saudi Arabia, Mohammad Younis, King Abdullah University of Science and Technology, Thuwal, Saudi Arabia*

## MNS-5

### **QUANTUM & FUNCTIONAL MATERIALS AND SURFACE**

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#### ENGINEERING

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#### Session MNS-5-1

#### MNS-5-1

#### Capistrano A 10:50AM–12:10PM

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#### 10:50AM Acoustic Characteristic of Metamaterials with Gradient Impedance

Technical Presentation. IDETC2019-98257

*Jing Qiao, Yiwen Feng, Guangbin Shao, Longqiu Li, Harbin Institute of Technology, Harbin, Heilongjiang, China*

#### 11:10AM 3D Printed High Performance Soft Sensors via Direct Ink Writing

Technical Presentation. IDETC2019-98443

*Erwei Shang, Jiawen Xu, Yu Liu, Jie Zhang, Jiangnan University, Wuxi, China, Yongqiang Deng, Western University, London, ON, Canada, Yanqiu Chen, Jiangnan University, Wuxi, China, Jin Jiang, Western University, London, ON, Canada*

#### 11:30AM How Precise Can Direct Ink Writing Move To \_ Studied by A Latest System Development

Technical Presentation. IDETC2019-98445

*Yanqiu Chen, Jiangnan University, Wuxi, China, Yongqiang Deng, Western University, London, ON, Canada, Yu Liu, Jiangnan University, Wuxi, China, Jin Jiang, Western University, London, ON, Canada*

# Technical Sessions

**11:50AM** Mechanical response of carbon nanotube nanocomposite wires  
Technical Presentation. IDETC2019-98519

*Michela Talo, Marco Marini, Sapienza University of Rome, Rome, Italy, Giulia Lanzara, University of Rome, Rome, Italy, Walter Lacarbonara, Univ Of Rome La Sapienza-disg, Rome, Italy*

## MNS-1

### KEYNOTE LECTURES

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Session MNS-1-2

Keynote speaker 2

Capistrano A 2:10PM–3:50PM

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Session Organizer: **Gou-Jen Wang**, National Chung Hsing Univ, Taichung, Taiwan

Session Co-Organizer: **Yong Shi**, Stevens Inst Of Tech, Hoboken, NJ, United States

## MNS-2

### DYNAMICS OF MEMS AND NEMS (MNS/VIB)

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Session MNS-2-2

MEMS Oscillators

Capistrano A 4:10PM–5:50PM

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Session Organizer: **Shahrzad Towfighian**, Binghamton University, Vestal, NY, United States

Session Co-Organizer: **Najib Kacem**, Univ. Bourgogne Franche-Comté, FEMTO-ST Institute, Besancon, France

**4:10PM** Synchronization of arrays of MEMS oscillators  
Technical Presentation. IDETC2019-97457

*Aditya Bhaskar, B Shayak, Richard Rand, Cornell University, Ithaca, NY, United States, Alan T. Zehnder, Cornell Univ, Ithaca, NY, United States*

**4:30PM** Dynamics of a System of Two Coupled MEMS Oscillators

Technical Presentation. IDETC2019-97570

*B Shayak, Richard Rand, Cornell University, Ithaca, NY, United States, Alan T. Zehnder, Cornell Univ, Ithaca, NY, United States, Aditya Bhaskar, Cornell University, Ithaca, NY, United States*

**4:50PM** Tuning of the Zero Dispersion Point for MEM Resonators

Technical Presentation. IDETC2019-98002

*Rebekah Blackwell, Florida Institute of Technology, West Melbourne, FL, United States, Steven Shaw, Florida Tech, Melbourne, FL, United States*

**5:10PM** Experimental and Numerical study of Combination Resonances in a Geometrically Nonlinear Micromechanical Resonator

Technical Presentation. IDETC2019-98074

*Keivan Asadi, The Ohio State University, Columbus, OH, United States, Snehan Peshin, Junghoon Yeom, Michigan State University, East Lansing, OH, United States, Hanna Cho, The Ohio State University, Columbus, OH, United States*

**5:30PM** Wide-Band Event-Driven Bistable Mechanical Vibrometer With A Tunable Threshold

Technical Presentation. IDETC2019-97646

*Oren G. Levi, Tel-Aviv University, Tel-Aviv, Israel, Naftaly Krakover, Tel Aviv University, Tel-Aviv, Israel, Slava Krylov, Tel Aviv University, Tel Aviv, Israel*

## WEDNESDAY, AUGUST, 21

## MNS-4

### MICRO/NANO ROBOTICS AND MANUFACTURING

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Session MNS-4-1

MNS-4-1

Capistrano A 8:00AM–9:40AM

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**8:00AM** Customized PEEK Implants with Microporous and Surface Modification Using 3D Printing  
Technical Paper Publication. IDETC2019-97117

*Chao-Yaug Liao, Po-Lun Wu, National Central University, Taoyuan City, Taiwan, Chao-Yu Lee, National Formosa University, Yunlin County, Taiwan*

**8:20AM** Contour Scanning Method with Inner Supports for Micro-shell Structural Strengthening Strategy Based on Two-photon Polymerization Technology  
Technical Paper Publication. IDETC2019-97321

*Yu-Wen Tseng, Chao-Yaug Liao, Chin-Huang Tseng, Po-Kai Chen, National Central University, Taoyuan City, Taiwan*

**8:40AM** PRELIMINARY STUDY ON THE MANUFACTURING FEASIBILITY OF MICROFEATURES FOR MICROFLUIDICS BY DLP STEREO LITHOGRAPHY  
Technical Paper Publication. IDETC2019-97864

*Lara Rebaioli, CNR-STIIMA, Milano, MI, Italy, Irene Fassi, STIIMA-CNR, Milano, Italy*

**9:00AM** MOLDING PARAMETERS DESIGN FOR MESO AND MICRO COMPONENTS USING POLYLACTIC ACID (PLA)  
Technical Paper Publication. IDETC2019-97900

*Rossella Surace, Vincenzo Bellantone, STIIMA-CNR, Bari, Italy, Irene Fassi, STIIMA-CNR, Milano, Italy*



# Technical Sessions

**9:20AM** A ROBOTIC TOOL FOR MAGNETIC MICROMANIPULATION OF CELLS IN THE PRESENCE OF AN AMBIENT FLUID FLOW

Technical Paper Publication. IDETC2019-97941

*Dharmveer Agarwal, Ajay D. Thakur, Atul Thakur, Indian Institute of Technology Patna, Patna, Bihar, India*

**MNS-2**

**DYNAMICS OF MEMS AND NEMS (MNS/VIB)**

Session MNS-2-3

Vibration of MEMS Structures

Capistrano A 10:00AM–11:40AM

Session Organizer: **Hanna Cho**, *The Ohio State University, Columbus, OH, United States*

Session Co-Organizer: **Steven Shaw**, *Florida Tech, Melbourne, FL, United States*

**10:00AM** Feasibility Study of a Capacitive MEMS Filter Using Electrostatic Levitation

Technical Paper Publication. IDETC2019-97445

*Mark Pallay, Binghamton University, Binghamton, NY, United States, Shahrzad Towfighian, Binghamton Univ, Binghamton, NY, United States*

**10:20AM** The Effects of Nonlinear Damping on Parametric Amplification

Technical Presentation. IDETC2019-97861

*Donghao Li, Florida Institute of Technology, Melbourne, FL, United States, Steven Shaw, Florida Tech, Melbourne, FL, United States*

**10:40AM** Modeling of prestressed electrostatically actuated initially curved micro plates

Technical Presentation. IDETC2019-97870

*Lior Medina, Northwestern University, Evanston, IL, United States, Rivka Gilat, Ariel University, Ariel, Israel, Slava Krylov, Tel-Aviv University, Tel-Aviv, Israel*

**11:00AM** Towards Versatile Folded Microfibers: Folded versus Straight Configuration on Hydrophilic and Hydrophobic Substrates

Technical Paper Publication. IDETC2019-98164

*Alexandra Blank, Tel Aviv University, Tel Aviv, Israel, Moti Fridman, Bar Ilan University, Ramat Gan, Israel, Yoav Linzon, Tel Aviv University, Tel Aviv, Choose A State, Israel*

**11:20AM** On multi-fidelity modeling of squeeze film damping effect on electrically-coupled microbeams

Technical Presentation. IDETC2019-98269

*Fehmi Najjar, Tunisia Polytechnic School, Tunis, Tunisia, Mehdi Ghommem, American University of Sharjah, Sharjah, Abdessattar Abdelkefi, New Mexico State University, Las Cruces, NM, United States*

**15th International Conference on Multibody Systems, Nonlinear Dynamics, and Control (MSNDC)**

**MONDAY, AUGUST, 19**

**MSNDC-9**

**KEYNOTE PRESENTATIONS**

Session MSNDC-9-1

Keynote 1

Redondo 8:00AM–9:00AM

**MSNDC-2**

**CONTACT, FRICTION AND INTERFACE DYNAMICS**

Session MSNDC-2-1

Interface Dynamics and interdisciplinary Contact Problems

La Jolla 9:10AM–10:30AM

Session Organizer: **Dan Negrut**, *Univ Of Wisc, Madison, Madison, WI, United States*

Session Co-Organizer: **Radu Serban**, *University of Wisconsin - Madison, Zurich, Switzerland*

**9:10AM** FINITE ELEMENT MODEL OF SCHALLAMACH WAVES IN BELT-DRIVES

Technical Paper Publication. IDETC2019-97667

*Mohammed Khattab, Indiana University - Purdue University Indianapolis, Indianapolis, IN, United States, Tamer Wasfy, Indiana University Purdue University Indianapolis, Indianapolis, IN, United States*

**9:30AM** Predicting Finite Element Submodel Boundary Conditions For Contact Models Using Richardson Extrapolation

Technical Paper Publication. IDETC2019-98070

*Michael W. Sracic, William J. Elke, III, Milwaukee School of Engineering, Milwaukee, WI, United States*

**9:50AM** The Influence of the Tilting Train on the Initiation of the Head Check on the Low Rail

Technical Presentation. IDETC2019-97178

*Masahiro Tsujie, Railway Technical Research Institute, Tokyo, Japan, Megu Miura, Graduate school of Sophia University, Tokyo, Japan, Hua Chen, Railway Technical Research Institute, Tokyo, Japan, Yoshiaki Terumichi, Sophia Univ, Tokyo, Japan*

**10:10AM** Granular flows vs. fluid flows: similarities and differences

Technical Paper Publication. IDETC2019-97999

*Milad Rakhsha, University of Wisconsin-Madison, Madison, WI, United States, Conlain Kelly, University of Wisconsin - Madison, Prairie Du Sac, WI, United States, Nicholas Olsen, University of Wisconsin, Madison, WI, United States, Radu Serban, University of Wisconsin - Madison, Zurich, Switzerland, Dan Negrut, Univ Of Wisc, Madison, Madison, WI, United States*

# Technical Sessions

## MSNDC-3

### NONLINEAR SYSTEMS AND PHENOMENA (MSNDC/VIB)

#### Session MSNDC-3-2

#### Session 2

**Sunset 9:10AM–10:30AM**

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**9:10AM**            **Semi-parallelization and modification of Simple Cell Mapping method for cluster computations**  
Technical Presentation. IDETC2019-97124

*Nemanja Andonovski, Polytechnic University of Marche, Ancona, Italy, Stefano Lenci, Polytechnic Univ Of Marche, Ancona, Italy*

**9:30AM**            **Resonance Responses and Bifurcations of Circular Mesh Antenna in Thermal Environment**  
Technical Paper Publication. IDETC2019-97538

*Tao Liu, Wei Zhang, Xiangying Guo, Yan Zheng, Beijing University of Technology, Beijing, China*

**9:50AM**            **Phase-locking and Chaotic Phenomena of Circular Mesh Antenna with 1:3 Internal Resonance**  
Technical Paper Publication. IDETC2019-97754

*Tao Liu, Wei Zhang, Yan Zheng, Xiangying Guo, Beijing University of Technology, Beijing, China*

**10:10AM**          **Effect of Structural Nonlinearity on a Piecewise Linear Aeroleastic System**  
Student Competition Poster. IDETC2019-98208

*Janos Lelkes, Tamas Kalmar-Nagy, Budapest University of Technology and Economics, Department of Fluid Mechanics, Budapest, Hungary*

## MSNDC-5

### COMPUTATIONAL METHODS FOR MULTIBODY SYSTEMS AND NONLINEAR DYNAMICS

#### Session MSNDC-5-1

#### Advances in MSTMM (Rui method)

**Redondo 9:10AM–10:30AM**

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Session Organizer: **Xuping Zhang**, Aarhus University, Aarhus, Denmark

Session Co-Organizer: **Bao Rong**, Institute of Plasma Physics, Chinese Academy of Sciences, Hefei, China

**9:10AM**            **Research Progress and Development Tendency of Transfer Matrix Method for Multibody Systems (Rui Method)**  
Technical Paper Publication. IDETC2019-97698

*Xiaoting Rui, Nanjing University of Science & Technology, Nanjing, China, Xun Wang, Jianshu Zhang, Junjie Gu, Zhang Shujun, Nanjing University of Science and Technology, Nanjing, China*

**9:30AM**            **Study on Transfer Matrix of Single-ended Input and Single-ended Output Plate with Large Motion and Small Deformation**  
Technical Paper Publication. IDETC2019-97323

*Zihao He, Nanjing University of Science and Technology, Nanjing, Jiangsu province, China, Xiaoting Rui, Nanjing University of Science & Technology, Nanjing, China, Jianshu Zhang, Lina Zhang, Shaoheng Hu, Nanjing University of Science and Technology, Nanjing, Jiangsu Province, China*

**9:50AM**            **Advances in Dynamics Software of Transfer Matrix Method for Multibody Systems**  
Technical Presentation. IDETC2019-97627

*Junjie Gu, Nanjing University of Science and Technology, Nanjing, Jiangsu, China, Xiaoting Rui, Nanjing University of Science & Technology, Nanjing, China, Jianshu Zhang, Nanjing University of Science and Technology, Nanjing, Jiangsu, China*

**10:10AM**          **Study on the Mixed Method of Transfer Matrix Method and Finite Element Method for Vibration of Multibody System**  
Technical Paper Publication. IDETC2019-97749

*Hanjing Lu, Nanjing University of Science and Technology, Nanjing, Jiangsu, China, Xiaoting Rui, Nanjing University of Science & Technology, Nanjing, China, Jianshu Zhang, Nanjing University of Science and Technology, Nanjing, Jiangsu, China, Yuanyuan Ding, Nanjing University of Science & Technology, Nanjing, China*

## MSNDC-2

### CONTACT, FRICTION AND INTERFACE DYNAMICS

#### Session MSNDC-2-3

#### Interface Dynamics and interdisciplinary Contact Problems

**La Jolla 10:50AM–12:10PM**

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Session Organizer: **Dan Negrut**, Univ Of Wisc, Madison, Madison, WI, United States

Session Co-Organizer: **Radu Serban**, University of Wisconsin - Madison, Zurich, Switzerland

**10:50AM**          **Comparison of surface tension models in Smoothed Particles Hydrodynamics method**  
Student Competition Poster. IDETC2019-98124

*Lijing Yang, Milad Rakhsha, University of Wisconsin-Madison, Madison, WI, United States, Dan Negrut, Univ Of Wisc, Madison, Madison, WI, United States*

**11:30AM**          **Effects Of Cut Boundary Location On Finite Element Submodels With Contacts**  
Technical Paper Publication. IDETC2019-98132

*William J. Elke, III, Michael W. Sracic, Milwaukee School of Engineering, Milwaukee, WI, United States*

# Technical Sessions

## MSNDC-3

### NONLINEAR SYSTEMS AND PHENOMENA (MSNDC/VIB)

#### Session MSNDC-3-3

##### Session 3

**Sunset 10:50AM–12:10PM**

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**10:50AM Identification of Variable Amplitude Fatigue Loading Based On Bivariate Probability Mass Functions**  
Technical Paper Publication. IDETC2019-97488

*Hewenxuan Li, David Chelidze, University of Rhode Island, Kingston, RI, United States*

**11:16AM Damping Characteristics in Nonlinear Oscillators near Transcritical Bifurcations**  
Technical Presentation. IDETC2019-97571

*Richard Wiebe, University of Washington, Seattle, WA, United States, Lawrence Virgin, Duke University, Durham NC, NC, United States*

**11:42AM Computing Poincaré-Lyapunov constants via Carleman linearization**  
Student Competition Poster. IDETC2019-98413

*Csanád Árpád Hubay, Tamás Kalmár-Nagy, Budapest University of Technology and Economics, Department of Fluid Mechanics, Budapest, Hungary*

## MSNDC-5

### COMPUTATIONAL METHODS FOR MULTIBODY SYSTEMS AND NONLINEAR DYNAMICS

#### Session MSNDC-5-10

##### Advances in MSTMM (Rui method)

**Redondo 10:50AM–12:10PM**

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Session Organizer: **Xuping Zhang, Aarhus University, Aarhus, Denmark**

Session Co-Organizer: **Bao Rong, Institute of Plasma Physics, Chinese Academy of Sciences, Hefei, China**

**10:50AM Dynamics Analysis of Rigid-Flexible-Thermal Coupling Flexible Beam Systems by Using Transfer Matrix Method of Multibody System**  
Technical Paper Publication. IDETC2019-97814

*Bao Rong, Institute of Plasma Physics, Chinese Academy of Sciences, Hefei, China, Xiaoting Rui, Nanjing University of Science & Technology, Nanjing, China, Kun Lu, Institute of Plasma Physics, Chinese Academy of Sciences, Hefei, China, Jianshu Zhang, Institute of Launch Dynamics, Nanjing University of Science and Technology, Nanjing, China, Ling Tao, Institute of Plasma Physics, Chinese Academy of Sciences, Hefei, China, Guoping Wang, Nanjing University of Science and Technology, Nanjing, China*

**11:30AM Generalized Coordinate Correction in Transfer Matrix Method for Closed-loop Multibody Systems**  
Technical Presentation. IDETC2019-98488

*lina zhang, Xiaoting Rui, Nanjing University of Science & Technology, Nanjing, China, Jianshu Zhang, Nanjing University of Science and Technology, Nanjing, Jiangsu Province, China*

## MSNDC-3

### NONLINEAR SYSTEMS AND PHENOMENA (MSNDC/VIB)

#### Session MSNDC-3-1

##### Session 1

**Sunset 2:10PM–3:45PM**

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**2:10PM LUCID ANALYSIS OF PERIODICALLY FORCED NONLINEAR SYSTEMS VIA NORMAL FORMS**  
Technical Paper Publication. IDETC2019-97100

*Peter, M.B., Waswa, Arizona State University, Mesa, AZ, United States, Sangram Redkar, Arizona State University, Mesa, AZ, United States*

**2:29PM Internal Resonance and Nonlinear Vibrations of Eccentric Rotating Composite Laminated Circular Cylindrical Shell**  
Technical Paper Publication. IDETC2019-97101

*Tao Liu, Wei Zhang, Yan Zheng, Beijing University of Technology, Beijing, China, Yufei Zhang, Shenyang Aerospace University, Shenyang, China*

**2:48PM Design and Analysis of An Auto-Parametrically Excited Platform for Active Vibration Control**  
Technical Paper Publication. IDETC2019-97471

*Thao Le, Sandesh G. Bhat, Susheekumar Cherangara Subramanian, Peter Waswa, Sangram Redkar, Arizona State University, Mesa, AZ, United States*

**3:07PM Modal analysis to interpret localization phenomena of harmonic oscillations in nonlinear oscillator arrays**  
Technical Paper Publication. IDETC2019-97780

*Yuji Harata, Aichi Institute of Technology, Toyota, Japan, Takashi Ikeda, Hiroshima University, Higashi-Hiroshima, Japan*

**3:26PM Multi-Pulse Chaotic Dynamics of Eccentric Rotating Composite Laminated Circular Cylindrical Shell by Using the Extended Melnikov Method**  
Technical Paper Publication. IDETC2019-97868

*Yan Zheng, Wei Zhang, Tao Liu, Beijing University of Technology, Beijing, China*

# Technical Sessions

## MSNDC-5 COMPUTATIONAL METHODS FOR MULTIBODY SYSTEMS AND NONLINEAR DYNAMICS

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### Session MSNDC-5-5

#### Modeling theory and simulation implementation

**Redondo 2:10PM–3:45PM**

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Session Organizer: **Mohammad Poursina**, *University of Arizona, Tucson, AZ, United States*

Session Co-Organizer: **Jianshu Zhang**, *Nanjing University of Science and Technology, Nanjing, Jiangsu, China*

#### 2:10PM Benchmarks for the Explicit Co-Simulation of Mechanical and Non-Mechanical Subsystems

Technical Presentation. IDETC2019-97422

*Jarkko Rahikainen*, *Lappeenranta University of Technology, Lappeenranta, Finland*, *Francisco Gonzalez*, *Miguel A Naya*, *University of A Coruña, Ferrol, Spain*, *Aki Mikkola*, *LUT, Lappeenranta, Finland*, *Jussi Sopanen*, *Lappeenranta University of Technology, Lappeenranta, Finland*

#### 2:29PM Coordinate vs. geometric interpolation in structural mechanics: A planar case study

Technical Presentation. IDETC2019-97440

*Olivier Brûls*, *University of Liège, Liege, Belgium*

#### 2:48PM Parallel Co-Simulation Approach with Macro-Step Size and Order Control Algorithm

Technical Paper Publication. IDETC2019-97781

*Jan Kraft*, *TU Darmstadt, Darmstadt, Germany*, *Tobias Meyer*, *Bernhard Schweizer*, *Technical University Darmstadt, Darmstadt, Germany*

#### 3:07PM Detailed Multibody Simulation in Real Time

Technical Presentation. IDETC2019-98149

*Naresh Khude*, *Michael Collingridge*, *MSC Software Corp., Ann Arbor, MI, United States*

#### 3:26PM A Higher-order Plate Element for Locking Alleviation Based on Geometrically Exact Formulation

Poster Paper Presentation. IDETC2019-98544

*Teng Zhang*, *Beijing Institute of Technology, Beijing, China*

## MSNDC-6 MOTION PLANNING, DYNAMICS, AND CONTROL

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### Session MSNDC-6-1

#### Motion planning, dynamics, and control

**La Jolla 2:10PM–3:45PM**

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Session Organizer: **Andreas Mueller**, *Johannes Kepler University, Institute of Robotics, Linz, Select State/Province, Austria*

Session Co-Organizer: **Dirk Söffker**, *University of Duisburg-Essen, Duisburg, Germany*

#### 2:10PM Modified Model-Free Adaptive Control Method Applied To Vibration Control Of An Elastic Crane

Technical Paper Publication. IDETC2019-97654

*Hoang Anh Pham*, *Dirk Söffker*, *University of Duisburg-Essen, Duisburg, Germany*

#### 2:29PM Sizing of Inspired Insects? Wings for Hovering Nano Air Vehicles

Technical Presentation. IDETC2019-98060

*Glen Throneberry*, *New Mexico State University, Las Cruces, NM, United States*, *Mostafa Hassanalian*, *New Mexico Technology and Mining, Socorro, NM, United States*, *Abdessattar Abdelkefi*, *New Mexico State University, Las Cruces, NM, United States*

#### 2:48PM A Lie Group Approach to the modular Modeling of Kinematically Non-Redundant Parallel Mechanisms

Technical Paper Publication. IDETC2019-98283

*Andreas Mueller*, *Johannes Kepler University, Institute of Robotics, Linz, Select State/Province, Austria*

#### 3:07PM Design and Implementation of Air Mass Controller for Surge Vessels

Technical Presentation. IDETC2019-98537

*Hala Al Nuaimi*, *Abu Dhabi Transmission & Despatch Company, Abu Dhabi, United Arab Emir.*, *Staba Chakrabarti*, *Mohamed Al Hosani*, *TRANSCO, Abu Dhabi, India*

#### 3:26PM Cage Design and Performance Optimization of Spherical Multi-Rotor Platforms

Technical Presentation. IDETC2019-98547

*Kyle Edgerton*, *Glen Throneberry*, *Adam Takeshita*, *New Mexico State University, Las Cruces, NM, United States*, *Cliff Hudson*, *Emerging Technology Ventures, Alamogordo, NM, United States*, *Abdessattar Abdelkefi*, *New Mexico State University, Las Cruces, NM, United States*

## MSNDC-5 COMPUTATIONAL METHODS FOR MULTIBODY SYSTEMS AND NONLINEAR DYNAMICS

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### Session MSNDC-5-7

#### Vibration attenuation with Magnetorheological design

**Sunset 4:10PM–5:50PM**

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Session Organizer: **Fufeng Yang**, *Nanjing University of Science and Technology, Nanjing, China*

Session Co-Organizer: **Yunfei Miao**, *Institute of Launch Dynamics, Nanjing University of Science and Technology, Nanjing, China*



# Technical Sessions

**4:10PM** Development of a compression vibration isolator based on magnetorheological elastomer  
Technical Presentation. IDETC2019-98557

*Fufeng Yang, Yu Tao, Gangli Chen, Nanjing University of Science and Technology, Nanjing, China, Xiaoting Rui, Nanjing University of Science & Technology, Nanjing, China, Weijun Du, Nanjing University of Science and Technology, Nanjing, China*

**4:30PM** THE STUDY OF MAGNETORHEOLOGICAL ELASTOMER BASED ON NATURAL RUBBER (NR)/THERMOPLASTIC ELASTOMER SEBS HYBRID MATRIX: EXPERIMENTAL AND NUMERICAL SIMULATION  
Technical Paper Publication. IDETC2019-98296

*Wenju Wang, Xincheng Song, Nanjing Univ Sci Technol, Nanjing, China, Fufeng Yang, Guoping Wang, Nanjing University of Science and Technology, Nanjing, China, Xiaoting Rui, Nanjing University of Science & Technology, Nanjing, China*

**4:50PM** THE STUDY OF MAGNETORHEOLOGICAL ELASTOMER BASED ON NATURAL RUBBER (NR)/ POLYBUTADIENE RUBBER (BR) HYBRID MATRIX: EXPERIMENTAL AND NUMERICAL SIMULATION  
Technical Paper Publication. IDETC2019-98299

*Wenju Wang, Xincheng Song, Nanjing Univ Sci Technol, Nanjing, China, Guoping Wang, Fufeng Yang, Nanjing University of Science and Technology, Nanjing, China, Xiaoting Rui, Nanjing University of Science & Technology, Nanjing, China*

**5:10PM** Modeling and Control of Magnetorheological 6-DOF Stewart Platform Based on Multibody Systems Transfer Matrix Method  
Technical Presentation. IDETC2019-98545

*Min Jiang, Nanjing University of Science and Technology, Nanjing, China, Xiaoting Rui, Nanjing University of Science & Technology, Nanjing, China, Fufeng Yang, Wei Zhu, Nanjing University of Science and Technology, Nanjing, China*

**5:30PM** Study on the Magnetorheological Elastomer Micro-Vibration Isolation System Based on Multi-Body System Transfer Matrix Method  
Technical Presentation. IDETC2019-98553

*Lili Fan, Nanjing University of Science and Technology Nanjing, Nanjing, China, Xiaoting Rui, Nanjing University of Science & Technology, Nanjing, China, Guoping Wang, Nanjing University of Science and Technology, Nanjing, China, Wenju Wang, Nanjing University of Science and Technology Nanjing, Nanjing, China*

**Session MSNDC-5-8**  
**Dynamical Simulation of non-smooth & granular System**  
**Redondo 4:10PM–5:50PM**

Session Organizer: **Jun Hong**, Southeast University, Nanjing, Jiangsu, China

Session Co-Organizer: **Nicholas Olsen**, University of Wisconsin, Madison, WI, United States

**4:10PM** Dynamical Simulation of Polyhedral Granular System with Partial Particles? Fracture  
Technical Presentation. IDETC2019-97410

*Jun Hong, Southeast University, Nanjing, Jiangsu, China*

**4:30PM** A co-simulation framework for the analysis of complex granular dynamics problems  
Technical Presentation. IDETC2019-97909

*Nicholas Olsen, University of Wisconsin, Madison, WI, United States, Conlain Kelly, University of Wisconsin - Madison, Prairie Du Sac, WI, United States, Dan Negrut, Univ Of Wisc, Madison, Madison, WI, United States*

**4:50PM** Billion degree-of-freedom granular dynamics simulation on commodity hardware  
Technical Paper Publication. IDETC2019-98055

*Conlain Kelly, University of Wisconsin - Madison, Prairie Du Sac, WI, United States, Dan Negrut, Univ Of Wisc, Madison, Madison, WI, United States, Nicholas Olsen, University of Wisconsin, Madison, WI, United States*

**5:10PM** Interface Models for Multirate Co-Simulation of Nonsmooth Multibody Systems  
Technical Paper Publication. IDETC2019-98098

*Albert Peiret, McGill University, Montreal, QC, Canada, Francisco Gonzalez, University of A Coruña, Ferrol, Spain, Jozsef Kovacs, McGill University, Montreal, QC, Canada, Marek Teichmann, CM Labs Simulations, Montreal, QC, Canada*

**5:30PM** Approximate force history estimation in multi-point non-smooth collisions  
Technical Presentation. IDETC2019-98609

*Alan Bowling, Univ of Texas at Arlington, Arlington, TX, United States*

**MSNDC-8**  
**STUDENT PAPER COMPETITION**

**Session MSNDC-8-1**  
**Student paper competition**  
**La Jolla 4:10PM–5:50PM**

**TUESDAY, AUGUST, 20**

**MSNDC-9**  
**KEYNOTE PRESENTATIONS**  
**Session MSNDC-9-2**  
**Keynote 2**  
**Redondo 8:00AM–9:00AM**

# Technical Sessions

## MSNDC-2

### CONTACT, FRICTION AND INTERFACE DYNAMICS

#### Session MSNDC-2-2

#### Non-Smooth Dynamics and Frictional Contact

#### La Jolla 9:10AM–10:30AM

Session Organizer: **Radu Serban**, *University of Wisconsin - Madison, Zurich, Switzerland*

Session Co-Organizer: **Naresh Khude**, *MSC Software Corp., Ann Arbor, MI, United States*

#### 9:10AM A Novel Hybrid Modeling Method for Contact Problems

Technical Paper Publication. IDETC2019-97125

**Qian Liu**, *Beijing Key Laboratory of Intelligent Space Robotic Systems and Applications, Beijing, Beijing, China*, **Haiquan Li**, *Tsinghua University, Beijing, China*, **Ou Ma**, *University of Cincinnati, Cincinnati, OH, United States*

#### 9:30AM CHARACTERIZATION OF THE DAMPING COEFFICIENT IN THE CONTINUOUS CONTACT MODEL

Technical Paper Publication. IDETC2019-97476

**Mohammad Poursina**, *University of Arizona, Tucson, AZ, United States*, **Parviz Nikravesh**, *Univ Of Arizona, Tucson, AZ, United States*

#### 9:50AM General Purpose Formulation For Nonsmooth Dynamics Including Large Rotations: Application To The Woodpecker Toy

Technical Paper Publication. IDETC2019-97606

**Javier Galvez**, *University of Liège, Liège, Belgium*, **Alejandro Cosimo**, *University of Liège, Liege, Belgium*, **Federico Cavaliere**, **Alberto Cardona**, *Universidad Nacional del Litoral CONICET, CIMEC, Santa Fe, Argentina*, **Olivier Brüls**, *University of Liège, Liege, Belgium*

#### 10:10AM Approximate Force History Estimation In Multi-Point Non-Smooth Collisions

Technical Paper Publication. IDETC2019-98143

**Abhishek Chatterjee**, *University of Texas At Arlington, Arlington, TX, United States*, **Alan Bowling**, *Univ of Texas at Arlington, Arlington, TX, United States*, **Hamid Ghaednia**, *Harvard Medical School, MA, MA, United States*, **Matthew Brake**, *Rice University, Houston, TX, United States*

## MSNDC-5

### COMPUTATIONAL METHODS FOR MULTIBODY SYSTEMS AND NONLINEAR DYNAMICS

#### Session MSNDC-5-2

#### Applications of MSTMM (Rui method) to modeling and simulation of Launch Systems

#### Redondo 9:10AM–10:30AM

Session Organizer: **Guoping Wang**, *Nanjing University of Science & Technology, Nanjing, China*

Session Co-Organizer: **Junjie Gu**, *Nanjing University of Science and Technology, Nanjing, Jiangsu, China*

#### 9:10AM VIBRATION CHARACTERISTICS ANALYSIS OF MULTIBODY SYSTEMS WITH RANDOM PARAMETERS BASED ON MSTMM

Technical Paper Publication. IDETC2019-97244

**Guoping Wang**, *Nanjing University of Science & Technology, Nanjing, China*, **Yunfei Miao**, *Institute of Launch Dynamics, Nanjing University of Science and Technology, Nanjing, China*, **Xue Rui**, *Institute of Launch Dynamics, Nanjing, China*, **Tianxiang Tu**, *Nanjing University of Science and Technology, Nanjing, Jiangsu, China*, **Xiaoting Rui**, *Nanjing University of Science & Technology, Nanjing, China*

#### 9:30AM Modified Riccati Transfer Equations For Joint Elements

Technical Presentation. IDETC2019-97626

**Jianshu Zhang**, *Nanjing University of Science and Technology, Nanjing, Jiangsu, China*, **Xiaoting Rui**, *Nanjing University of Science & Technology, Nanjing, China*, **Junjie Gu**, *Nanjing University of Science and Technology, Nanjing, Jiangsu, China*

#### 9:50AM Transversal Vibration Analysis of Vehicle Track System

Technical Paper Publication. IDETC2019-98331

**Pingxin Wang**, *Institute of Launch Dynamics, Nanjing University of Science and Technology, Nanjing, Jiangsu, China*, **Xiaoting Rui**, *Nanjing University of Science & Technology, Nanjing, China*, **Jianshu Zhang**, *Institute of Launch Dynamics, Nanjing University of Science and Technology, Nanjing, Jiangsu, China*, **Hailong Yu**, *Nanjing University of Science and Technology, Nanjing, Jiangsu, China*

#### 10:10AM Model of Rotor Aeroelastic Stability Using Transfer Matrix Method for Multibody Systems

Technical Presentation. IDETC2019-98336

**Jialiang Lv**, *Nanjing University of Science and Technology, Nanjing, China*, **Xiaoting Rui**, *Nanjing University of Science & Technology, Nanjing, China*, **Fufeng Yang**, *Nanjing University of Science and Technology, Nanjing, China*

# Technical Sessions

## MSNDC-2

### CONTACT, FRICTION AND INTERFACE DYNAMICS

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#### Session MSNDC-2-4

#### Non-Smooth Dynamics and Frictional Contact

**La Jolla 10:50AM–12:10PM**

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Session Organizer: **Radu Serban**, *University of Wisconsin - Madison, Zurich, Switzerland*

Session Co-Organizer: **Naresh Khude**, *MSC Software Corp., Ann Arbor, MI, United States*

**10:50AM** Examining the Effect Of Friction During Dry Sliding on Select Thermoplastics  
Technical Paper Publication. IDETC2019-98403

*Adam Madison, Kyle Koren, Elisabeth Kames, Florida Institute of Technology, Melbourne, FL, United States, Beshoy Morkos, Florida Institute of Technology, Florida, FL, United States*

**11:30AM** Load-Dependent Nonlinearities in Energy Dissipation and Tangential Stiffness of Nominally-flat Rough Interfaces  
Technical Presentation. IDETC2019-98536

*Karthik Yerrapragada, University of Wisconsin - Madison, Madison, WI, United States, Lejie Liu, Ahmet D. Usta, University of Wisconsin-Madison, Madison, WI, United States, Melih Eriten, University of Wisconsin, Madison, WI, United States*

## MSNDC-5

### COMPUTATIONAL METHODS FOR MULTIBODY SYSTEMS AND NONLINEAR DYNAMICS

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#### Session MSNDC-5-11

#### Applications of MSTMM (Rui method) to modeling and simulation of Launch Systems

**Redondo 10:50AM–12:10PM**

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Session Organizer: **Guoping Wang**, *Nanjing University of Science & Technology, Nanjing, China*

Session Co-Organizer: **Junjie Gu**, *Nanjing University of Science and Technology, Nanjing, Jiangsu, China*

**10:50AM** Modal Simulation and Experimental Study of An Armored Vehicle Based on Transfer Matrix Method for Multibody Systems  
Technical Presentation. IDETC2019-98345

*Fucheng Zhang, Nanjing University of Science and Technology, Nanjing, China, Xiaoting Rui, Nanjing University of Science & Technology, Nanjing, China*

**11:30AM** Study on the Influence of Trunnion-Bearing with Clearance on Launch Dynamics of Tank during Marching  
Technical Presentation. IDETC2019-98346

*Xun Wang, Nanjing University of Science and Technology, Nanjing, China, Xiaoting Rui, Nanjing University of Science & Technology, Nanjing, China*

## MSNDC-7

### TIME-VARYING AND TIME-DELAY SYSTEMS, ENERGY HARVESTING

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#### Session MSNDC-7-1

#### Machining related problems in time-delayed and parametrically excited systems

**Sunset 10:50AM–12:10PM**

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**10:50AM** Stability of Variable Pitch Milling Tools in Interrupted Cutting Processes  
Technical Presentation. IDETC2019-97078

*Alexander Iglesias, Jokin Munoa, IDEKO S.COOP., ELGOIBAR, GIPUZKOA, Spain, Zoltán Dombóvári, Budapest University of Technology and Economics, Budapest, Hungary*

**11:10AM** An Analytical Study of Wheel Regeneration in Surface Grinding  
Technical Presentation. IDETC2019-97362

*Mate Toth, The University of Sheffield, Sheffield, South Yorkshire, United Kingdom, Neil Sims, Univ Of Sheffield, Sheffield, S.yorks, United Kingdom, David Curtis, AMRC, Rotherham, United Kingdom*

**11:30AM** Modeling and stability of milling processes with active damping  
Technical Paper Publication. IDETC2019-97551

*David Lehotzky, Zoltán Dombóvári, Budapest University of Technology and Economics, Budapest, Hungary*

**11:50AM** Optimization of Edge Geometry of Cylindrical Milling Tools to Enhance Dynamic Stability  
Technical Paper Publication. IDETC2019-97761

*Zoltán Dombóvári, Budapest University of Technology and Economics, Budapest, Hungary, Daniel Bachrathy, Budapest Univ of Tech & Econ, Budapest, Hungary, Gabor Stepan, Budapest Univ of Tech and Eco, Budapest, Hungary*

## MSNDC-5

### COMPUTATIONAL METHODS FOR MULTIBODY SYSTEMS AND NONLINEAR DYNAMICS

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#### Session MSNDC-5-3

#### MSTMM (Rui method) with Control theory for Launch Systems

**Redondo 2:10PM–3:50PM**

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Session Organizer: **Xiaoting Rui**, *Nanjing University of Science & Technology, Nanjing, China*

Session Co-Organizer: **Bo Li**, *Nanjing University of Aeronautics and Astronautics, Nanjing, China*

# Technical Sessions

**2:10PM**            **Nonlinear dynamics modelling and control for a multiple launch rocket system**  
Technical Paper Publication. IDETC2019-97229

*Bo Li*, Nanjing University of Aeronautics and Astronautics, Nanjing, China, *Xiaoting Rui*, Nanjing University of Science & Technology, Nanjing, China, *Wei Tian*, Nanjing University of Aeronautics and Astronautics, Nanjing, *Guoping Wang*, Nanjing University of Science and Technology, Nanjing, China, *Lin Zhang*, Nanjing University of Aeronautics and Astronautics, Nanjing, China

**2:35PM**            **Ride Comfort Enhancement Of Mr-Damped Vehicle Suspension System Based On Fractional Order Fuzzypi+D Controller**  
Technical Paper Publication. IDETC2019-97739

*Ahmed Bashir*, Nanjing University of science and Technology, Nanjing, Jiangsu, China, *Xiaoting Rui*, Nanjing University of Science & Technology, Nanjing, China, *Adeel Shehzad*, Nanjing University of science and Technology, Nanjing, Jiangsu, China

**3:00PM**            **Dynamics Simulation And Control Design Of Gun Adjustment For Nonlinear Multibody System Of Multiple Launch Rocket System**  
Technical Paper Publication. IDETC2019-97790

*Yunfei Miao*, Institute of Launch Dynamics, Nanjing University of Science and Technology, Nanjing, China, *Guoping Wang*, Nanjing University of Science and Technology, Nanjing, China, *Xiaoting Rui*, Nanjing University of Science & Technology, Nanjing, China, *Tianxiang Tu*, *Lilin Gu*, Nanjing University of Science and Technology, Nanjing, Jiangsu, China

**3:25PM**            **Dynamic Analysis of Multiple Launch Rocket System under the Action of Jet Flow**  
Technical Paper Publication. IDETC2019-98493

*Shutian Li*, Nanjing University of Science&Technology, Nanjing, China, *Guoping Wang*, Nanjing University of Science and Technology, Nanjing, China, *Yunfei Miao*, Institute of Launch Dynamics, Nanjing University of Science and Technology, Nanjing, China, *Xiaoting Rui*, Nanjing University of Science & Technology, Nanjing, China

**Session MSNDC-5-9**  
**Quantification and Measurement in Multibody Systems**  
**La Jolla 2:10PM–3:50PM**

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Session Organizer: *Glen Throneberry*, New Mexico State University, Las Cruces, NM, United States

Session Co-Organizer: *Feifei Liu*, China Weapon Industry Corporation NHIC Nanjing Research Institute, Nanjing, China

**2:10PM**            **Sensitivity Analysis for Hybrid Systems and Systems with Memory**  
Technical Presentation. IDETC2019-97358

*Radu Serban*, University of Wisconsin - Madison, Zurich, Switzerland, *Antonio Recuero*, The Goodyear Tire and Rubber Company, Akron, OH, United States

**2:30PM**            **MEASUREMENT OF MULTIDIRECTIONAL ARM STRENGTH FOR PEOPLE IN A SEATED POSITION**  
Technical Paper Publication. IDETC2019-98097

*George Stilwell*, University of Canterbury, Christchurch, Canterbury, New Zealand, *Digby Symons*, University of Canterbury / Te Whare Wananga o Waitaha, Christchurch, New Zealand, *Shayne Gooch*, Univ Of Canterbury, Christchurch, New Zealand, *Jennifer Dunn*, University of Otago, Christchurch, Christchurch, New Zealand

**2:50PM**            **Interval-based uncertainty quantification techniques for dynamical systems**  
Technical Presentation. IDETC2019-98359

*Glen Throneberry*, New Mexico State University, Las Cruces, NM, United States, *Leobardo Valera*, The University of Texas at El Paso, El Paso, TX, United States, *Daniel Furth*, New Mexico State University, Las Cruces, NM, United States, *Angel Garcia Contreras*, *Martine Ceberio*, The University of Texas at El Paso, El Paso, TX, United States, *Abdessattar Abdelkefi*, New Mexico State University, Las Cruces, NM, United States

**3:10PM**            **Quantitative analysis for affecting factors of firing dispersion of tank**  
Poster Paper Presentation. IDETC2019-98538

*Feifei Liu*, China Weapon Industry Corporation NHIC Nanjing Research Institute, Nanjing, China, *Yan-ming Song*, China Weapon Industry Corporation NHIC, Baotou, China, *Hai-long Yu*, Nanjing University of Science & Technology, Nanjing, China, *Wen-ding Lin*, China Weapon Industry Corporation NHIC, Baotou, China, *Zhang Jie*, China Weapon Industry Corporation NHIC Nanjing Research Institute, Baotou, China, *Zhi-hui Si*, China Weapon Industry Corporation NHIC Nanjing Research Institute, Nanjing, China, *Xiaoting Rui*, Nanjing University of Science & Technology, Nanjing, China

**3:30PM**            **Finite Volume Method for analysis in non-linear dynamics of energetic materials**  
Technical Presentation. IDETC2019-97326

*Yanchun Yu*, Northeast Agricultural University, Harbin, China, *Weidong Chen*, Harbin Engineering University, Harbin, Heilongjiang, China, *Qiang Fu*, Northeast Agricultural University, Harbin, China

**MSNDC-7**  
**TIME-VARYING AND TIME-DELAY SYSTEMS, ENERGY HARVESTING**

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**Session MSNDC-7-2**

**Nonlinear phenomena in time-delayed and time-varying systems**  
**Sunset 2:10PM–3:50PM**

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**2:10PM**            **Nonlinear and stochastic dynamics in a forced vibro-impact energy harvester**  
Technical Presentation. IDETC2019-97300

*Rachel Kuske*, Georgia Institute of Technology, Atlanta, GA, United States, *Larissa Serdukova*, Georgia Tech, Atlanta, GA, United States, *Daniil Yurchenko*, Heriot-Watt, Edinburgh, United Kingdom



# Technical Sessions

**2:30PM** Periodic control in a stick balancing problem  
Technical Paper Publication. IDETC2019-97979

*Laszlo Bencsik, Tamas Insperger, Budapest University of Technology and Economics, Budapest, Hungary*

**2:50PM** Equilibria and oscillations of a regulated two—  
gene model  
Technical Presentation. IDETC2019-98196

*Gabor Kiss, Queen's University Belfast, Belfast, United Kingdom*

**3:10PM** Chaotic oscillation and Hopf bifurcation of a  
delayed homogeneous AIMD/RED Network congestion Model  
Technical Presentation. IDETC2019-98600

*Lijun Pei, Huihui Zhao, Zhengzhou Univ., Zhengzhou, Henan, China*

**3:30PM** Exact model reduction via slow-fast analysis of  
nonlinear thermo-mechanical systems  
Technical Presentation. IDETC2019-98617

*SHOBHIT JAIN, ETH Zurich, Zurich, Zurich, Switzerland*

## **MSNDC-1** **FLEXIBLE MULTIBODY DYNAMICS**

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Session MSNDC-1-1  
Flexible multibody dynamics  
**La Jolla 4:10PM–5:50PM**

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Session Organizer: **Tamer Wasfy**, Advanced Science and Automation Corp., Indianapolis, IN, United States

Session Co-Organizer: **Han Shilei**, University of Maryland, Hyattsville, MD, United States

**4:10PM** A Two-Stage Model Order Reduction Scheme For  
Flexible Multibody Based Structural Topology Optimization  
Technical Presentation. IDETC2019-97303

*Frank Naets, KU Leuven, DMMS Lab, Flanders Make, Heverlee, Belgium, Karim Asrih, KU Leuven, Heverlee, Belgium, Wim Desmet, KU Leuven, DMMS Lab, Flanders Make, Heverlee, Belgium*

**4:30PM** Efficient Finite Element Formulation For  
Geometrically Exact Beams  
Technical Paper Publication. IDETC2019-97639

*Olivier A. Bauchau, University of Maryland, College Park, MD, United States, Han Shilei, University of Maryland, Hyattsville, MD, United States*

**4:50PM** Galerkin Method for Flexible Multibody Dynamics:  
Initial Value and Periodic Boundary Value Problems, and Stability  
Analysis of Periodic Solutions  
Technical Paper Publication. IDETC2019-97651

*Han Shilei, University of Maryland, Hyattsville, MD, United States, Olivier A. Bauchau, University of Maryland, College Park, MD, United States*

**5:10PM** Component-Based Modeling And Sensitivity  
Analysis Of Composite Beam Cross-Sections  
Technical Paper Publication. IDETC2019-98065

*Matteo Scapolan, Valentin Sonneville, Alfonso Callejo, Olivier A. Bauchau, University of Maryland, College Park, MD, United States*

**5:30PM** EFFECT OF RUBBER MATERIAL PROPERTIES ON  
STEADY-STATE FLAT BELT RESPONSE  
Technical Paper Publication. IDETC2019-98166

*Tamer Wasfy, Hatem Wasfy, Advanced Science and Automation Corp., Indianapolis, IN, United States*

## **MSNDC-5** **COMPUTATIONAL METHODS FOR MULTIBODY SYSTEMS AND NONLINEAR DYNAMICS**

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Session MSNDC-5-12  
MSTMM (Rui method) with Control theory for Launch Systems  
**Redondo 4:10PM–5:50PM**

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Session Organizer: **Xiaoting Rui**, Nanjing University of Science & Technology, Nanjing, China

Session Co-Organizer: **Bo Li**, Nanjing University of Aeronautics and Astronautics, Nanjing, China

**4:10PM** Dynamic Modeling and Velocity Control Strategy  
of Tracked Vehicle Multi-rigid-flexible Body System  
Technical Presentation. IDETC2019-98546

*Huaqing Zheng, Nanjing University of Science and Technology, Nanjing, China, Xiaoting Rui, Nanjing University of Science & Technology, Nanjing, China, Jianshu Zhang, Institute of Launch Dynamics, Nanjing University of Science and Technology, Nanjing, Jiangsu, China*

**5:00PM** Application of Transfer Matrix Method for  
Multibody Systems in IMU Isolation Control System  
Technical Presentation. IDETC2019-98559

*Yu Tao, Nanjing University of Science and Technology, Nanjing, China, Xiaoting Rui, Nanjing University of Science & Technology, Nanjing, China, Fufeng Yang, Nanjing University of Science and Technology, Nanjing, China, Jianshu Zhang, Institute of Launch Dynamics, Nanjing University of Science and Technology, Nanjing, Jiangsu, China*

## **MSNDC-7** **TIME-VARYING AND TIME-DELAY SYSTEMS, ENERGY HARVESTING**

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Session MSNDC-7-3  
Properties of linear time-delayed and parametrically excited  
systems  
**Sunset 4:10PM–5:50PM**

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# Technical Sessions

**4:10PM** Dynamic modelling and diagnosis of transverse crack and rotor/stator rub in a flexible rotor system  
Technical Paper Publication. IDETC2019-97047

*Rajiv Kumar Vashisht, Qingjin Peng, University of Manitoba, Winnipeg, MB, Canada*

**4:30PM** The effect of gravity and rotor configuration on dry friction whip and safe rotor/stator clearance  
Technical Paper Publication. IDETC2019-97048

*Rajiv Kumar Vashisht, University of Manitoba, Winnipeg, MB, Canada*

**4:50PM** Simultaneous Resonance And Anti-Resonance In Dynamical Systems Under Asynchronous Parametric Excitation  
Technical Paper Publication. IDETC2019-97070

*Artem Karev, Peter Hagedorn, Technische Universität Darmstadt, Darmstadt, Hesse, Germany*

**5:10PM** On Computation Of Approximate Lyapunov-Perron Transformations  
Technical Paper Publication. IDETC2019-97702

*Ashu Sharma, SUBHASH SINHA, Auburn University, AUBURN, AL, United States*

**5:30PM** Integration of 5-axis milling dynamics into virtual machining  
Technical Presentation. IDETC2019-98281

*Z. Murat Kilic, Z. Murat Kilic, University of British Columbia, Vancouver, BC, Canada, Byron Reynolds, Yusuf Altintas, The University of British Columbia, Vancouver, BC, Canada*

## WEDNESDAY, AUGUST, 21

### MSNDC-9

#### KEYNOTE PRESENTATIONS

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Session MSNDC-9-3

Keynote 3 - Lyapunov Award

Redondo 8:00AM–9:40AM

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### MSNDC-4

#### MODELLING, CONTROL, AND SIMULATION OF VEHICLE DYNAMICS (MSNDC/AVT)

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Session MSNDC-4-1

Modelling, control, and simulation of vehicle dynamics I

Sunset 10:00AM–11:40AM

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Session Organizer: **Guangqiang Wu**, Tongji University, Shanghai, China

Session Co-Organizer: **Daixing Lu**, TU-Darmstadt, Darmstadt, Germany

**10:00AM** Dynamics and Control of Self-Standable Motorcycle  
Technical Paper Publication. IDETC2019-97154

*Susumu Hara, Koki Nakagami, Kikuko Miyata, Nagoya University, Nagoya, Aichi, Japan, Mitsuo Tsuchiya, Eiichirou Tsujii, Yamaha Motor Co., Ltd., Iwata, Shizuoka, Japan*

**10:25AM** Numeric Approach on Optimal Control for the Path Following System in Autonomous Vehicle  
Student Competition Poster. IDETC2019-97518

*Huyao Wu, Bin Ran, University of Wisconsin-Madison, Madison, WI, United States*

**10:50AM** An Off-road Tire Model with 3DOFs Wheel Dynamics Based on Dynamic Contact Force  
Technical Paper Publication. IDETC2019-97786

*JUN ZHAN, Kai Yang, XIN GUAN, Jilin University, China, Changchun, China*

**11:15AM** Vehicle-Terrain Interaction Simulation with Parallelized Multiscale Moving Soil Patch Model  
Technical Paper Publication. IDETC2019-97920

*Hiroki Yamashita, Guanchu Chen, University of Iowa, Iowa City, IA, United States, Yeefeng Ruan, Paramsothy Jayakumar, U.S. Army TARDEC, Warren, MI, United States, Hiroyuki Sugiyama, The University of Iowa, Iowa City, IA, United States*

### MSNDC-5

#### COMPUTATIONAL METHODS FOR MULTIBODY SYSTEMS AND NONLINEAR DYNAMICS

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Session MSNDC-5-4

Applied nonlinear dynamics

Redondo 10:00AM–11:40AM

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Session Organizer: **Dongyang Chen**, School of Hydraulic, Energy and Power Engineering, Yangzhou University, Yangzhou, China

Session Co-Organizer: **Zhiyong Zhang**, Nanjing University of Science and Technology, Nanjing, China

**10:00AM** Fully Tubulent Vortex-induced Vibration on a Cylinder Structure with a Nonlinear Energy Sink Absorber  
Technical Paper Publication. IDETC2019-97247

*Dongyang Chen, School of Hydraulic, Energy and Power Engineering, Yangzhou University, Yangzhou, China, Qing Xiao, China Ship Development and Design Center, Wuhan, China, Lei Ma, Shanghai Institute of Spacecraft equipment, Shanghai, China, Weijun Zhu, School of Hydraulic and Energy Power Engineering, Yangzhou University, Yangzhou, China, Laith K. Abbas, Institute of Launch Dynamics, Nanjing University of Science and Technology, Nanjing, China, Xiaoting Rui, Nanjing University of Science & Technology, Nanjing, China*

# Technical Sessions

**10:20AM** Investigating the nonlinear dynamics of human balance using topological data analysis  
**Student Competition Poster.** IDETC2019-98014

*Kyle W. Siegrist, Miami University, Oxford, OH, United States, Ryan M. Kramer, Air Force Research Laboratory, Wright-Patterson Air Force Base, OH, United States, James Chagdes, Miami University, Oxford, OH, United States*

**10:40AM** Control of Period-doubling and Chaos in Varying Compliance Resonances for Ball Bearings  
**Technical Presentation.** IDETC2019-98306

*Zhiyong Zhang, Nanjing University of Science and Technology, Nanjing, China, Xiaoting Rui, Nanjing University of Science & Technology, Nanjing, China, Xuan Li, Nanjing University of Science and Technology, Nanjing, China*

**11:00AM** Nonlinear Dynamic Characteristics of Spindle on Single-point Diamond Fly Cutting Machine Tool  
**Technical Presentation.** IDETC2019-98340

*Yiheng Chen, Xiaoting Rui, Nanjing University of Science & Technology, Nanjing, China, Zhiyong Zhang, Nanjing University of Science and Technology, Nanjing, China*

**11:20AM** numerical investigations on dynamic stall of a pitching-lagging motion airfoil under unsteady freestream  
**Technical Paper Publication.** IDETC2019-98496

*Kai Xie, Nanjing University of Science and Technology, Nanjing, Jiangsu, China, Laith K. Abbas, Institute of Launch Dynamics, Nanjing University of Science and Technology, Nanjing, China, Dongyang Chen, School of Hydraulic, Energy and Power Engineering, Yangzhou University, Yangzhou, China, Fufeng Yang, Nanjing University of Science and Technology, Nanjing, China, Xiaoting Rui, Nanjing University of Science & Technology, Nanjing, China*

## **MSNDC-4** **MODELLING, CONTROL, AND SIMULATION OF VEHICLE DYNAMICS (MSNDC/AVT)**

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**Session MSNDC-4-2**  
**Modelling, control, and simulation of vehicle dynamics II**  
**Sunset 1:15PM–2:55PM**

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Session Organizer: **Hiroyuki Sugiyama**, *The University of Iowa, Iowa City, IA, United States*  
Session Co-Organizer: **Daixing Lu**, *TU-Darmstadt, Darmstadt, Germany*

**1:15PM** VISUAL PERFORMANCE EVALUATION OF HELICOPTER PILOTS IN VIBRATING COCKPIT  
**Technical Paper Publication.** IDETC2019-97525

*Aykut Tamer, Andrea Zononi, Alessandro Cocco, Politecnico di Milano, Milano, Italy, Pierangelo Masarati, Politecnico Di Milano, Milan, OO, Italy*

**1:40PM** Robust observer-based load extenuation control for wind turbines  
**Technical Paper Publication.** IDETC2019-97645

*M. Hung Do, Dirk Söffker, University of Duisburg-Essen, Duisburg, NRW, Germany*

**2:05PM** Quasi-static Curve Negotiation Analysis of Railway Vehicle Considering Nonlinear Air Suspension LV and DPV Flow Characteristics  
**Technical Paper Publication.** IDETC2019-97936

*Takayuki Tanaka, Railway Technical Research Institute, Kokubunji, Tokyo, Japan, Hiroyuki Sugiyama, The University of Iowa, Iowa City, IA, United States*

**2:30PM** A NUMERICAL ANALYSIS OF TURBOCHARGER ROTORS SUPPORTING BY BALL BEARINGS AND SQUEEZE FILM DAMPER  
**Technical Presentation.** IDETC2019-98353

*Daixing Lu, Shanghai Institute of Technology, Shanghai, China*

## **MSNDC-5** **COMPUTATIONAL METHODS FOR MULTIBODY SYSTEMS AND NONLINEAR DYNAMICS**

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**Session MSNDC-5-6**  
**Robot dynamics and optimal control**  
**Redondo 1:15PM–2:55PM**

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Session Organizer: **Xuping Zhang**, *Aarhus University, Aarhus, Denmark*  
Session Co-Organizer: **Philip Voglewede**, *Marquette University, Milwaukee, WI, United States*

**1:15PM** Improvement of a Forward Dynamic Predictive Human Gait Model  
**Technical Paper Publication.** IDETC2019-97162

*Jessica Thayer, Philip Voglewede, Marquette University, Milwaukee, WI, United States*

**1:40PM** SINGULARITIES IN AXISYMMETRIC VECTORING EXHAUST NOZZLE AND A FEASIBLE SINGULARITY-FREE APPROACH  
**Technical Paper Publication.** IDETC2019-98122

*Yu-Tong LI, China University of Petroleum, Huangdao, Qingdao, China, Yu-Xin Wang, China University of Petroleum, Huadong, Qingdao, China*

**2:05PM** Dynamic Modelling of a Planar Parallel Robot Manipulator Using the Discrete Time Transfer Matrix Method  
**Technical Paper Publication.** IDETC2019-98333

*mengqiu chu, guoning si, University of Shanghai for Science and Technology, Shanghai, China, Xuping Zhang, Aarhus University, Aarhus, Denmark, Haijie Li, University of Copenhagen, Copenhagen, Denmark*

# Technical Sessions

**2:30PM** Analysis of Constraint Forces in Multibody Systems Based on the Differential Null Space Matrix Method  
Technical Paper Publication. IDETC2019-97730

*Keisuke Kamiya, Aichi Institute of Technology, Toyota, OO, Japan*

## 31st Conference on Mechanical Vibration and Noise (VIB) MONDAY, AUGUST, 19

### VIB-15

#### VIB KEYNOTE TALKS

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##### Session VIB-15-1

**2019 ASME J. P. Den Hartog Award Talk**

**San Simeon A 8:00AM–9:00AM**

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Session Organizer: **Massimo Ruzzene**, Georgia Institute Of Tech, Atlanta, GA, United States

Session Co-Organizer: **Lei Zuo**, Virginia Tech, Blacksburg, VA, United States

**8:00AM** ASME J. P. Den Hartog Award Talk: Vibration Analysis in the Presence of Uncertain Parameters  
Keynote Presentation. IDETC2019-98692

*Singiresu Rao, Univ Of Miami, Coral Gables, FL, United States*

### VIB-1

#### DYNAMICS OF MEMS AND NEMS (VIB/NMS)

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##### Session VIB-1-1

**Nonlinear Vibrations of MEMS structures**

**Huntington A 9:10AM–10:30AM**

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Session Organizer: **Abdessattar Abdelkefi**, New Mexico State University, Las Cruces, NM, United States

Session Co-Organizer: **Subramanian Ramakrishnan**, Florida A&M University, Tallahassee, FL, United States

**9:10AM** Experimental Study of Cochlear Dynamics With an Intracochlear Acoustic Micro-actuator  
Technical Paper Publication. IDETC2019-97295

*Sergiy Taylakov, University of Washington, Seattle, WA, United States, I. Y (Steve) Shen, Univ Of Washington, Seattle, WA, United States*

**9:30AM** Tuning Internal Resonance in a MEMS Resonator  
Technical Presentation. IDETC2019-98082

*Jun Yu, The Ohio State University, Columbus, OH, United States*

**9:50AM** On Quality Factor Improvement in a NEMS Resonator with Nonlinear Damping  
Technical Paper Publication. IDETC2019-98505

*Subramanian Ramakrishnan, Md Raf E Ul Shougat, University of Minnesota Duluth, Duluth, MN, United States*

**10:10AM** Dynamical analysis and characteristics of cracked micro/nano-gyroscopes  
Technical Presentation. IDETC2019-98551

*Kevin Larkin, New Mexico State University, Las Cruces, NM, United States, Mehdi Ghommem, American University of Sharjah, Sharjah, Abigail Hunter, Los Alamos National Laboratory, Los Alamos, NM, United States, Abdessattar Abdelkefi, New Mexico State University, Las Cruces, NM, United States*

### VIB-2

#### DYNAMICS OF SOFT MEDIA AND ROBOTICS

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##### Session VIB-2-1

**Dynamics of Soft Media and Robotics I**

**San Simeon B 9:10AM–10:30AM**

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Session Organizer: **Suyi Li**, Clemson University, Clemson, SC, United States

**9:10AM** Design and Optimization of an Origami-inspired Jumping Mechanism With Nonlinear Stiffness Properties  
Technical Paper Publication. IDETC2019-97706

*Sahand Sadeghi, Blake D. Betsill, Suyi Li, Clemson University, Clemson, SC, United States*

**9:30AM** A discrete geometric approach to simulation of soft multi-limbed robots  
Technical Presentation. IDETC2019-98201

*Xiaonan Huang, Carnegie Mellon University, Pittsburgh, PA, United States, Weicheng Huang, UCLA, Los Angeles, CA, United States, Carmel Majidi, Carnegie Mellon University, Pittsburgh, PA, United States, Mohammad Khalid Jawed, University of California, Los Angeles, Los Angeles, CA, United States*

**9:50AM** Stiffness modulation of a soft-robotic foot for foot-ground interaction control  
Technical Presentation. IDETC2019-98484

*Shivam Chopra, Emily Lathrop, University of California San Diego, La Jolla, CA, United States, Saurabh Jadhav, University of California, San Diego, La Jolla, CA, United States, Michael Tolley, Nick Gravish, UC San Diego, La Jolla, CA, United States*

**10:10AM** Granular Jamming Soft Foot for Improved Traction over Natural Terrain  
Technical Presentation. IDETC2019-98504

*Emily Lathrop, University of California San Diego, La Jolla, CA, United States, Saurabh Jadhav, University of California, San Diego, La Jolla, CA, United States, Shivam Chopra, University of California San Diego, La Jolla, CA, United States, Nick Gravish, Michael Tolley, UC San Diego, La Jolla, CA, United States*



# Technical Sessions

## VIB-3

### DYNAMICS & WAVES IN SOLIDS AND METAMATERIALS

#### Session VIB-3-1

##### Nonlinear and Quasiperiodic Metamaterials

**San Simeon A 9:10AM–10:30AM**

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Session Organizer: **Michael Leamy**, Georgia Institute of Technology, Atlanta, GA, United States

Session Co-Organizer: **Kathryn H. Matlack**, University of Illinois Urbana-Champaign, Urbana, IL, United States, **Ryan L Harne**, The Ohio State University, Columbus, OH, United States

#### 9:10AM Internal Resonance of Plane Waves in Nonlinear Lattices

Technical Paper Publication. IDETC2019-97879

**Matthew Fronk, Michael Leamy**, Georgia Institute of Technology, Atlanta, GA, United States

#### 9:30AM Acoustic Non-reciprocal Band Structure in a Passive Nonlinear, 1D Material

Technical Paper Publication. IDETC2019-97888

**Lezheng Fang, Amir Darabi**, Georgia Institute of Technology, Atlanta, GA, United States, **Alexander F. Vakakis**, University of Illinois, Urbana, IL, United States, **Michael Leamy**, Georgia Institute of Technology, Atlanta, GA, United States

#### 9:50AM Quasiperiodic Beams and Plates: Topology and Localization Landscapes

Technical Presentation. IDETC2019-97929

**Matheus Rosa**, Georgia Institute of Technology, Atlanta, GA, United States, **Raj Kumar Pal**, California Institute of Technology, Pasadena, CA, United States, **Massimo Ruzzene**, Georgia Institute Of Tech, Atlanta, GA, United States

#### 10:10AM Non-trivial Bandgaps And Edge-localized Modes In Quasiperiodically Spaced Locally Resonant Metastructures

Technical Presentation. IDETC2019-98017

**Yiwei Xia, Alper Erturk**, Georgia Institute of Technology, Atlanta, GA, United States, **Massimo Ruzzene**, Georgia Institute Of Tech, Atlanta, GA, United States

## VIB-15

### VIB KEYNOTE TALKS

#### Session VIB-15-2

##### ASME 2019 C. D. Mote Jr., Early Career Award Talk

**San Simeon A 10:50AM–12:10PM**

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Session Organizer: **Jeff Rhoads**, Purdue University, West Lafayette, IN, United States

Session Co-Organizer: **Jiong Tang**, University of Connecticut, Storrs, CT, United States

**10:50AM Topological Elastic Waveguides: exploring analogue quantum mechanical effects to tailor wave propagation in classical mechanics**

Keynote Presentation. IDETC2019-98693

**Fabio Semperlotti**, Purdue University, West Lafayette, IN, United States

## VIB-1

### DYNAMICS OF MEMS AND NEMS (VIB/NMS)

#### Session VIB-1-2

##### Dynamics of MEMS sensors

**Huntington A 2:10PM–3:45PM**

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Session Organizer: **Jeff Rhoads**, Purdue University, West Lafayette, IN, United States

Session Co-Organizer: **Meysam Daeichin**, Binghamton University, Binghamton, NY, United States

#### 2:10PM Experimental Characterization of the Electrostatic Levitation Force in MEMS Transducers

Technical Presentation. IDETC2019-97927

**Meysam Daeichin**, Binghamton University, Binghamton, NY, United States, **Shahrazad Towfighian**, Binghamton Univ, Binghamton, NY, United States, **Ronald Miles**, Binghamton University, Binghamton, NY, United States

#### 2:29PM Thermal effects and dynamic characteristics of carbon nanotube-based mass sensors subjected to external harmonic excitation

Technical Presentation. IDETC2019-98549

**Seyedeh Sepideh Ghaffari**, New Mexico State University, Las Cruces, NM, United States, **Samantha Ceballes**, New Mexico State University, Alamogordo, NM, United States, **Abdessattar Abdelkefi**, New Mexico State University, Las Cruces, NM, United States

#### 2:48PM An FPGA-Controlled Oscillator-Based Volatile Organic Compound Sensing Array

Technical Presentation. IDETC2019-98569

**Allison Murray, Joseph R. Meseke, Nikhil Bajaj, Jeff Rhoads**, Purdue University, West Lafayette, IN, United States

#### 3:07PM Color Sensing via a Network of Coupled Oscillators

Technical Presentation. IDETC2019-98570

**Conor Pyles, Nikhil Bajaj, Dana Weinstein**, Purdue University, West Lafayette, IN, United States, **D. Dane Quinn**, The University of Akron, Akron, OH, United States, **Jeff Rhoads**, Purdue University, West Lafayette, IN, United States

# Technical Sessions

**3:26PM** Nonlinear oscillations of parametrically excited bridged carbon nanotube-based bio-mass sensors  
Technical Presentation. IDETC2019-98550

*Hossein Ali-Akbari*, Sharif University of Technology, Tehran, Select State/Province, *Samantha Ceballes*, New Mexico State University, Alamogordo, NM, United States, *Abdessattar Abdelkefi*, New Mexico State University, Las Cruces, NM, United States

## **VIB-2** **DYNAMICS OF SOFT MEDIA AND ROBOTICS**

**Session VIB-2-2**  
**Dynamics of Soft Media and Robotics II**  
**San Simeon B 2:10PM–3:45PM**

Session Organizer: **Hongbin Fang**, Fudan University, Shanghai, Shanghai, China

**2:10PM** Variable rigidity actuator based on fiber jamming and its applications in soft robotics.  
Technical Presentation. IDETC2019-98501

*Saurabh Jadhav*, University of California, San Diego, La Jolla, CA, United States, *Mohamad Ramzi Abdul Majit*, University of California San Diego, La Jolla, CA, United States, *Benjamin Shih*, University of California, San Diego, La Jolla, CA, United States, *Jurgen Schulze*, University of California, San Diego & Qualcomm Institute, La Jolla, CA, United States, *Michael Tolley*, UC San Diego, La Jolla, CA, United States

**2:30PM** Vibration-based Adhesion and Locomotion for Wall-Climbing Robots  
Technical Presentation. IDETC2019-98509

*William Weston-Dawkes*, University of California, San Diego, La Jolla, CA, United States, *Yi-Weng Hu*, National Sun Yat-sen University, Kaohsiung City, Taiwan, *Nick Gravish*, *Michael Tolley*, UC San Diego, La Jolla, CA, United States

**2:50PM** Dynamic Modeling of Origami Structures: Inverse Approaches  
Technical Presentation. IDETC2019-97707

*Hongbin Fang*, Fudan University, Shanghai, Shanghai, China, *Zuolin Liu*, *Jian Xu*, Tongji University, Shanghai, China, *Kon-Well Wang*, University of Michigan, Ann Arbor, MI, United States

**3:10PM** Programmable Band Structure of an Origami Metastucture  
Technical Presentation. IDETC2019-97825

*Qiwei Zhang*, *Jian Xu*, Tongji University, Shanghai, Shanghai, China, *Hongbin Fang*, Fudan University, Shanghai, Shanghai, China

## **VIB-3**

### **DYNAMICS & WAVES IN SOLIDS AND METAMATERIALS**

#### **Session VIB-3-2**

#### **Wave Propagation in Engineered Media**

**San Simeon A 2:10PM–3:45PM**

Session Organizer: **Michael Leamy**, Georgia Institute of Technology, Atlanta, GA, United States

Session Co-Organizer: **Kathryn H. Matlack**, University of Illinois Urbana-Champaign, Urbana, IL, United States, **Ryan L Harne**, The Ohio State University, Columbus, OH, United States

**2:10PM** Using Complex Orthogonal Decomposition To Extract Dispersion Relationships For Mass Chain  
Technical Paper Publication. IDETC2019-97186

*Nicholas Valente*, Merrimack College, Tewksbury, MA, United States, *Rickey Caldwell*, Merrimack College, North Andover, MA, United States

**2:29PM** Experimental Investigations into Broadband Vibration Absorption of Metastructures with Lattice Designs  
Technical Paper Publication. IDETC2019-97673

*Joshua R. Tempelman*, Michigan State University, Dewitt, MI, United States, *Audun Myers*, *Melih C. Yesilli*, *Firas Khasawneh*, Michigan State University, East Lansing

**2:48PM** Leveraging modular, linear tessellated acoustic arrays for wave focusing  
Technical Presentation. IDETC2019-98288

*Ningxiner Zhao*, *Ryan L Harne*, The Ohio State University, Columbus, OH, United States

**3:07PM** Gradient metamaterials and metasurfaces for elastic wave guiding and focusing  
Technical Presentation. IDETC2019-98369

*Serife Tol*, University of Michigan, Ann Arbor, MI, United States

**3:26PM** On the Spectro-Spatial Wave Features in Nonlinear Metamaterials with Multiple Local Resonators  
Technical Paper Publication. IDETC2019-98414

*Mohammad Bukhari*, *Oumar Barry*, Virginia Tech, BLACKSBURG, VA, United States

## **VIB-4**

### **ENERGY HARVESTING**

#### **Session VIB-4-1**

#### **Modelling and Dynamics of Energy Harvesting I**

**San Simeon A 4:10PM–5:50PM**

Session Organizer: **Junyi Cao**, Xi'an Jiaotong University, Xi'an, Shaanxi, China

Session Co-Organizer: **Oumar Barry**, Virginia Tech, Blacksburg, VA, United States

# Technical Sessions

**4:10PM** Framed Harvesters For Collecting Energy From Vibrations In Industrial Plants  
Technical Paper Publication. IDETC2019-97291

*Alberto Doria, University of Padova-Dept of Industrial Eng, Padova, Italy*

**4:30PM** Mathematical Modeling of a Two Degree of Freedom Vibration Energy Harvester for Low Speed Rotary Structure Application  
Technical Paper Publication. IDETC2019-97555

*Saman Nezami, University of Maryland Baltimore County, Catonsville, MD, United States, Soobum Lee, UMBC, Baltimore, MD, United States*

**4:50PM** An underwater magnetically coupled bistable vibration energy harvester using wings  
Technical Paper Publication. IDETC2019-97588

*Hong-Xiang Zou, Hunan Institution of Engineering, Xiangtan, China, Lin-Chuan Zhao, Shanghai Jiao Tong University, Shanghai, Shanghai, China, Ke-Xiang Wei, Hunan Institution of Engineering, Xiangtan, Hunan, China, Lei Zuo, Feng Qian, Virginia Tech, Blacksburg, VA, United States, Wenming Zhang, Shanghai Jiaotong University, Shanghai, China*

**5:10PM** Efficiency of piezoelectric energy harvesters under Gaussian white excitations  
Technical Paper Publication. IDETC2019-97853

*Sha Zhou, Zhejiang University, Hangzhou, China, Tianjun Yu, Beijing Institute of Technology, Beijing, China*

**5:30PM** EXPLOITING NONLINEAR DYNAMICS AND ENERGY LOCALIZATION TO ENHANCE THE PERFORMANCES OF AN ELECTROMAGNETIC VIBRATION ENERGY HARVESTER  
Technical Paper Publication. IDETC2019-97862

*Kaouthar Aouali, Najib Kacem, Nouredine Bouhaddi, Univ. Bourgogne Franche-Comté, FEMTO-ST Institute, BESANCON, France, Elyes Mrabet, Mohamed Haddar, National Engineering School of Sfax, Laboratory of Mechanics Modeling and Production, SFAX, Tunisia*

## VIB-5 FLUID-INDUCED VIBRATIONS

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Session VIB-5-1  
San Simeon B 4:10PM–5:50PM

Session Organizer: **Albert Luo**, Southern Illinois Univ, Edwardsville, IL, United States

Session Co-Organizer: **Jianzhe Huang**, Shanghai Jiao Tong University, Shanghai, China, **Bo Yu**, University of Wisconsin, Platteville, WI, United States

**4:10PM** PERIODIC MOTIONS IN A SINGLE-DEGREE-OF-FREEDOM SYSTEM UNDER BOTH AN AERODYNAMIC FORCE AND A HARMONIC EXCITATION  
Technical Paper Publication. IDETC2019-97716

*Bo Yu, University of Wisconsin, Platteville, WI, United States, Albert Luo, Southern Illinois Univ, Edwardsville, IL, United States*

**4:30PM** Modeling of Multi-Physics and Multi-Component Dynamics with Neural Networks  
Technical Presentation. IDETC2019-97302

*David A. Najera-Flores, ATA Engineering, San Diego, CA, United States, Carianne Martinez, Kevin M. Potter, Adam Brink, Peter D. Yeh, Sandia National Laboratories, Albuquerque, NM, United States*

**4:50PM** ON PERIOD-1 AND PERIOD-2 MOTIONS OF A JEFFCOTT ROTOR SYSTEM  
Technical Paper Publication. IDETC2019-97259

*YeYin Xu, Southern Illinois University Edwardsville, Edwardsville, IL, United States, Albert Luo, Southern Illinois Univ, Edwardsville, IL, United States*

**5:10PM** Linear vibration response of air-coupled tensioned webs in roll-to-roll processes  
Technical Presentation. IDETC2019-98131

*Dan Feng, Purdue University, West Lafayette, IN, United States, Arvind Raman, Jie Wang, Purdue University, W Lafayette, IN, United States, George Chiu, Purdue University, West Lafayette, IN, United States*

**5:30PM** PERIOD-1 TO PERIOD-2 MOTIONS IN A NONLINEAR SPRING PENDULUM  
Technical Paper Publication. IDETC2019-97292

*Albert Luo, Southern Illinois Univ, Edwardsville, IL, United States, Yaoguang Yuan, Southern Illinois University Edwardsville, Edwardsville, IL, United States*

## VIB-7 JOINTED STRUCTURES, CONTACT, AND FRICTION

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Session VIB-7-1  
Jointed Structures, Contact, and Friction  
Huntington A 4:10PM–5:50PM

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**4:10PM** As-built, as-deployed analysis of a jointed structure  
Technical Presentation. IDETC2019-97305

*Adam Brink, Robert Kuether, Brendan L. Nation, Sandia National Laboratories, Albuquerque, NM, United States*

**4:30PM** Predictive Modeling of Jointed Structures ? A New Approach Consistent with Experimental Observations  
Technical Presentation. IDETC2019-97332

*Nidish Balaji, Matthew Brake, Rice University, Houston, TX, United States*

# Technical Sessions

**4:50PM** Belt-Drive Mechanics: Energy Losses in the Presence of Detachment Waves  
Technical Paper Publication. IDETC2019-97643

*Yingdan Wu, Michael Leamy, Michael Varenberg, Georgia Institute of Technology, Atlanta, GA, United States*

**5:10PM** Finite Element Modeling of Structures with Solid-riveted Joints  
Technical Presentation. IDETC2019-98023

*Jueseok Kim, Yongfeng Xu, University of Cincinnati, Cincinnati, OH, United States, Weidong Zhu, Univ Of Maryland, Baltimore Ct, Baltimore, MD, United States*

**5:30PM** Implementation and Comparison of Advanced Models for Frictional Interfaces of Jointed Structural Systems  
Technical Presentation. IDETC2019-98503

*Allen Mathis, The University of Akron, Wadsworth, OH, United States, D. Dane Quinn, The University of Akron, Akron, OH, United States*

## TUESDAY, AUGUST, 20

### VIB-15

#### VIB KEYNOTE TALKS

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##### Session VIB-15-3

##### VIB Keynote Talk 1

##### San Simeon A 8:00AM–9:00AM

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Session Organizer: **Matthew Brake**, Rice University, Houston, TX, United States

Session Co-Organizer: **Massimo Ruzzene**, Georgia Institute Of Tech, Atlanta, GA, United States

**8:00AM** Exact model reduction and forced response in high-degree-of-freedom nonlinear mechanical systems  
Keynote Presentation. IDETC2019-98695

*George Haller, ETH Zurich, Zurich, Switzerland*

### VIB-4

#### ENERGY HARVESTING

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##### Session VIB-4-2

##### Modelling and Dynamics of Energy Harvesting II

##### San Simeon A 9:10AM–10:30AM

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Session Organizer: **Najib Kacem**, Univ. Bourgogne Franche-Comté, FEMTO-ST Institute, Besancon, France

Session Co-Organizer: **Serife Tol**, University of Michigan, Ann Arbor, MI, United States

**9:10AM** Nonlinear Response Identification of an Asymmetric Bistable Harvester Excited at Different Bias Angles by Multiscale Entropy and Recurrence Plot  
Technical Paper Publication. IDETC2019-97224

*Wei Wang, Xi'an Jiaotong University, Xi'an, China, Junyi Cao, Xi'an Jiaotong University, Xi'an, China, Chris Bowen, Uni Bath, Bath, United Kingdom, Grzegorz Litak, Lublin University of Technology, Lublin, Poland*

**9:30AM** Theoretical Modeling And Performance Analysis For Electromagnetic Energy Harvesting From Galloping  
Technical Paper Publication. IDETC2019-97271

*Ting Tan, Shanghai Jiao Tong University, Shanghai, China, Weipeng Sun, Xi'an University of Technology, Xi'an, Shaanxi, China, Zhimiao Yan, Shanghai Jiao Tong University, Shanghai, Shanghai, China, Wenming Zhang, Shanghai Jiaotong University, Shanghai, China*

**9:50AM** DESIGN AND SIMULATION ANALYSIS OF VIBRATION ENERGY HARVESTING SYSTEM BASED ON ADAMS  
Technical Paper Publication. IDETC2019-97273

*Ziheng Zhu, Wuhan University of Technology, Wuhan, Hubei, China, Lin Xu, Wuhan University of Technology, Wuhan, Hubei, Mohamed A.A. Abdelkareem, junyi zou, Wuhan University of Technology, Wuhan, China, Jia Mi, Virginia Polytechnic Institute and State University, Virginia, VA, United States*

**10:10AM** Nonparametric Identification of Electromagnetic Energy Harvesters  
Technical Presentation. IDETC2019-97604

*Tian-Chen Yuan, Jian Yang, Rui-Gang Song, Shanghai University of Engineering Science, Shanghai, China*

### VIB-6

#### INDUSTRIAL APPLICATIONS OF VIBRATION & ACOUSTICS

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##### Session VIB-6-1

##### Industrial Applications of Dynamics, Vibration and Acoustics I Huntington A 9:10AM–10:30AM

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Session Organizer: **Ryan Monroe**, FCA US, Auburn Hills, MI, United States

Session Co-Organizer: **Bruce Geist**, FCA US, Auburn Hills,, MI, United States

**9:10AM** TRANSIENT VIBRATIONS OF TWO-DIMENSIONAL BEAM FRAMES AT MID- AND HIGH-FREQUENCIES  
Technical Paper Publication. IDETC2019-97331

*Yichi Zhang, University of Southern California, Los Angeles, CA, United States, Bingen (ben) Yang, Univ Of Southern California, Los Angeles, CA, United States*



# Technical Sessions

**9:50AM** Experimental Assessment of Two-Scale Command Shaping Applied to Engine Restart  
Technical Presentation. IDETC2019-97874

*Justin Wilbanks, Sandia National Laboratories, Albuquerque, NM, United States, Michael Leamy, Georgia Institute of Technology, Atlanta, GA, United States*

## VIB-12 VIBRATION AND STABILITY OF MECHANICAL SYSTEMS

### Session VIB-12-1

#### VIB-12 Vibration and Stability of Mechanical Systems I

**San Simeon B 9:10AM–10:30AM**

Session Organizer: **Christopher Cooley**, Oakland University, Rochester, MI, United States

Session Co-Organizer: **Robert Parker**, Virginia Tech, Blacksburg, VA, United States

**9:10AM** A TRANSIENT MODEL OF INDUSTRACK DYNAMIC SYSTEMS  
Technical Paper Publication. IDETC2019-97166

*Ruiyang Wang, University of Southern California, Los Angeles, CA, United States, Bingen (ben) Yang, Univ Of Southern California, Los Angeles, CA, United States*

**9:30AM** Damping-Induced Stability Transitions in Non-Conservative Systems: New Thoughts on an Old Paradox  
Technical Paper Publication. IDETC2019-97203

*Mahmoud Abdullatif, Ranjan Mukherjee, Michigan State University, East Lansing, MI, United States, Aren Hellum, Naval Undersea Warfare Center, Newport, RI, United States*

**9:50AM** Effect of Intermediate Support on Instabilities of a Cantilever with Terminal Dynamic Moment  
Technical Paper Publication. IDETC2019-97204

*Mahmoud Abdullatif, Ranjan Mukherjee, Michigan State University, East Lansing, MI, United States*

**10:10AM** Dynamic Response Of A Cycloid Reducer With Involute Profiles  
Technical Presentation. IDETC2019-97352

*Tommy Pinel, Philippe Vex, Jerome Bruyere, INSA Lyon - LaMCoS, VILLEURBANNE, France*

## VIB-4 ENERGY HARVESTING

### Session VIB-4-3

#### Nonlinear Energy Harvesting

**San Simeon A 10:50AM–12:10PM**

Session Organizer: **Wei-Hsin Liao**, Chinese Univ of Hong Kong, Shatin NT, Hong Kong, China, Hong Kong

**10:50AM** Method for Controlling Vibration by Exploiting Piecewise-Linear Nonlinearity in Energy Harvesters  
Technical Presentation. IDETC2019-97132

*Meng-Hsuan Tien, The Ohio State University, Columbus, OH, United States, Kiran D'Souza, Ohio State University, Columbus, OH, United States*

**11:10AM** The Coupled Lever-Bistable Nonlinear Energy Harvester For Performance Enhancement Under Band-limited Noise Excitation  
Technical Presentation. IDETC2019-97210

*Kai Yang, Qi Zhou, Huazhong University of Science and Technology, Wuhan, China*

**11:30AM** A NON-TRADITIONAL VARIANT NONLINEAR ENERGY SINK: TRANSIENT RESPONSES  
Technical Paper Publication. IDETC2019-97363

*Youzuo Jin, Kefu Liu, Deli Li, lakehead university, thunder bay, ON, Canada, Liuyang Xiong, University of Auckland, Auckland, New Zealand, Lihua Tang, University of Auckland, Auckland, New Zealand*

**11:50AM** Orbit Jumps of Monostable Energy Harvesters by a Bidirectional Energy Conversion Circuit  
Student Competition Poster. IDETC2019-97807

*Jiahua Wang, The Chinese University of Hong Kong, Shatin, NT, Hong Kong, Other, Hong Kong, Bao Zhao, Junrui Liang, ShanghaiTech University, Shanghai, China, Wei-Hsin Liao, Chinese Univ of Hong Kong, Shatin NT, Hong Kong, China, Hong Kong*

## VIB-8 NONLINEAR SYSTEMS & PHENOMENA (VIB/MSNDC)

### Session VIB-8-1

#### nonlinear dynamics methodology and simulation

**Huntington A 10:50AM–12:10PM**

**10:50AM** On Nonlinear Dynamics and Control of an Inverted Flexible Pendulum System with Chaos  
Technical Paper Publication. IDETC2019-97644

*Hartiny Kahar, Dirk Söffker, University of Duisburg-Essen, Duisburg, Germany*

**11:10AM** MODELING NONLINEAR OSCILLATORS VIA VARIABLE-ORDER FRACTIONAL OPERATORS  
Student Competition Poster. IDETC2019-97944

*Sansit Patnaik, Herrick Laboratories, Purdue University, West Lafayette, IN, United States, Fabio Semperlotti, Purdue University, West Lafayette, IN, United States*

# Technical Sessions

**11:30AM**      **Computational Simulation of the Effects of Local Nonlinear Stores on the Global Dynamics of an Experimental Model Plane**  
Technical Presentation. IDETC2019-98487

*Jon Dewitt E. Dalisay*, University of Illinois, Urbana, IL, United States, *Keegan J. Moore*, University of Nebraska-Lincoln, Lincoln, NE, United States, *Lawrence A. Bergman*, *Alexander F. Vakakis*, University of Illinois, Urbana, IL, United States

**11:50AM**      **Experimental and Numerical Investigations on Two Degrees of Freedom Piecewise-linear Nonlinear Systems with Gaps under Harmonic Excitation**  
Technical Presentation. IDETC2019-97319

*Kohei Noguchi*, Meiji University, Kawasaki, Japan, *Akira Saito*, Meiji University, Tokyo, -, Japan, *Meng-Hsuan Tien*, The Ohio State University, Columbus, OH, United States, *Kiran D'Souza*, Ohio State University, Columbus, OH, United States

**VIB-12**  
**VIBRATION AND STABILITY OF MECHANICAL SYSTEMS**  
**Session VIB-12-2**  
**VIB-12 Vibration and Stability of Mechanical Systems II**  
**San Simeon B 10:50AM–12:10PM**

Session Organizer: **Christopher Cooley**, Oakland University, Rochester, MI, United States  
Session Co-Organizer: **Robert Parker**, Virginia Tech, Blacksburg, VA, United States

**10:50AM**      **Critical Stability of a Hinged Beam with Dynamic Moment: With and without External Flow**  
Technical Paper Publication. IDETC2019-97893

*Mahmoud Abdullatif*, *Ranjan Mukherjee*, Michigan State University, East Lansing, MI, United States, *Aren Hellum*, Naval Undersea Warfare Center, Newport, RI, United States

**11:10AM**      **On the Friction Isolator for Precision Motion Control and Its Dynamics**  
Technical Paper Publication. IDETC2019-98354

*Xin Dong*, *Chinedum Okwudire*, University of Michigan, Ann Arbor, MI, United States, *Jiamin Wang*, *Oumar Barry*, Virginia Tech, Blacksburg, VA, United States

**11:30AM**      **Effect of Rotary Inertia on the Vibration of High-Speed Spinning Elastic Beams**  
Technical Presentation. IDETC2019-97877

*Christopher Cooley*, Oakland University, Rochester, MI, United States

**11:50AM**      **AEROSERVOELASTIC MODELING AND STABILITY ANALYSIS**  
Technical Paper Publication. IDETC2019-97773

*Yu Wang*, *Wei Tang*, *Mao Cui*, Northwestern Polytechnical University, Xi'an, China, *Gongping Zhang*, Luoyang Opto-Electro Technology Development Center, Luoyang, China

**VIB-4**  
**ENERGY HARVESTING**

**Session VIB-4-4**  
**Smart Energy Harvesting Structures and Applications I**  
**San Simeon A 2:10PM–3:50PM**

Session Organizer: **Lei Zuo**, Virginia Tech, Blacksburg, VA, United States  
Session Co-Organizer: **Haifeng Zhang**, University of North Texas, Denton, TX, United States

**2:10PM**      **Metamaterial-Inspired Microbeam With Piezoelectric Element For Energy Harvesting Based On Modified Couple Stress Theory**  
Technical Presentation. IDETC2019-98064

*Majid Akbarzadeh Khorshidi*, Ferdowsi University of Mashhad, Mashhad, Islamic Republic Of Iran, *Seyedeh Sepideh Ghaffari*, *Abdessattar Abdelkefi*, New Mexico State University, Las Cruces, NM, United States

**2:30PM**      **An Archimedean Screw Based Energy Harvester for Oil Extraction, Water Injection, and Related Activities**  
Student Competition Poster. IDETC2019-98127

*Rui Lin*, Virginia Polytechnic Institute and State University, Blacksburg, VA, United States, *Boxi Jiang*, *Lei Zuo*, Virginia Tech, Blacksburg, VA, United States

**2:50PM**      **Maximizing the Power Extraction from Train Suspension Energy Harvesting System**  
Technical Paper Publication. IDETC2019-98209

*Luigi Costanzo*, Università degli Studi della Campania "Luigi Vanvitelli", Aversa, Caserta, Italy, *Massimo Vitelli*, Università della Campania "Luigi Vanvitelli", Aversa, Caserta, Italy, *Lei Zuo*, *Yu Pan*, Virginia Tech, Blacksburg, VA, United States

**3:10PM**      **A New Hybrid Piezoelectric-Electromagnetic Energy Harvester With High Output Power Density**  
Technical Presentation. IDETC2019-98260

*L.B. Zhang*, Huazhong University of Science & Technology, Wuhan, Hubei, China, *Huliang Dai*, Huazhong University of Science and Technology, Wuhan, China, *L. Wang*, Huazhong University of Science & Technology, Wuhan, Hubei, China

# Technical Sessions

**3:30PM**      **Multi-Parameter Coupling Effect Of Wearable Energy Harvesting Backpack From Human Motion Student Competition Poster.** IDETC2019-98370

*Zehao Hou, Xi'an Jiao Tong University, Xi'an, Shaanxi, China, Junyi Cao, Xi'an Jiaotong University, Xi'an, China, Lei Zuo, Virginia Tech, Blacksburg, VA, United States*

## **VIB-8** **NONLINEAR SYSTEMS & PHENOMENA (VIB/MSNDC)**

**Session VIB-8-2**  
**nonlinear system identification and energy harvesting related nonlinearity**  
**Huntington A 2:10PM–3:50PM**

**2:10PM**      **Theoretical and Experimental Analyses of Broadband L-Shaped Beam-Mass Piezoelectric Energy Harvester Using Nonlinear Resonance**  
**Technical Presentation.** IDETC2019-97741

*Zhimiao Yan, Shanghai Jiao Tong University, Shanghai, Shanghai, China, Xiaocun Nie, Chongqing University, Chongqing, China, Ting Tan, Shanghai Jiao Tong University, Shanghai, China*

**2:35PM**      **BACKWARD MECHANICAL-ELECTRIC COUPLING EFFECT OF A FREQUENCY-UP-CONVERSION PIEZOELECTRIC ENERGY HARVESTER**  
**Technical Paper Publication.** IDETC2019-97867

*Fengxia Wang, Southern Illinois University Edwardsville, Edwardsville, IL, United States, Saeed Onsorynezhad, SIUE, Edwardsville, IL, United States*

**3:00PM**      **DISCONTINUOUS DYNAMICS OF A FREQUENCY UP-CONVERSION PIEZOELECTRIC HARVESTER**  
**Technical Paper Publication.** IDETC2019-97883

*Saeed Onsorynezhad, SIUE, Edwardsville, IL, United States, Fengxia Wang, Southern Illinois University Edwardsville, Edwardsville, IL, United States*

**3:25PM**      **NONLINEAR DYNAMICS OF NONLINEAR L-SHAPE PIEZOELECTRIC SYSTEMS FOR POSITIVE AND REVERSE SWEEP WAVEFORM**  
**Technical Paper Publication.** IDETC2019-97697

*Minghui Yao, College of Artificial Intelligence, Tianjin Polytechnic University, Tianjin, China*

## **VIB-13** **PASSIVE AND ACTIVE CONTROL OF VIBRATION, SHOCK, AND NOISE**

**Session VIB-13-1**  
**Strategies for Control of Vibration, Shock, and Noise**  
**San Simeon B 2:10PM–3:50PM**

Session Organizer: **Ryan L Harne, The Ohio State University, Columbus, OH, United States**  
Session Co-Organizer: **Hornsen(HS) TZOU, Univ Of Kentucky, Lexington, KY, United States, Zhenghua Qian, Nanjing University of Aeronautics and Astronautics, Nanjing, China, Mustafa Acar, Fiat Chrysler Automobiles Group, Detroit, MI, United States**

**2:10PM**      **IBM POWER9 SYSTEMS, SHOCK SIMULATION & TESTING VALIDATION**  
**Technical Paper Publication.** IDETC2019-97028

*arshad alfoqaha, Kevin O'Connell, IBM, Rochester, MN, United States, Eric Campbell, IBM Corp., Rochester, MN, United States*

**2:30PM**      **TIP POSITION CONTROL OF SINGLE FLEXIBLE LINKS VIA PARALLEL FEEDFORWARD COMPENSATION**  
**Technical Paper Publication.** IDETC2019-97572

*Keyvan Noury, University of Southern California, Los Angeles, CA, United States, Bingen (ben) Yang, Univ Of Southern California, Los Angeles, CA, United States*

**2:50PM**      **DRAFT: Optimum design of a new tuned inerter mass damper (TIMD) passive vibration control for stochastically motion-excited structures**  
**Technical Paper Publication.** IDETC2019-98044

*Wei-Che Tai, Michigan State University, East Lansing, MI, United States*

**3:10PM**      **Piezoelectric Subordinate Oscillator Arrays: Performance Recovery and Robustness to Uncertainty**  
**Technical Paper Publication.** IDETC2019-98092

*John Sterling, Naval Surface Warfare Centers, Carderock Division, Bethesda, MD, United States, Joseph Vignola, Catholic University, Washington, DC, United States, Sai T Paruchuri, Pablo A. Tarazaga, Andrew J. Kurdila, Vijaya Malladi, Virginia Tech, Blacksburg, VA, United States, Teresa Ryan, East Carolina University, Greenville, NC, United States*

**3:30PM**      **Poroviscoelastic (PVE) Damping Tuned by Interfaces: Application to Passive Vibration Absorbers**  
**Technical Presentation.** IDETC2019-98130

*Karthik Yerrapragada, University of Wisconsin - Madison, Madison, WI, United States, Lejie Liu, University of Wisconsin-Madison, Madison, WI, United States, Melih Eriten, University of Wisconsin, Madison, WI, United States, Corinne Henak, Guebum Han, university of Wisconsin-Madison, Madison, WI, United States*

# Technical Sessions

## VIB-4

### ENERGY HARVESTING

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#### Session VIB-4-5

#### Micro/Nano and Flexoelectric Energy Harvesting

#### San Simeon A 4:10PM–5:50PM

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Session Organizer: **Tian-Bing Xu**, Old Dominion University, Norfolk, VA, United States

Session Co-Organizer: **Abdessattar Abdelkefi**, New Mexico State University, Las Cruces, NM, United States

#### 4:10PM Size dependent modeling of micro/nano functionally graded energy harvesters

Technical Presentation. IDETC2019-97969

*Kevin Larkin*, New Mexico State University, Las Cruces, NM, United States, *Abigail Hunter*, Los Alamos National Laboratory, Los Alamos, NM, United States, **Abdessattar Abdelkefi**, New Mexico State University, Las Cruces, NM, United States

#### 4:30PM Surface integrity and size dependent modeling of non-uniform flexoelectric energy harvesters

Technical Presentation. IDETC2019-97977

*Edward Rojas*, New Mexico State University, El Paso, TX, United States, *Shirko Faroughi*, Urmia University of Technology, Urmia, Islamic Republic Of Iran, **Abdessattar Abdelkefi**, New Mexico State University, Las Cruces, NM, United States, *Young Park*, New Mexico State Univ, Las Cruces, NM, United States

#### 4:50PM Optimization of the Perforated Electret-based Vibration Energy Harvester

Technical Presentation. IDETC2019-98172

*Fei Wang*, Southern University of Science and Technology, Shenzhen, China

#### 5:10PM KEY ISSUES ON FLEXTENSIONAL PIEZOELECTRIC ENERGY HARVESTER DEVELOPMENTS

Technical Paper Publication. IDETC2019-98499

*Tian-Bing Xu*, Old Dominion University, Norfolk, VA, United States, *Lei Zuo*, Virginia Tech, Blacksburg, VA, United States

#### 5:30PM Enhanced Efficiency of a Rotational Vertical Axis Piezoelectric Windmill Using Impact Induced Resonance

Technical Presentation. IDETC2019-98528

*Ying Yang*, Nanjing University of Aeronautics and Astronautics, Nanjing, China

## VIB-5

### FLUID-INDUCED VIBRATIONS

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#### Session VIB-5-2

#### San Simeon B 4:10PM–5:50PM

Session Organizer: **Albert Luo**, Southern Illinois Univ, Edwardsville, IL, United States

Session Co-Organizer: **Bo Yu**, University of Wisconsin, Platteville, WI, United States, **Jianzhe Huang**, Shanghai Jiao Tong University, Shanghai, China

#### 4:10PM Suppressing Vortex-Induced Vibrations Through Energy Harvesting Absorber

Technical Presentation. IDETC2019-98408

*Ian McNeil*, **Abdessattar Abdelkefi**, New Mexico State University, Las Cruces, NM, United States

#### 4:30PM INDEPENDENT ASYMMETRIC PERIOD-3 MOTIONS IN A PERIODICALLY FORCED DOUBLE-PENDULUM

Technical Paper Publication. IDETC2019-97250

*Albert Luo*, Southern Illinois Univ, Edwardsville, IL, United States, *Chuan Guo*, Southern Illinois University Edwardsville, Edwardsville, IL, United States

#### 4:50PM Flow-induced deformation of an array of filaments

Technical Presentation. IDETC2019-98003

*Mehrad Mortazavi*, University of California, Merced, Merced, CA, United States, *Soheil Fatehboroujeni*, *Arvind Gopinath*, *Venkatraman Ayyaswamy*, University of California, Merced, Merced, CA, United States, *Sachin Goyal*, University of California, Merced, CA, United States

#### 5:10PM Reduced-Order Modeling and Experimental Studies of Two-Way Coupled Fluid-Structure Interaction In Flapping Wings

Technical Paper Publication. IDETC2019-98291

*Ryan Schwab*, *Heidi Reid*, *Mark Jankauski*, Montana State University, Bozeman, MT, United States

#### 5:30PM REAL-TIME SIMULATION OF UNMANNED ROTORCRAFT WITH GROUND EFFECT THROUGH ADJOINT THEOREM

Technical Paper Publication. IDETC2019-98313

*Jianzhe Huang*, Shanghai Jiao Tong University, Shanghai, Shanghai, China

## VIB-8

### NONLINEAR SYSTEMS & PHENOMENA (VIB/MSNDC)

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#### Session VIB-8-3

#### Nonlinear systems studies

#### Huntington A 4:10PM–5:50PM

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# Technical Sessions

**4:10PM Identification of a laboratory slide drilling experiment: the relationship between the top drive rotation and the tool-face angle**  
Technical Paper Publication. IDETC2019-97322

**KAIDONG CHEN, XIAOYU ZHONG**, Tsinghua University, Beijing, China, **ZAIBIN CHENG**, CNOOC Research Institute Co., Ltd., Beijing, China, **YINGJIE LU**, Tsinghua University, Beijing, China, **Qihai Lu**, Tsinghua University, Beijing, China, Beijing, China

**4:30PM Laboratory experiment of slide drilling tool-face control based on model similarity theory**  
Technical Paper Publication. IDETC2019-97325

**XIAOYU ZHONG, KAIDONG CHEN**, Tsinghua University, Beijing, China, **ZAIBIN CHENG**, CNOOC Research Institute Co., Ltd., Beijing, China, **YINGJIE LU**, Tsinghua University, Beijing, China, **Qihai Lu**, Tsinghua University, Beijing, China, Beijing, China

**4:50PM Stability Analysis of High-Performance Drones with Suspended Payloads**  
Student Competition Poster. IDETC2019-97947

**Samantha Hoang**, University of Washington, Mechanical Engineering Department, Seattle, WA, United States, **Yifeng Liu**, Univ of Washington, Seattle, WA, United States, **Alberto Aliseda**, University of Washington, Seattle, WA, United States, **I. Y (Steve) Shen**, Univ Of Washington, Seattle, WA, United States

**5:10PM On The Nonlinear Mode-Coupling In Ultra Precision Manufacturing Machines: Experimental And Analytical Analyses**  
Technical Presentation. IDETC2019-98624

**Mohammad Bukhari, Sunit Kumar Gupta, Oumar Barry**, Virginia Tech, BLACKSBURG, VA, United States, **Chinedum Okwudire**, University of Michigan, Ann Arbor, MI, United States

**5:30PM REGENERATIVE CUTTING DYNAMICS FOR A PERIODICALLY FORCED MACHINE-TOOL SYSTEM**  
Technical Paper Publication. IDETC2019-97262

**Siyuan Xing**, Southern Illinois University Edwardsville, Glen Carbon, IL, United States, **Albert Luo**, Southern Illinois Univ, Edwardsville, IL, United States

## WEDNESDAY, AUGUST, 21

### VIB-15

#### VIB KEYNOTE TALKS

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##### Session VIB-15-4

##### VIB Keynote Talk 2

##### San Simeon A 8:00AM–9:40AM

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Session Organizer: **Jiong Tang**, University of Connecticut, Storrs, CT, United States

Session Co-Organizer: **Lei Zuo**, Virginia Tech, Blacksburg, VA, United States

**8:00AM Parametrically Excited Vibrations**  
Keynote Presentation. IDETC2019-98694

**Brian Feeny**, Michigan State Univ, East Lansing, MI, United States

### VIB-4

#### ENERGY HARVESTING

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##### Session VIB-4-6

##### Smart Energy Harvesting Structures and Applications II San Simeon A 10:00AM–11:40AM

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Session Organizer: **Oumar Barry**, Virginia Tech, Blacksburg, VA, United States

**10:00AM Piezoelectric Energy Harvesting for Rotor Applications**  
Technical Presentation. IDETC2019-97329

**Liufeng Zhang, Zhaoye Qin, Fulei Chu**, Tsinghua University, Beijing, China

**10:20AM SELF-RESONANT ENERGY HARVESTER WITH A PASSIVELY TUNED SLIDING MASS**  
Technical Presentation. IDETC2019-98430

**Oumar Barry, Lei Zuo, Hongjip Kim, Arthur Smith**, Virginia Tech, Blacksburg, VA, United States

**10:40AM HYBRID WAVE AND CURRENT ENERGY CONVERTER'S DESIGN AND DYNAMICS**  
Technical Paper Publication. IDETC2019-98040

**Shuo Chen, Boxi Jiang, Xiaofan Li, Qiuchi Xiong, Jianuo Huang, Lei Zuo**, Virginia Tech, Blacksburg, VA, United States

**11:00AM Open Sea Tests of the Offshore Floating Type Wave Power Device Sharp Eagle Wanshan**  
Technical Presentation. IDETC2019-97789

**Songwei Sheng, Zhenpeng Wang, Kunlin Wang, Hongjun Lin, Yin Ye**, Guangzhou Institute of Energy Conversion, Chinese Academy of Sciences (GIEC), Guangzhou, Guangdong, China

**11:20AM Harvesting Energy From the Combined Vibration and Rotation of Host Systems**  
Technical Presentation. IDETC2019-97998

**Christopher Cooley**, Oakland University, Rochester, MI, United States

### VIB-9

#### ROTATING SYSTEMS AND ROTOR DYNAMICS

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##### Session VIB-9-1

##### Nonlinear Vibrations of Rotor System

##### Huntington A 10:00AM–11:40AM

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Session Organizer: **Akira Saito**, Meiji University, Tokyo, -, Japan

Session Co-Organizer: **Meng-Hsuan Tien**, The Ohio State University, Columbus, OH, United States

# Technical Sessions

**10:00AM**      **NONLINEAR VIBRATION ANALYSIS OF A FLEXIBLE ROTOR SUPPORTED BY A JOURNAL BEARING CONSIDERING JOURNAL ANGULAR MOTION**  
Technical Paper Publication. IDETC2019-97404

*Nuntaphong Koondilopiboon, Nagoya University, Nagoya, Aichi, Japan, Tsuyoshi Inoue, Nagoya University, Chikusa-Ku Nagoya, Aichi, Japan*

**10:20AM**      **Vibration characteristics of steam-turbine rotor system with slant crack**  
Technical Paper Publication. IDETC2019-97609

*Chao Liu, Wenzhen Xie, Dongxiang Jiang, Tsinghua University, Beijing, Beijing, China*

**10:40AM**      **Study on the Dynamic Response of an Unbalance Rotor System Supported by Ball Bearings**  
Technical Paper Publication. IDETC2019-97737

*Bin Fang, Xi'an Jiaotong University, Xi'an, China, Jinhua Zhang, Xi'an Jiaotong University, Xi'an, China, Ke Yan, Key Laboratory of Education Ministry for Modern Design and Rotor-Bearing System, School of Mechanica, Xi'an, China, Jun Hong, Xi'an Jiaotong University, Xi'an, China*

**11:00AM**      **The Lower Pad Adjustable Bearing Reduces the Vibration Response of The Rotor System During Acceleration**  
Technical Paper Publication. IDETC2019-98101

*Lei Zhang, Xi'an Jiaotong University, Xi'an, China, Hua Xu, Shenglun Zhang, Shiyuan Pei, Xi'an Jiaotong University, Xi'an, China*

**11:20AM**      **Influence Of Different Design Parameters On The Theoretical Flow Ripple In Balanced Vane Pumps**  
Technical Paper Publication. IDETC2019-97052

*Mattia Battarra, University Of Ferrara, Ferrara, FE, Italy, Emiliano Mucchi, University Of Ferrara, Ferrara 44100, FE, Italy*

## **VIB-10** **STRUCTURAL DAMAGE DETECTION AND DIAGNOSTICS**

### **Session VIB-10-1**

**Structural Damage Detection and Diagnostics I**  
**San Simeon B 10:00AM–11:40AM**

Session Organizer: **Murat Inalpolat**, *University of Massachusetts Lowell, Lowell, MA, United States*

Session Co-Organizer: **Caleb Traylor**, *University of Massachusetts Lowell, Lowell, MA, United States*

**10:00AM**      **A hierarchical Bayesian method for time domain structure damage detection**  
Technical Paper Publication. IDETC2019-97026

*WEI FENG, QIAOFENG LI, Qiuhai Lu, Tsinghua University, Beijing, China, Beijing, China*

**10:25AM**      **MODEL BASED DETERMINATION OF SIZE AND LOCATION OF A CRACK IN A ROTOR SYSTEM USING WAVELET TRANSFORMATION AND PATTERN SEARCH OPTIMIZATION**  
Technical Paper Publication. IDETC2019-97072

*Rajiv Kumar Vashisht, University of Manitoba, Winnipeg, MB, Canada*

**10:50AM**      **Investigation on Adaptive Filter for On-line Detection and Active Control of Chatter Vibration in Milling Process**  
Technical Paper Publication. IDETC2019-97290

*Shaoke Wan, Xi'an Jiaotong University, Xi'an, China, Xiaohu Li, Xi'an Jiaotong University, Xi'an, China, Wenjun Su, Xi'an Jiaotong University, Xi'an, China, Jun Hong, Xi'an Jiaotong University, Xi'an, China*

**11:15AM**      **Diagnosis of Fault Severity Level on Planetary Gearbox with Sparse Vibration Dataset by Generating Virtual Signal**  
Student Competition Poster Presentation. IDETC2019-98688

*SooHo Kim, Byeng D. Youn, Seoul National University, Seoul, Gwanakgu, Korea (Republic)*

## **VIB-9**

### **ROTATING SYSTEMS AND ROTOR DYNAMICS**

#### **Session VIB-9-2**

**Vibrations and Control of Rotating Structures**

**Huntington A 1:15PM–2:55PM**

Session Organizer: **Kiran D'Souza**, *Ohio State University, Columbus, OH, United States*

Session Co-Organizer: **Jing Liu**, *Chongqing University, Chongqing, China*

**1:15PM**      **NUMERICAL STUDY OF SUPERHARMONIC RESONANCES IN A MISTUNED HORIZONTAL-AXIS WIND-TURBINE BLADE-ROTOR SET**  
Student Competition Poster. IDETC2019-98010

*Ayşe Sapmaz, Michigan State University, East Lansing, MI, United States, Gizem Dilber Acar, University of Maryland, College Park, College Park, MD, United States, Brian Feeny, Michigan State Univ, East Lansing, MI, United States*

**1:35PM**      **COMMAND SHAPING CONTROL OF A VERTICALLY ROTATING FLEXIBLE BEAM**  
Technical Paper Publication. IDETC2019-97903

*Khaled Alhazza, Kuwait University, Kuwait City, Kuwait*

**1:55PM**      **UNSTEADY AERODYNAMIC MODELING AND PREDICTION OF LOADS FOR ROTARY WINGS IN FORWARD FLIGHT**  
Technical Paper Publication. IDETC2019-97531

*Abdallah Dayhoun, Mohamed Y. Zakaria, Omar E. Abdelhamid, Military Technical College, Cairo, Egypt*

# Technical Sessions

**2:15PM** Blade Tip Timing Based Vibration Analysis in Gas Turbine  
Poster Paper Presentation. IDETC2019-98155

*Yutaek Oh, Hanyang University, Seoul, Korea (Republic)*

**2:35PM** Two way Coupled Analysis of Fluid Force in the Annular Plain Seal and Vibration of the Rotor System Using Shooting Method  
Technical Paper Publication. IDETC2019-97334

*Yudai Kunori, NAGOYA university, NAGOYA, Aichi Prefecture, Japan, Tsuyoshi Inoue, Nagoya University, Chikusa-Ku Nagoya, Aichi, Japan, Kenjiro Miyake, Nagoya University, Aichi, Japan*

**VIB-10**  
**STRUCTURAL DAMAGE DETECTION AND DIAGNOSTICS**  
Session VIB-10-2  
Structural Damage Detection and Diagnostics II  
**San Simeon B 1:15PM–2:55PM**

Session Organizer: **Weidong Zhu**, Univ Of Maryland, Baltimore Ct, Baltimore, MD, United States  
Session Co-Organizer: **Yongfeng Xu**, University of Cincinnati, Cincinnati, OH, United States

**1:15PM** Diagnosis of Fault Severity Level on Planetary Gearbox with Sparse Vibration Dataset by Generating Virtual Signal  
Technical Presentation. IDETC2019-97816

*SooHo Kim, Byeng D. Youn, Seoul National University, Seoul, Gwanakgu, Korea (Republic)*

**1:35PM** Deep Learning Based Domain Adaptation Techniques for Fault Diagnosis of Different Mechanical Systems  
Technical Presentation. IDETC2019-97938

*Myungyon Kim, Joon Ha Jung, Jin Uk Ko, Hyeon Bae Kong, Byeng D. Youn, Seoul National University, Seoul, Korea (Republic), Kyung ho Sun, Korea Institute of Machinery & Materials, Daejeon, Korea (Republic)*

**1:55PM** Robust Fault Diagnosis Method for Low-Speed Rolling Element Bearings using Acoustic Emission Sensor  
Technical Presentation. IDETC2019-97972

*Su J. Kim, Jongmin Park, Hwayong Jeong, seoul national university, south korea, seoul, Korea (Republic), Byeng D. Youn, Seoul National University, Seoul, Korea (Republic)*

**2:15PM** A Computational Investigation into the Impact of Sensor Location on the Acoustics-based Damage Detection from An Airfoil Structure  
Technical Paper Publication. IDETC2019-98004

*Caleb Traylor, Murat Inalpolat, University of Massachusetts Lowell, Lowell, MA, United States*

**2:35PM** THE IMPORTANCE OF ENERGY CRITERIA FOR SELECTING MODES IN REDUCED ORDER MODELING  
Technical Paper Publication. IDETC2019-98140

*SUPARNO BHATTACHARYYA, PENN STATE UNIVERSITY, STATE COLLEGE, PA, United States, Joseph Cusumano, Penn State Univ, University Park, PA, United States*

**VIB-14**  
**VIBRATION OF CONTINUOUS SYSTEMS**

Session VIB-14-1  
Vibration of Continuous Systems I  
**San Simeon A 1:15PM–2:55PM**

Session Organizer: **Dumitru Caruntu**, University Of Texas Rio Grande Valley, Edinburg, TX, United States  
Session Co-Organizer: **Weidong Zhu**, Univ Of Maryland, Baltimore Ct, Baltimore, MD, United States

**1:15PM** CROSS-WELL DYNAMICS OF BISTABLE CROSS-PLY LAMINATES  
Technical Paper Publication. IDETC2019-97044

*Samir Emam, American University of Sharjah, Sharjah, Sharjah, United Arab Emir., Daniel Inman, University of Michigan, Ann Arbor, MI, United States*

**1:35PM** VIBRATIONS OF A DOUBLE BEAM STRUCTURE CARRYING A HIGH-PRESSURE DRIVEN PROJECTILE  
Technical Paper Publication. IDETC2019-97139

*Alexander Khair, University of Southern California, Los Angeles, CA, United States, Bingen (ben) Yang, Univ Of Southern California, Los Angeles, CA, United States*

**1:55PM** A New Approach to Compute Natural Frequencies and Mode shapes of Non-Uniform Continuous Bar, Circular Shaft and Beam Vibration  
Technical Paper Publication. IDETC2019-97263

*Alok Sinha, Pennsylvania State Univ, University Park, PA, United States*

**2:15PM** DYNAMIC ANALYSIS OF A ROTATING PLANAR TIMOSHENKO BEAM USING AN ACCURATE GLOBAL SPATIAL DISCRETIZATION METHOD  
Technical Paper Publication. IDETC2019-98058

*Wei Fan, Sichuan University, Chengdu, China, China, Weidong Zhu, Univ Of Maryland, Baltimore Ct, Baltimore, MD, United States, Hao Zhu, Sichuan University, Chengdu, China*

**2:35PM** Modal Analysis of Darrieus Wind Turbine Blade  
Technical Presentation. IDETC2019-98091

*Fatemeh Afzali, Michigan State University, East Lansing, MI, United States, Brian Feeny, Michigan State Univ, East Lansing, MI, United States, Amr Saleh, Michigan State University, East Lansing, MI, United States*

# Technical Sessions

## VIB-10

### STRUCTURAL DAMAGE DETECTION AND DIAGNOSTICS

#### Session VIB-10-3

#### Structural Damage Detection and Diagnostics III

San Simeon B 3:15PM - 4:55PM

Session Organizer: **Yongfeng Xu**, University of Cincinnati, Cincinnati, OH, United States

Session Co-Organizer: **Weidong Zhu**, Univ Of Maryland, Baltimore Ct, Baltimore, MD, United States

#### **3:15PM EVALUATION OF THE ISHM METHOD APPLIED FOR COMPOSITE ROTORS**

Technical Paper Publication. IDETC2019-98119

**Karina M. Tsuruta**, Federal University of Uberlândia, Uberlândia, Minas Gerais, Brazil, **Lucas A. A. Rocha**, LMEst ? Structural Mechanics Laboratory/Federal University of Uberlândia, Uberlândia, MG, Brazil, **Aldemir A. Cavalini Jr.**, Federal University of Uberlândia, Uberlândia, Minas Gerais, Brazil, **Roberto M. Finzi Neto**, LMEst ? Structural Mechanics Laboratory/Federal University of Uberlândia, Uberlândia, MG, Brazil, **Valder Steffen Jr.**, Federal University of Uberlândia, Uberlândia, Minas Gerais, Brazil

#### **3:35PM Experimental and Numerical Investigation of Residual Stress Stiffening Influence on Dynamic Response of Welded Structures**

Technical Paper Publication. IDETC2019-98123

**Amirhossein Majdirad**, Yimesker Yihun, Wichita State University, Wichita, KS, United States

#### **3:55PM Characterization of full-field nonlinear dynamics from video measurements using low-rank sparse decomposition and sparse coefficient identification**

Technical Presentation. IDETC2019-98422

**Gregory Taylor**, New Mexico State University, El Paso, TX, United States, **Yongchao Yang**, Argonne National Laboratory, Lemont, IL, United States, **David Mascarenas**, Los Alamos National Laboratory, Los Alamos, NM, United States, **Abdessattar Abdelkefi**, New Mexico State University, Las Cruces, NM, United States

#### **4:15PM Detection and measurement of impact events in noisy environments using L1-norm regularization**

Technical Presentation. IDETC2019-98433

**Gregory Taylor**, New Mexico State University, El Paso, TX, United States, **David Mascarenas**, Los Alamos National Laboratory, Los Alamos, NM, United States, **Abdessattar Abdelkefi**, New Mexico State University, Las Cruces, NM, United States

#### **4:35PM Robust Fault Diagnosis Method for Low-Speed Rolling Element Bearings using Acoustic Emission Sensor**

Technical Presentation. IDETC2019-97965

**dd dd, dd, dd, dd**, Czech Republic, **Su J. Kim, Jongmin Park, Hwayong Jeong**, seoul national university. south korea, seoul, Korea (Republic)

## VIB-11

### TIME-DELAY SYSTEMS AND DISCONTINUOUS DYNAMICAL SYSTEMS

#### Session VIB-11-1

#### Time-delay Systems and Discontinuous dynamical systems

Huntington A 3:15PM - 4:55PM

Session Organizer: **Yu Guo**, Midwest State University, Wichita Falls, TX, United States

Session Co-Organizer: **Siyuan Xing**, Southern Illinois University Edwardsville, Glen Carbon, IL, United States

#### **3:15PM A SPICE SUB-CIRCUIT MODEL FOR BACKWARD DIODE**

Technical Paper Publication. IDETC2019-97060

**Wei Wu**, Berea College, Berea, KY, United States, **Fengxia Wang, Andy Lozowski**, Southern Illinois University Edwardsville, Edwardsville, IL, United States

#### **3:35PM PERIOD-2 MOTIONS TO CHAOS IN A PARAMETRICALLY EXCITED PENDULUM**

Technical Paper Publication. IDETC2019-97260

**Yu Guo**, Midwest State University, Wichita Falls, TX, United States, **Albert Luo**, Southern Illinois Univ, Edwardsville, IL, United States

#### **3:55PM The Effect of Time-delay on Bandgap Control of the Phononic Beam with Digital Synthetic Impedance**

Technical Presentation. IDETC2019-97585

**Xiaoxu Zhang**, Fudan University, Shanghai, China, **Jian Xu**, Tongji University, Shanghai, Shanghai, China

#### **4:15PM Switching and sliding motions on the two circular boundaries in discontinuous dynamical systems**

Technical Paper Publication. IDETC2019-97876

**Siyu Guo**, Southern Illinois University Edwardsville, Peoria, IL, United States, **Albert Luo**, Southern Illinois Univ, Edwardsville, IL, United States

#### **4:35PM Placement of sensors for the detection of freeplay in vertical pipes conveying fluid**

Technical Presentation. IDETC2019-98416

**Gregory Taylor**, New Mexico State University, El Paso, TX, United States, **Samantha Ceballes**, New Mexico State University, Alamogordo, NM, United States, **David Mascarenas**, Los Alamos National Laboratory, Los Alamos, NM, United States, **Abdessattar Abdelkefi**, New Mexico State University, Las Cruces, NM, United States



# Technical Sessions

VIB-14

## **VIBRATION OF CONTINUOUS SYSTEMS**

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Session VIB-14-2

**Vibration of Continuous Systems II**

**San Simeon A 3:15PM - 4:55PM**

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Session Organizer: **Weidong Zhu**, *Univ Of Maryland, Baltimore Ct, Baltimore, MD, United States*

Session Co-Organizer: **Dumitru Caruntu**, *University Of Texas Rio Grande Valley, Edinburg, TX, United States*

**3:15PM DYNAMIC ANALYSIS AND PARAMETRIC RESONANCE OF A FAST PROJECTION SYSTEM**  
Technical Paper Publication. IDETC2019-97257

*Hao Gao*, *University of Southern California, Los Angeles, CA, United States*, *Bingen (ben) Yang*, *Univ Of Southern California, Los Angeles, CA, United States*

**3:35PM AN INCREMENTAL HARMONIC BALANCE METHOD WITH TWO TIME SCALES FOR QUASI-PERIODIC MOTION OF NONLINEAR SYSTEMS WITH CUBIC NONLINEARITY**  
Technical Paper Publication. IDETC2019-97582

*Jianliang Huang*, *Sun Yat-sen University, Guangzhou, China*, *Weidong Zhu*, *Univ Of Maryland, Baltimore Ct, Baltimore, MD, United States*, *Shuhui Chen*, *Sun Yat-sen University, Guangzhou, China*

**3:55PM Reduced-Order Models for Electro-Magnetic-Structural Coupling Phenomena**  
Technical Presentation. IDETC2019-98029

*Chenyu Yi*, *University of Michigan, Ann Arbor, MI, United States*, *Heath Hofmann*, *University of Michigan, Ann Arbor, Ann Arbor, MI, United States*, *Bogdan Epureanu*, *Univ Of Michigan, Ann Arbor, MI, United States*

**4:15PM Comparison of Frequency Response of Primary Resonance of DWCNT and CNT Resonators under Electrostatic Actuation**  
Technical Paper Publication. IDETC2019-98085

*Dumitru Caruntu*, *Ezequiel Juarez*, *University Of Texas Rio Grande Valley, Edinburg, TX, United States*

**4:35PM Frequency Response of Parametric Resonance of Electrostatically Actuated Circular plates Under Hard Excitations**  
Technical Paper Publication. IDETC2019-98104

*Julio Beatriz*, *Dumitru Caruntu*, *University of Texas Rio Grande Valley, Edinburg, TX, United States*

**2019 International Power Transmission and Gearing Conference (PTG)**  
**MONDAY, AUGUST, 19**

PTG-2

## **GEAR ANALYSIS, MATERIALS, AND FATIGUE**

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Session PTG-2-1

**Gear Analysis, Materials, and Fatigue I**

**Monterey 8:00AM–9:00AM**

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Session Organizer: **Ahmet Kahraman**, *Ohio State University, Columbus, OH, United States*

Session Co-Organizer: **Robert Handschuh**, *RH Engineering, North Olmsted, OH, United States*

**8:00AM Welcome to the 2019 ASME PTG Conference Plenary Presentation.** IDETC2019-98697

*Qi Fan*, *Gleason Works, Rochester, NY, United States*

**8:20AM Closed form calculation of lead flank modification proposal for spur and helical gear stages**  
Technical Paper Publication. IDETC2019-97993

*Uwe Weinberger*, *FZG, Garching, Germany*, *Michael Otto*, *TUM FZG, Munich, Germany*, *Karsten Stahl*, *FZG of TUM, Garching, OO, Germany*

**8:40AM Tooth Root Shape Optimization of Thin-Rimmed Planet Gears**  
Technical Paper Publication. IDETC2019-97345

*Chen-Xiang Chao*, *Dieter Bestle*, *Brandenburg University of Technology Cottbus-Senftenberg, Cottbus, Brandenburg, Germany*, *David Krüger*, *Rolls-Royce Deutschland Ltd & Co KG, Blankenfelde-Mahlow, Germany*

PTG-4

## **GEARBOX DESIGN, RELIABILITY, AND DIAGNOSTICS**

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Session PTG-4-1

**Gearbox Design, Reliability, and Diagnostics I**

**Salinas 8:00AM–9:00AM**

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Session Organizer: **Alfonso Fuentes-Aznar**, *Rochester Institute of Technology, Rochester, NY, United States*

Session Co-Organizer: **Isaac Hong**, *The Ohio State University, Columbus, OH, United States*

**8:00AM Welcome to the 2019 ASME PTG Conference (See PTG 2-1)**  
Plenary Presentation. IDETC2019-98698

*Qi Fan*, *Gleason Works, Rochester, NY, United States*

# Technical Sessions

**8:20AM** A Method to Describe the Distribution of Gear Surface Fatigue Lives Using the Three-Parameter Weibull Distribution  
Technical Presentation. IDETC2019-97233

*Timothy Krantz, NASA Glenn Research Center, Cleveland, OH, United States, Zachary Cameron, NASA, Cleveland, OH, United States*

**8:40AM** DESIGN OPTIMIZATION OF A THREE-STAGE PLANETARY GEAR REDUCER USING GENETIC ALGORITHM  
Technical Paper Publication. IDETC2019-97387

*Yanbiao FENG, University of Victoria, Victoria, BC, Canada, Wenming ZHANG, Jue YANG, University of Science Technology Beijing, Beijing, China, Zuomin DONG, University of Victoria, Victoria, BC, Canada*

## PTG-1 GEAR GEOMETRY

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Session PTG-1-1  
Gear Geometry I

**Monterey 9:10AM–10:30AM**

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Session Organizer: **Shao Yimin**, Chongqing University, Chongqing, China  
Session Co-Organizer: **Kenneth Nowaczyk**, Ford, Livonia, MI, United States

**9:10AM** GEOMETRIC DESIGN OF PURE ROLLING RACK AND PINION MECHANISMS  
Technical Paper Publication. IDETC2019-97256

*Zhen Chen, Ming Zeng, China University of Geosciences (wuhan), Wuhan, China, Alfonso Fuentes-Aznar, Rochester Institute of Technology, Rochester, NY, United States*

**9:30AM** Design and Simulation of Meshing Performance of Modified Straight Bevel Gears  
Technical Presentation. IDETC2019-97592

*Mingzhang Chen, Lin Hua, Xinghui Han, Wuhao Zhuang, Wuhan University of Technology, Wuhan, China*

**9:50AM** Research on Face Gear Drives Considering Compensation of Errors of Alignment Caused by Shaft Deflections  
Technical Presentation. IDETC2019-97315

*HUI GUO, Northwestern Polytechnical University, Xi'an, Shaanxi, China, Alfonso Fuentes-Aznar, Rochester Institute of Technology, Rochester, NY, United States*

**10:10AM** MESHING THEORY OF ZC1 WORM DRIVE  
Technical Paper Publication. IDETC2019-97578

*Yaping Zhao, Northeastern University China, Shenyang Liaoning, China*

## PTG-4

### GEARBOX DESIGN, RELIABILITY, AND DIAGNOSTICS

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Session PTG-4-2

Gearbox Design, Reliability, and Diagnostics II

**Salinas 9:10AM–10:30AM**

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Session Organizer: **Lin Hua**, Wuhan University of Technology, Wuhan, China

Session Co-Organizer: **Thomas Tallerico**, NASA Glenn Research Center, Cleveland, OH, United States

**9:10AM** Research on Transmission Error test and Analysis of RV Reducer  
Technical Paper Publication. IDETC2019-97237

*Zhonggang Zhu, Zhejiang Shuanghuan Driveline Co., Ltd., Yuhuan, Zhejiang, China, Jing Zhang, Zhejiang Shuanghuan Driveline Co. Ltd, Taizhou, China*

**9:30AM** Exhaustive Synthesis And Analysis Of Automotive 2-Stage Planetary Transmission Designs  
Technical Paper Publication. IDETC2019-97753

*Henri Karhula, Mike Nicolai, Siemens Industry Software NV, Leuven, Belgium, Wim Desmet, KU Leuven, DMMS Lab, Flanders Make, Heverlee, Belgium*

**9:50AM** Technology of Measuring EMA Transmission Accuracy and Its Implementation  
Technical Presentation. IDETC2019-97211

*Huiming Cheng, Zhaoyao Shi, Bo Yu, Yiwen Zhu, Hongyu Ding, Pan Zhang, Beijing University of Technology, Beijing, Beijing, China*

**10:10AM** Three-dimensional Spatial Meshing Quality Pre-control of Harmonic Drive Based on Double-circular-arc Tooth Profile  
Technical Paper Publication. IDETC2019-97228

*Faxiang Xie, Zhejiang Shuanghuan Driveline Co., Ltd., Yuhuan, Zhejiang, China, Jing Zhang, Zhejiang Shuanghuan Driveline Co. Ltd, Taizhou, China, Yinan Han, Canyuan Wu, Zhengyang Zhao, Min Zhan, Zhejiang Shuanghuan Driveline Co., Ltd., Yuhuan, Zhejiang, China*

## PTG-9

### EARLE BUCKINGHAM LECTURE (KEYNOTE)

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Session PTG-9-1

Earle Buckingham Lecture (Keynote)

**Monterey 10:50AM–12:10PM**

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Session Organizer: **Qi Fan**, Gleason Works, Rochester, NY, United States

Session Co-Organizer: **David Talbot**, The Ohio State University, Columbus, OH, United States

# Technical Sessions

**10:50AM** Mechanical-Electric Coupled Dynamic Analysis and Adaptive Control of Power Transmission Systems  
Keynote Presentation. IDETC2019-98701

*Datong Qin, Chongqing University, Chongqing, China*

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## PTG-2

### **GEAR ANALYSIS, MATERIALS, AND FATIGUE**

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#### **Session PTG-2-2**

#### **Gear Analysis, Materials, and Fatigue II Monterey 2:10PM–3:45PM**

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Session Organizer: **Sheng Li**, Wright State University, Dayton, OH, United States

Session Co-Organizer: **Isaac Hong**, The Ohio State University, Columbus, OH, United States

**2:10PM** Influence of the Case Properties after Nitriding on the Load Carrying Capacity of Highly Loaded Gears  
Technical Paper Publication. IDETC2019-97405

*André Sitzmann*, Gear Research Centre (FZG), Technical University of Munich, Garching b. München, Germany, **Thomas Tobie**, Gear Research Centre (FZG), Technical University of Munich, Garching/Munich, Germany, **Karsten Stahl**, FZG of TUM, Garching, OO, Germany, **Stefan Schurer**, MAN Truck & Bus AG, Munich, Germany

**2:30PM** BENDING FATIGUE TESTING OF AUSTEMPERED DUCTILE IRON SPUR GEAR  
Technical Paper Publication. IDETC2019-97194

*Qi Zhang, Jianhua Lv, Rizwanulhaque Syed, Jing Zhang*, Zhejiang Shuanghuan Driveline Co. Ltd, Taizhou, China, **Yang Xu, Baojian Liu**, Xi'an University of Technology, Xi'an, China

**2:50PM** Ultrasonic Gear Steel Fatigue Research at NASA  
Technical Presentation. IDETC2019-97481

*Thomas Tallerico*, NASA Glenn Research Center, Cleveland, OH, United States

**3:10PM** Calibration Experiments on a Visual Measurement System for Pinion Gears  
Technical Paper Publication. IDETC2019-97147

*Jie Tang, Xiaobing Liu, Lingyu Chai, Zhaoyao Shi, Rui Li*, Beijing University of Technology, Beijing, China

**3:30PM** FLASH TEMPERATURE ANALYSIS METHOD FOR POLYMER GEARS WITH CONSIDERATION OF DEVIATIONS IN MESHING KINEMATICS  
Technical Paper Publication. IDETC2019-97824

*Borut Cerne, Damijan Zorko, Jože Duhovnik, Joze Tavcar, Roman Zavbi*, Faculty of Mechanical Engineering, University of Ljubljana, Ljubljana, Slovenia

## PTG-7

### **BEARINGS, CLUTCHES, COUPLINGS, AND SPLINES**

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#### **Session PTG-7-1**

#### **Bearings, Clutches, Couplings, and Splines I Salinas 2:10PM–3:45PM**

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Session Organizer: **Jing Zhang**, Zhejiang Shuanghuan Driveline Co. Ltd, Taizhou, China

Session Co-Organizer: **Robert Handschuh**, RH Engineering, North Olmsted, OH, United States

**2:10PM** Research on temperature rise of wet clutch based on Multi-field Coupling  
Technical Paper Publication. IDETC2019-97059

*Bangzhi Wu, Datong Qin, Jianjun Hu*, chongqing university, chongqing, Chongqing, China, **qing zhang**, Power Research Institute of Chang'an Automobile, Chongqing, chongqing, China

**2:30PM** An Inclusion Energy Model for Predicting Contact Fatigue of Heterogeneous Materials  
Technical Presentation. IDETC2019-97837

*Rui Zhang, pu li, yuhuan an, Xiaoqing Jin*, Chongqing University, Chongqing, China

**2:50PM** Numerical investigation on the mixed lubrication performance of water-lubricated journal and thrust coupled bearings  
Technical Paper Publication. IDETC2019-97234

*Yanfeng Han*, State Key Laboratory of Mechanical Transmission, Chongqing University, Chongqing, China, **Guo Xiang, Jiaxu Wang**, Chongqing University, Chongqing, China

**3:10PM** Optimization Design and Analysis for Pre-shift Control Parameters of Wet Dual Clutch Transmissions based on Dynamic Modeling of Synchronizer  
Technical Paper Publication. IDETC2019-97324

*Ke Zheng, Jianjun Hu, Bangzhi Wu*, Chongqing University, Chongqing, Chongqing, China, **Yin Wang**, Power Research Institute of Chang'an Automobile, Chongqing, Chongqing, China

**3:30PM** A Benchmark Study of Conformal Contact With Applications to Rolling Element Bearings  
Technical Presentation. IDETC2019-97855

*yuhuan an, Rui Zhang, pu li, qiang xi, Yumei Hu, Xiaoqing Jin*, chongqing university, chongqing, chongqing, China

# Technical Sessions

TUESDAY, AUGUST, 20

PTG-2

## GEAR ANALYSIS, MATERIALS, AND FATIGUE

Session PTG-2-3

**Gear Analysis, Materials, and Fatigue III**

**Monterey 4:10PM–5:50PM**

Session Organizer: **Sheng Li**, *Wright State University, Dayton, OH, United States*

Session Co-Organizer: **Yawen Wang**, *University of Texas at Arlington, Arlington, TX, United States*

**4:10PM A Load Distribution Model for Double-Planet Planetary Gear Sets**

Technical Paper Publication. IDETC2019-98512

*Yong Hu*, *Ohio State University, Columbus, OH, United States*, **David Talbot**, *The Ohio State University, Columbus, OH, United States*, **Ahmet Kahraman**, *Ohio State University, Columbus, OH, United States*

**4:30PM Theoretical Study On The Influence Of Planet Gear Rim Thickness And Bearing Clearance On Calculated Bearing Life**  
Technical Paper Publication. IDETC2019-97930

*Andreas Fingerle*, *Jonas Hochrein*, *Technical University of Munich, Garching, Germany*, **Michael Otto**, *TUM FZG, Munich, Germany*, **Karsten Stahl**, *FZG of TUM, Garching, OO, Germany*

**4:50PM Mesh Stiffness Calculation of Spur Gears with Tooth Surface Crack**

Technical Paper Publication. IDETC2019-97857

*Luke Zhang*, *Shao Yimin*, *Chongqing University, Chongqing, China*

**5:10PM Research on Prediction Method of Transmission Accuracy of Harmonic Drive**

Technical Paper Publication. IDETC2019-97214

**Qiushi Hu**, **Zhifeng Liu**, **Ligang Cai**, **Congbin Yang**, *Beijing University of Technology, Beijing, China*, **Tao Zhang**, *Beijing University of Technology, Beijing China, China*, **Guang Wang**, *Beijing University of Technology, Beijing, China*

**5:30PM Conversion Model for the Design of Steel and Polymer S-gears**

Technical Paper Publication. IDETC2019-97817

**Damijan Zorko**, **Borut Cerne**, **Jože Duhovnik**, **Roman Zavbi**, **Joze Tavcar**, *Faculty of Mechanical Engineering, University of Ljubljana, Ljubljana, Slovenia*

PTG-3

## GEAR DYNAMICS AND NOISE

Session PTG-3-1

**Gear Dynamics and Noise I**

**Monterey 8:00AM–9:00AM**

Session Organizer: **Murat Inalpolat**, *University of Massachusetts Lowell, Lowell, MA, United States*

Session Co-Organizer: **Prashant Sondkar**, *FCA US LLC, Auburn Hills, MI, United States*

**8:00AM Dynamics in Multi-mesh Idler Gear Systems**  
Technical Presentation. IDETC2019-97318

*Xiang Dai*, *Sentient Science, West Lafayette, IN, United States*, **Christopher Cooley**, *Oakland University, Rochester, MI, United States*, **Robert Parker**, *Virginia Tech, Blacksburg, VA, United States*

**8:20AM RESPONSE SENSITIVITY IN A NONLINEAR PLANETARY GEAR SET**

Technical Paper Publication. IDETC2019-97366

**Zhaobin Zhan**, **Hui Liu**, *Beijing Institute of Technology, Beijing, China*, **Brian Feeny**, *Michigan State Univ, East Lansing, MI, United States*, **Changle Xiang**, **Lijin Han**, *Beijing Institute of Technology, Beijing, China*

**8:40AM Modeling and Dynamic Characteristics of Planetary Gear Transmission in Non-inertial System of Aerospace Environment**

Technical Paper Publication. IDETC2019-97193

*Jing Wei*, *Chongqing University, Chongqing, China*, **lei shi**, **aiqiang zhang**, *chongqing university, chongqing city, China*, **Datong Qin**, *Chongqing University, Chongqing, China*

PTG-6

## LUBRICATION AND EFFICIENCY

Session PTG-6-1

**Lubrication and Efficiency I**

**Salinas 8:00AM–9:00AM**

Session Organizer: **Hai Xu**, *General Motors, Milford, MI, United States*  
Session Co-Organizer: **Michael Handschuh**, *The Ohio State University, Columbus, OH, United States*

**8:00AM The effect of starvation on a thermal mixed EHL line contact**

Technical Paper Publication. IDETC2019-97082

**Sheng Li**, **Danielle Masse**, *Wright State University, Dayton, OH, United States*



# Technical Sessions

**8:20AM**            **A Numerical Model to Predict Dynamic Performance of Layered Gears at Starved Lubrication**  
**Technical Paper Publication.** IDETC2019-97276

*Qingbing Dong, Jing Wei, Yan Li, Lixin Xu, Chongqing University, Chongqing, China*

**8:40AM**            **Asymmetric Varying Velocity Elliptical Point Contact Lubrication Model for Spiral Bevel Gears**  
**Technical Paper Publication.** IDETC2019-98142

*Srikumar Gopalakrishnan, Indian Institute of Technology Bombay, Mumbai, Maharashtra, India, Teik C. Lim, Yawen Wang, University of Texas At Arlington, Arlington, TX, United States*

## PTG-3

### **GEAR DYNAMICS AND NOISE**

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#### **Session PTG-3-2**

#### **Gear Dynamics and Noise II**

**Monterey**            **9:10AM–10:30AM**

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Session Organizer: **Karsten Stahl**, FZG of TUM, Garching, OO, Germany

Session Co-Organizer: **Kenneth Nowaczyk**, Ford, Livonia, MI, United States

**9:10AM**            **An Experimental Investigation of the Impact of Random Spacing Errors on the Dynamic Transmission Error of Spur Gear Pairs**  
**Technical Paper Publication.** IDETC2019-98357

*Muhammad Nevin Anandika, The Ohio State University, Columbus, OH, United States, Ahmet Kahraman, Ohio State University, Columbus, OH, United States, David Talbot, The Ohio State University, Columbus, OH, United States*

**9:30AM**            **Shift Process Analysis of AT Based on Lever Analogy**  
**Technical Paper Publication.** IDETC2019-97131

*chao yi, ye wang, cui fen li, China north vehicle research institute, Beijing, China*

**9:50AM**            **OPTIMIZATION OF MACHINE TOOL SETTINGS ON HYPOID GEAR DYNAMICS**  
**Technical Paper Publication.** IDETC2019-97137

*Chia-Ching Lin, The University of Texas at Arlington, Arlington, TX, United States, Yawen Wang, Teik C. Lim, University of Texas at Arlington, Arlington, TX, United States, Weiqing Zhang, Chongqing university of Technology, Chongqing, China*

**10:10AM**            **A Methodology to Experimentally Investigate the Impact of Wobble Errors on the Contact Pattern and Static Transmission Error of Helical Gear Pairs**  
**Technical Paper Publication.** IDETC2019-98391

*Michael Benatar, Michael Handschuh, The Ohio State University, Columbus, OH, United States, Ahmet Kahraman, Ohio State University, Columbus, OH, United States, David Talbot, The Ohio State University, Columbus, OH, United States*

## PTG-6

### **LUBRICATION AND EFFICIENCY**

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#### **Session PTG-6-2**

#### **Lubrication and Efficiency II**

**Salinas**            **9:10AM–10:30AM**

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Session Organizer: **Timothy Krantz**, NASA Glenn Research Center, Cleveland, OH, United States

Session Co-Organizer: **Jing Wei**, Chongqing University, Chongqing, China

**9:10AM**            **Calculation Approaches for Wear Risk and Wear Lifetime of Oil and Grease Lubricated Gear Pairings**  
**Technical Paper Publication.** IDETC2019-97439

*Benedikt J. Siewerin, Andreas Dobler, Technical University of Munich, Garching/ Munich, Germany, Thomas Tobie, Gear Research Centre (FZG), Technical University of Munich, Garching/ Munich, Germany, Karsten Stahl, FZG of TUM, Garching, OO, Germany*

**9:30AM**            **Measurement of gears with a profilometer and its application in gear tribology**  
**Technical Presentation.** IDETC2019-97890

*Jiachun Lin, Beijing University of Technology, Beijing, China, Ulf Olofsson, KTH Royal Institute of Technology, Stockholm, Sweden, Zhaoyao Shi, Beijing University of Technology, Beijing, China*

**9:50AM**            **Single Gear and Disk Windage Power Loss Results**  
**Technical Presentation.** IDETC2019-97991

*Michael Hurrell, HX5 Sierra, LLC/TFOME II, Cleveland, OH, United States, Irebert Delgado, NASA Glenn Research Center, Cleveland, OH, United States*

**10:10AM**            **Power Loss Measurements of Rolling Element Bearings Subject to Combined Radial and Axial Loads**  
**Technical Paper Publication.** IDETC2019-97438

*Kevin Vedera, General Motors, Rochester Hills, MI, United States, Isaac Hong, David Talbot, The Ohio State University, Columbus, OH, United States, Ahmet Kahraman, Ohio State University, Columbus, OH, United States, Sen Zhou, General Motors Corporation, Troy, MI, United States*

# Technical Sessions

## PTG-1

### GEAR GEOMETRY

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#### Session PTG-1-2

#### Gear Geometry II

**Salinas 10:50AM–12:10PM**

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Session Organizer: **Alfonso Fuentes-Aznar**, Rochester Institute of Technology, Rochester, NY, United States

Session Co-Organizer: **Zachary Cameron**, NASA, Cleveland, OH, United States

#### 10:50AM Numerical Simulation for Optimizing Tooth Profile using Bezier Curve

Technical Paper Publication. IDETC2019-97009

**Kevin Qiu, Reza Samadi**, Stackpole International, Mississauga, ON, Canada

#### 11:10AM Theoretical Validation Of An Analytical Design Method For Beveloid Gears With Non-Parallel Non-Intersecting Axes

Technical Paper Publication. IDETC2019-97246

**Daniel Marino, Matthias Bachmann, Hansgeorg Binz**, University of Stuttgart, Stuttgart, Germany

#### 11:30AM Sine Curve Modification Of Spur Gears To Improve Hertz Pressure Distribution

Technical Presentation. IDETC2019-97577

**Xiangyang Xu, Huize Ding, Peng Dong, Junbin Lai**, Beihang University, Beijing, Beijing, China

#### 11:50AM TOOTH GEOMETRY DESIGN AND TWO-DIMENSIONAL FINITE ELEMENT ANALYSIS FOR A STRAIN WAVE GEAR WITH DOUBLE-CIRCULAR-ARC PROFILE

Technical Paper Publication. IDETC2019-97594

**Yi-Cheng Chen, Yun-Hao Cheng**, National Central University, Taoyuan city, Select State/Province, Taiwan, **Jui-Tang Tseng, Kun-Ju Hsieh**, Industrial Technology Research Institute, Hsinchu,, Taiwan

## PTG-3

### GEAR DYNAMICS AND NOISE

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#### Session PTG-3-3

#### Gear Dynamics and Noise III

**Monterey 10:50AM–12:10PM**

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Session Organizer: **Murat Inalpolat**, University of Massachusetts Lowell, Lowell, MA, United States

Session Co-Organizer: **Yawen Wang**, University of Texas at Arlington, Arlington, TX, United States

#### 10:50AM Advanced Mesh Interface Simulations in 3D Hybrid Dynamic Models

Technical Presentation. IDETC2019-97287

**Berengere Guilbert**, LaMCoS - INSA de Lyon, Villeurbanne CEDEX, France, **Philippe Velex**, INSA Lyon - LaMCoS, Villeurbanne, France

#### 11:10AM INVESTIGATION ON INFLUENCE OF TOOTH PRECISION ON MESHING NOISE

Technical Paper Publication. IDETC2019-97682

**Seiya Hamada**, Doshisha University, Kyotanabe, Kyoto, Japan, **Masao Nakagawa**, National Traffic Safety and Environment Laboratory, Chofu, Tokyo, Japan, **Tomoki Fukuda**, Doshisha University, Kyotanabe, Kyoto, Japan, **Toshiki Hirogaki, Eiichi Aoyama**, Doshisha Univ, Kyotanabe-shi, Japan

#### 11:30AM Analysis of a System-Level Finite Element/Contact Mechanics Model of a Rotorcraft Transmission

Technical Presentation. IDETC2019-97949

**Christopher Cooley**, Oakland University, Rochester, MI, United States, **Adrian Hood**, US Army Research Laboratory-Vehicle Technology Directorate, Aberdeen Proving Ground, MD, United States

#### 11:50AM An Improved Model for Calculating the Mesh Stiffness of Helical Gears

Technical Paper Publication. IDETC2019-97191

**Jing Wei**, Chongqing University, Chongqing, China, **shaoshuai hou, aiqiang zhang, chunpeng zhang**, chongqing university, chongqing city, China

## PTG-3

### GEAR DYNAMICS AND NOISE

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#### Session PTG-3-4

#### Gear Dynamics and Noise IV

**Monterey 2:10PM–3:50PM**

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Session Organizer: **Ahmet Kahraman**, Ohio State University, Columbus, OH, United States

Session Co-Organizer: **Jing Wei**, Chongqing University, Chongqing, China

#### 2:10PM An Analytical Investigation of the Impact of Design Parameters on the Performance of Centrifugal Pendulum Vibration Absorbers

Technical Paper Publication. IDETC2019-98018

**Bahadir Sarikaya, Murat Inalpolat**, University of Massachusetts Lowell, Lowell, MA, United States, **Hyun Ku Lee, Moo Suk Kim**, Hyundai Motor Company, Gyeonggi-do, Korea (Republic)

#### 2:30PM Modelling of embodied dissipative elements in high-power gears.

Technical Presentation. IDETC2019-97339

**Cyril CHEVREL—FRAUX**, LaMCoS, INSA Lyon, Villeurbanne, France, **Jerome Bruyere, Philippe Velex**, INSA Lyon - LaMCoS, Villeurbanne, France, **Romain Fargere**, Naval Group, Bouguenais, France

# Technical Sessions

**2:50PM ENERGY DISSIPATION OF DAMPER RINGS FOR THIN-WALLED GEARS**  
Technical Paper Publication. IDETC2019-97069

*Zichao Li, Yanrong Wang, Xianghua Jiang, Hang Ye, Weichao Yang, Beihang University, Beijing, Beijing, China*

**3:10PM Vibration Control of Spur Gear Rotor Systems with Transmission Errors by Active Magnetic Bearings**  
Technical Paper Publication. IDETC2019-97176

*Gargi Majumder, Rajiv Tiwari, Indian Institute of Technology Guwahati, Guwahati, India*

**3:30PM An Analytical Investigation of Rattle Characteristics of Powder Metal Gears**  
Technical Paper Publication. IDETC2019-98026

*Elizabeth Slavkovsky, Murat Inalpolat, University of Massachusetts Lowell, Lowell, MA, United States, Anders Flodin, Hoganas, Chapel Hill, NC, United States*

## PTG-5

### GEAR MANUFACTURING

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#### Session PTG-5-1

##### Gear Manufacturing I

**Monterey 4:10PM–5:50PM**

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Session Organizer: **Hai Xu**, General Motors, Milford, MI, United States  
Session Co-Organizer: **Prashant Sondkar**, FCA US LLC, Auburn Hills, MI, United States

**4:10PM A CNC Grinding Method for Hypoid Gears with Formate Face Hobbing Process**  
Technical Presentation. IDETC2019-97891

*Wei Qing Zhang, Xiaodong Guo, Chongqing university of Technology, Chongqing, China, Yawen Wang, Teik C. Lim, University of Texas at Arlington, Arlington, TX, United States, Chia-Ching Lin, The University of Texas at Arlington, Arlington, TX, United States, Yong Zheng, Chongqing university of technology, Chongqing, China*

**4:30PM Study on Path Planning of Involute Tooth Surface Milling with General Cutting Tool**  
Technical Paper Publication. IDETC2019-97156

*Zhaoyao Shi, Zhipeng Feng, Beijing University of Technology, Beijing, China*

**4:50PM Thermal Error Modeling and Prediction of High Speed Dry Hobbing Machine**  
Technical Paper Publication. IDETC2019-97111

*SHAOZHANG MA, Chongqing University, Chongqing, Chongqing, China, Jie Zhou, Chongqing University, Chongqing, China, Wang Shilong, Chi Ma, Lei Ren, Changjiu Xia, Chongqing University, Chongqing, China*

**5:10PM Tooth Contact Analysis and Machining of Face Gear Drive with Helical Pinion**  
Technical Presentation. IDETC2019-97570

*Kazumasa Kawasaki, Niigata University, Niigata, Japan, Isamu Tsuji, Iwasa Tech Co., Ltd., Funabashi, Japan*

**5:30PM Research on the Method of Improving the Transmission Accuracy of Gear Shaping Machine**  
Technical Presentation. IDETC2019-97635

*Yong Zheng, Donglin Peng, Yan Chen, Wei Qing Zhang, Chongqing university of technology, Chongqing, China, Teik C. Lim, University of Texas At Arlington, Arlington, TX, United States, Tianheng Zhang, Chongqing University of technology, Chongqing, China*

## WEDNESDAY, AUGUST, 21

## PTG-5

### GEAR MANUFACTURING

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#### Session PTG-5-2

##### Gear Manufacturing II

**Monterey 8:00AM–9:40AM**

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Session Organizer: **Datong Qin**, Chongqing University, Chongqing, China

Session Co-Organizer: **Michael Handschuh**, The Ohio State University, Columbus, OH, United States

**8:00AM Influence of key system errors of hot forging on gear accuracy of non-circular spur bevel gear**  
Technical Presentation. IDETC2019-97066

*Lin Hua, Wuhao Zhuang, Xinghui Han, Wuhan University of Technology, Wuhan, China*

**8:20AM Deformation Mechanism of the Tooth Material Filling for Precision Forging of Spur Gears**  
Technical Paper Publication. IDETC2019-97598

*Wei Feng, Mengjuan Zhou, Ling Mao, Hang Zhang, Wuhan University of Technology, Wuhan, China*

**8:40AM Stylization for Gear Tooth Surfaces with Different Machining Processes using Graphic Analysis**  
Technical Paper Publication. IDETC2019-97776

*Junichi Hongu, Hiroki Noborio, Takao Koide, Atsutaka Tamura, Tottori-Univ., Tottori, Japan*

**9:00AM A New Large-Size Involute Artifact**  
Technical Presentation. IDETC2019-97206

*Hongfang Chen, Baoshan Li, Zhaoyao Shi, Beijing University of Technology, Beijing, China, Huakun Xie, Chengdu Tool Research Institute, Chengdu, China*

# Technical Sessions

**9:20AM** Precision Evaluation for Cycloidal Gears  
Technical Paper Publication. IDETC2019-97327

*Yi-Pei Shih, Shih-Hung Lo, Bor-Tyng Sheen, National Taiwan University of Science and Technology, Taipei, Taiwan, Yi-Hung Tsai, HIWIN Technologies Corp., Taichung, Taiwan*

**PTG-8**  
**TRANSMISSION SYSTEMS INCLUDING NOVEL CONCEPTS**  
Session PTG-8-1  
Transmission Systems Including Novel Concepts I  
**Monterey 10:00AM–11:40AM**

Session Organizer: **Zhaoyao Shi**, *Beijing University of Technology, Beijing, China*  
Session Co-Organizer: **David Talbot**, *The Ohio State University, Columbus, OH, United States*

**10:00AM** RESEARCH ON DRIVING STYLE CLASSIFICATION FOR SHIFT SCHEDULE OF DUAL CLUTCH TRANSMISSION  
Technical Paper Publication. IDETC2019-97743

*Yonggang Liu, Jiming Wang, Pan Zhao, Dongye Sun, Yang Yang, Datong Qin, Chongqing University, Chongqing, China*

**10:20AM** Design of an Electric Motor Transmission System Without Friction Synchronization  
Technical Paper Publication. IDETC2019-97648

*Abdulmohsen Alowayed, Diarny Fernandes, Eric Jeunehomme, Siyang Liu, Zhishen Wang, Illina Yang, Daniel Dorsch, Amos G. Winter, V, Massachusetts Institute of Technology, Cambridge, MA, United States*

**10:40AM** Pericyclic Gearbox For Roving Application  
Technical Presentation. IDETC2019-97120

*Zachary Cameron, NASA, Cleveland, OH, United States, Timothy Krantz, NASA Glenn Research Center, Cleveland, OH, United States*

**11:00AM** Loaded Tooth Contact Pattern Analysis for Strain Wave Gear with Non-Elliptical Wave Generator  
Technical Paper Publication. IDETC2019-97464

*Zhiyuan Yu, Pennsylvania State University, Erie, PA, United States*

**11:20AM** Real-Time Optimal Control of the Gearshift schedule for Dual Clutch Transmissions  
Technical Paper Publication. IDETC2019-97787

*Yonggang Liu, Yougang Wan, Kunyu Yang, Datong Qin, Minghui Hu, Chongqing University, Chongqing, China*

**PTG-8**  
**TRANSMISSION SYSTEMS INCLUDING NOVEL CONCEPTS**  
Session PTG-8-2  
Transmission Systems Including Novel Concepts II  
**Monterey 1:15PM–2:55PM**

Session Organizer: **Timothy Krantz**, *NASA Glenn Research Center, Cleveland, OH, United States*  
Session Co-Organizer: **David Talbot**, *The Ohio State University, Columbus, OH, United States*

**1:15PM** Torsional stiffness model of an industrial robotic joint using fractal theory  
Technical Paper Publication. IDETC2019-97035

*Jingjing Xu, Beijing University of Technology, Beijing, China, Zhifeng Liu, CAD Centre, Beijing Univ of Technology, Beijing, Yongsheng Zhao, Qiang Cheng, Yanhu Pei, Congbin Yang, Beijing University of Technology, Beijing, China*

**1:48pm** Development of a Novel 2-speed Dedicated Electric Transmission (2DET) for Electric Passengers Vehicles  
Technical Presentation. IDETC2019-98236

*Xiangyang Xu, Xiaoxiao Wu, Peng Dong, Junbin Lai, Beihang University, Beijing, Beijing, China*

**2:21pm** Hypocycloid Gear Mechanism Versus Slider-Crank Mechanism in Engines  
Technical Paper Publication. IDETC2019-97802

*Mostafa ElBahloul, ELSayed Aziz, Constantin Chassapis, Stevens Institute of Technology, Hoboken, NJ, United States*

**MESA 2019 - 15th IEEE/ASME International Conference on Mechatronic and Embedded Systems and Applications**  
**MONDAY, AUGUST, 19**

**MESA-2**  
**BIO-INSPIRED ROBOTICS AND SOFT ROBOTICS**  
Session MESA-2-1  
Bio-Inspired Robotics and Soft Robotics  
**San Clemente 9:10AM–10:30AM**

Session Organizer: **Chris Pretty**, *University of Canterbury, Christchurch, New Zealand*



# Technical Sessions

**9:10AM**            **Dynamical Modelling and Control of Snake-like Motion in Vertical Plane for Locomotion in Unstructured Environments**  
Technical Paper Publication. IDETC2019-97227

*Mohammadali Javaheri Koopaee, University of Canterbury, Christ Church, New Zealand, Chris Pretty, University of Canterbury, Christchurch, New Zealand, Koen Classens, University of Eindhoven, Eindhoven, Netherlands, Xiaoqi Chen, Univ of Canterbury, Christchurch, New Zealand*

**9:36AM**            **ANALYSIS OF A MULTIBODY ELASTODYNAMIC MODEL FOR CLOSED-LOOP KINEMATIC MECHANISMS**  
Technical Paper Publication. IDETC2019-97901

*Matteo C. Palpacelli, Luca Carbonari, Stefano Brillarelli, Massimo Callegari, Polytechnic University of Marche, Ancona, Italy*

**10:02AM**            **Computer Vision-Based Object Recognition and Automatic Pneumatic Soft Gripping**  
Technical Paper Publication. IDETC2019-97976

*Ebrahim Shahabi, Wei-Hao Lu, Po Ting Lin, National Taiwan University of Science and Technology, Taipei, Taiwan, Chin-Hsing Kuo, University of Wollongong, NSW 2522, Australia*

## **MESA-9** **MECHATRONICS AND INDUSTRY 4.0**

**Session MESA-9-1**  
**Mechatronics and Industry 4.0**  
**Palos Verdes A 9:10AM–10:30AM**

Session Organizer: **Tapio Heikkilä**, VTT Technical Research Centre of Finland, Oulu, OO, Finland  
Session Co-Organizer: **Emanuele Frontoni**, Università Politecnica delle Marche, Ancona, Italy, Italy

**9:10AM**            **Heuristic approach for warehouse resources and production planning optimization: an industry case study**  
Technical Paper Publication. IDETC2019-97768

*Roberto Rosetti, Università Politecnica delle Marche, Ancona, Italy, Italy, Mirco Sturari, Università Politecnica delle Marche, Dipartimento di Ingegneria dell' Informazione, Ancona, Italy, Italy, Emanuele Frontoni, Università Politecnica delle Marche, Ancona, Italy, Italy, Jelena Loncarski, Department of Engineering Sciences, Division of Electricity, Uppsala University, Uppsala, Ancona, Sweden, Anselmo Cicchitti, Enrico Iavazzo, Diego Gualtieri, Fameccanica.Data SPA, Pescara, Italy, Italy*

**9:36AM**            **An event based machine learning framework for predictive maintenance in Industry 4.0**  
Technical Paper Publication. IDETC2019-97917

*Matteo Calabrese, Martin Cimmino, Martina Manfrin, ACCENTURE, Milan, Italy, Francesca Fiume, Accenture, 20154, Italy, Dimos Kapetis, Accenture, Milan, Italy, Maura Mengoni, Silvia Ceccacci, Emanuele Frontoni, Marina Paolanti, Università Politecnica delle Marche, Ancona, Italy, Alberto Carrotta, Giuseppe Toscano, Biesse Group, Pesaro, Italy*

**10:02AM**            **On-line programming of robot skills**  
Technical Paper Publication. IDETC2019-97958

*Tapio Heikkilä, Janne Saukkoriipi, VTT Technical Research Centre of Finland, Oulu, OO, Finland, Jari Ahola, VTT Technical Research Centre of Finland Ltd, Oulu, OO, Finland, Tuomas Seppälä, VTT Technical Research Centre of Finland, Oulu, Finland*

## **MESA-4** **MECHATRONIC AND EMBEDDED SYSTEMS FOR AGRICULTURE 4.0**

**Session MESA-4-1**  
**Mechatronic and Embedded Systems for Agriculture 4.0**  
**San Clemente 10:50AM–12:10PM**

Session Organizer: **Abhijit Nagchaudhuri**, Univ Of Maryland Eastern Shore, Princess Anne, MD, United States  
Session Co-Organizer: **Manoj Karkee**, Washington State University, Prosser, WA, United States

**10:50AM**            **Deep Learning Automatic Inspections of Mushroom Substrate Packaging for PP-bag Cultivations**  
Technical Paper Publication. IDETC2019-97011

*Rong-yuan Jou, National Formosa Univ, Yuulin 632, Taiwan, Tseng-Wei Li, National Formosa University, Huwei/Yunlin, Taiwan*

**11:10AM**            **A Novel Fruit Removal Mechanism for an Olive Harvester**  
Technical Presentation. IDETC2019-97093

*Taymaz Homayouni, University of California Merced, Merced, CA, United States, Arash Mohammadi Toudeshki, University of California Merced, Merced, CA, United States, Reza Ehsani, University of California Merced, Merced, CA, United States*

**11:30AM**            **OVERVIEW OF REMOTE SENSING EFFORTS AT UNIVERSITY OF MARYLAND EASTERN SHORE**  
Technical Paper Publication. IDETC2019-98457

*Abhijit Nagchaudhuri, Univ Of Maryland Eastern Shore, Princess Anne, MD, United States, Travis Ford, Christopher Hartman, University of Maryland Eastern Shore, Princess Anne, MD, United States*

# Technical Sessions

**11:50AM** Design and development of a 5R 2DOF parallel robot arm for handling paper pot seedlings in a vegetable transplanter  
Technical Presentation. IDETC2019-98177

*Vikas Paradkar, Rahul Sundaram, Hifjur Raheman, Indian Institute of Technology, Kharagpur, Kharagpur, West Bengal, India*

## MESA-5

### DISTURBANCE REJECTION CONTROL

Session MESA-5-1

Disturbance Rejection Control

**Palos Verdes A 10:50AM–12:10PM**

Session Organizer: **Mingwei Sun**, Nankai University, Tianjin, China  
Session Co-Organizer: **Jin Tao**, Aalto University, Espoo, Finland

**10:50AM** On External Disturbance Rejection of Linear ADRC  
Technical Paper Publication. IDETC2019-97831

*Huiyu Jin, Xiamen University, Xiamen, Fujian Province, China, Yang Chen, Weiyao Lan, Xiamen University, Xiamen, China*

**11:30AM** Frequency Response Analysis of Macro-micro Stages with Active Disturbance Reject Controller  
Technical Paper Publication. IDETC2019-98352

*Danping Zeng, Ruirui Huang, Guangdong University of Technology, Guangzhou, Guangdong, China, Zhijun Yang, Guangdong Provincial Key Laboratory of Micro-Nano Manufacturing Technology and Equipment, Guangzhou, China, Wenchao Xue, Amss, Chinese Academy of Sciences, Beijing, Beijing*

## MESA-1

### ARTIFICIAL INTELLIGENCE AND EMERGING TECHNOLOGIES FOR MECHATRONICS AND EMBEDDED SYSTEMS

Session MESA-1-1

Artificial Intelligence and Emerging Technologies for Mechatronics and Embedded Systems

**San Clemente 4:10PM–5:50PM**

Session Organizer: **Ching-Yuan Chang**, National Taipei University of Technology, Taipei, Taiwan  
Session Co-Organizer: **YangQuan Chen**, Univ of California Merced, Merced, CA, United States

**4:10PM** Embedded RIOTS - Model Predictive Control Towards Edge  
Technical Paper Publication. IDETC2019-97046

*Jairo Viola, Sina Dehghan, YangQuan Chen, Univ of California Merced, Merced, CA, United States*

**4:30PM** CONTACTLESS LI-ION BATTERY VOLTAGE DETECTION BY USING WALABOT AND MACHINE LEARNING  
Technical Paper Publication. IDETC2019-97668

*Yanan Wang, Beijing Institute of Technology, Beijing, China, Haoyu Niu, Tiebiao Zhao, University of California, Merced, Merced, CA, United States, Lei Dong, Xiaozhong Liao, Beijing Institute of Technology, Beijing, China, YangQuan Chen, Univ of California Merced, Merced, CA, United States*

**4:50PM** An embedded Machine-Vision System for the Real-time Measurement of Necking Effect and Mechanical Fracture  
Technical Presentation. IDETC2019-97700

*Ching-Yuan Chang, Wen-Chun Tseng, Hui-En Lin, National Taipei University of Technology, Taipei, Taiwan*

**5:10PM** Augmented Microscopy for DNA Damage Quantification: a Machine Learning Tool for Environmental, Medical and Health Sciences  
Technical Paper Publication. IDETC2019-97902

*Michele Bernardini, Alessandro Ferri, Lucia Migliorelli, Università Politecnica delle Marche, Ancona, Italy, Sara Moccia, Polytechnic University of Marche, Ancona, Italy, Luca Romeo, Sonia Silvestri, Luca Tiano, Adriano Mancini, Università Politecnica delle Marche, Ancona, Italy*

**5:30PM** Preventive maintenance of blanking molds by using embedded piezoelectric films and support vector machine  
Technical Presentation. IDETC2019-98192

*Ching-Yuan Chang, Tsung-Han Huang, Tzu-Chun Chung, National Taipei University of Technology, Taipei, Taiwan*

## MESA-11

### SENSORS AND ACTUATORS

Session MESA-11-1

Sensors and Actuators

**Palos Verdes A 4:10PM–5:50PM**

Session Organizer: **Ja Choon Koo**, Sungkyunkwan University, Suwon, Korea (Republic)

**4:10PM** Design of Multi-DOF Spherical Piezoelectric Motor Using Electrode Configuration Based Actuating Units  
Technical Paper Publication. IDETC2019-97116

*Chi-Ying Lin, National Taiwan University of Science and Technology, Taipei, Taipei, Taiwan, Yu-Ting Sung, Compal Electronics, Inc., Taipei, Taiwan, Yu-Hsi Huang, National Taiwan University, Taipei, Taiwan*

**4:30PM** Design of Acceleration Observers to Compensate for Low-Frequency Response of Piezoelectric Accelerometers  
Technical Presentation. IDETC2019-97852

*Yu-Sheng Lu, Po-Chen Lee, National Taiwan Normal University, Taipei, Taiwan*

# Technical Sessions

## 4:50PM ENERGY OPTIMAL CONTROL OF DIELECTRIC ELASTOMER ACTUATORS VIA ADAPTIVE DYNAMIC PROGRAMMING

Technical Paper Publication. IDETC2019-98156

*Paolo Roberto Massenio, Polytechnic University of Bari, Bari, Bari, Italy, Gianluca Rizzello, Department of Engineering and Department of Material Science and Engineering, Saarland University, Saarbrücken, Germany, David Naso, Department of Electrical and Information Engineering, Polytechnic University of Bari, Bari, Italy*

## 5:10PM Development of an Assist-as-need Controller for an Upper-limb Exoskeleton with Voluntary Torque Estimate

Technical Paper Publication. IDETC2019-98297

*Logan Chatfield, Benjamin Fortune, Lachlan McKenzie, Chris Pretty, University of Canterbury, Christchurch, Canterbury, New Zealand*

## 5:30PM Electrode-Skin Impedance Component Estimation in the Time-Domain

Technical Paper Publication. IDETC2019-98298

*Benjamin Fortune, Lachlan McKenzie, Logan Chatfield, Chris Pretty, University of Canterbury, Christchurch, Canterbury, New Zealand*

## TUESDAY, AUGUST, 20

### MESA-13 MICRO-/NANO-MANIPULATION TECHNOLOGIES AND APPLICATIONS

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#### Session MESA-13-1

#### Micro-/Nano-Manipulation Technologies and Applications San Clemente 8:00AM–9:00AM

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Session Organizer: **Peng Yan**, Shandong University, Jinan, Shandong, China

Session Co-Organizer: **Zhen Zhang**, Tsinghua University, Beijing, China

#### 8:00AM Tracking Performance Improvement of Repetitive Controller for Nano-Manipulating Systems with Time Delay

Technical Paper Publication. IDETC2019-97313

*Pengbo Liu, Qilu University of Technology, Jinan, China, Peng Yan, Shandong University, Jinan, Shandong*

#### 8:30AM Development of a Compact and Cost Effective MSL System based on a Compliant Nanomanipulator

Technical Paper Publication. IDETC2019-97522

*Zheng Liu, Zhen Zhang, Tsinghua University, Beijing, China, Yingchun Guan, Beihang University, Beijing, China*

### MESA-15

### UNMANNED VEHICLE TECHNOLOGIES AND APPLICATIONS

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#### Session MESA-15-1

#### Control and optimization techniques

#### Palos Verdes A 8:00AM–9:00AM

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Session Organizer: **Wencen Wu**, San Jose State Univ, San Jose, CA, United States

Session Co-Organizer: **Youmin Zhang**, Mechanical & Industrial Eng, Concordia Univ., Montreal, QC, Canada, **YangQuan Chen**, Univ of California Merced, Merced, CA, United States

#### 8:00AM Neighborhood Optimization Method For Shaping Bode Plot With Larger Phase Margin

Technical Paper Publication. IDETC2019-97288

*Bo Shang, Chengdong Wu, Northeastern University, Shenyang, Liaoning, China, YangQuan Chen, Univ of California Merced, Merced, CA, United States*

#### 8:20AM MULTI-RESOLUTION ENERGY STRATEGY FOR BATTERY MANAGEMENT SYSTEM OF UNMANNED GROUND VEHICLES IN AGRICULTURE

Technical Paper Publication. IDETC2019-97666

*Yanan Wang, Beijing Institute of Technology, Beijing, China, Junwei Tian, Xi'an Technological University, Xi'an, China, Haoyu Niu, University of California, Merced, Merced, CA, United States, Peng Wang, Nanjing Forest Univ, China, Nanjing, China, Xiaozhong Liao, Beijing Institute of Technology, Beijing, China, YangQuan Chen, Univ of California Merced, Merced, CA, United States*

#### 8:40AM A Modular Approach to Level Curve Tracking Using Two Nonholonomic Mobile Robots

Technical Paper Publication. IDETC2019-97665

*Sarthak Chatterjee, Rensselaer Polytechnic Institu, Troy, NY, United States, Wencen Wu, San Jose State Univ, San Jose, CA, United States*

### MESA-7

### EMBEDDED SYSTEMS INFRASTRUCTURE AND THEORY

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#### Session MESA-7-1

#### Embedded Systems Infrastructure and Theory

#### San Clemente 9:10AM–10:30AM

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Session Organizer: **Peter Rössler**, University of Applied Sciences Technikum Wien, Vienna, Vienna, Austria

#### 9:10AM A CLOUD-BASED HEALTHCARE INFRASTRUCTURE FOR NEONATAL INTENSIVE-CARE UNITS

Technical Paper Publication. IDETC2019-97526

*Lucia Migliorelli, Annalisa Cenci, Michele Bernardini, Luca Romeo, Sara Moccia, Primo Zingaretti, Università Politecnica delle Marche, Ancona, Italy*

# Technical Sessions

**9:50AM**                      **CHECKING APPLICATION LEVEL PROPERTIES USING ASSERTION SYNTHESIS**  
Technical Paper Publication. IDETC2019-97950

*Matthias Wenzl, UAS Technikum Wien, Vienna, Austria, Peter Rössler, University of Applied Sciences Technikum Wien, Vienna, Vienna, Austria, Andreas Puhm, UAS Technikum Wien, 1200, Austria*

**MESA-8**  
**EMBEDDED VISION AND AMBIENT INTELLIGENCE**

Session MESA-8-1  
Embedded Vision and Ambient Intelligence

**9:10AM–10:30AM**

Session Organizer: **Marina Paolanti**, *Università Politecnica delle Marche, Ancona, Italy*

**9:10AM**                      **Analysis Of Octree Coding For 3D Point Cloud Frame**  
Technical Paper Publication. IDETC2019-97328

*Pei-Heng Li, Juo-Wei Lin, Yi-Lun Huang, Ting-Lan Lin, National Taipei University of Technology, Taipei, Select State/Province, Taiwan*

**MESA-15**  
**UNMANNED VEHICLE TECHNOLOGIES AND APPLICATIONS**

Session MESA-15-2  
Application techniques  
Palos Verdes A **9:10AM–10:30AM**

Session Organizer: **YangQuan Chen**, *Univ of California Merced, Merced, CA, United States*  
Session Co-Organizer: **Wencen Wu**, *San Jose State Univ, San Jose, CA, United States*, **Youmin Zhang**, *Mechanical & Industrial Eng, Concordia Univ., Montreal, QC, Canada*

**9:10AM**                      **Fire Detection Using Both Infrared and Visual Images with Application to Unmanned Aerial Vehicle Forest Fire Surveillance**  
Technical Paper Publication. IDETC2019-97895

*Youmin Zhang, Mechanical & Industrial Eng, Concordia Univ., Montreal, QC, Canada, Chi Yuan, Zhixiang Liu, Anim Hossain, Concordia University, Montreal, QC, Canada*

**9:30AM**                      **PILOT-INDUCED-OSCILLATIONS ISSUE IN UNMANNED VEHICLES**  
Technical Paper Publication. IDETC2019-97939

*Jie Yuan, Southeast Univ, Nanjing, China, Zhenlong Wu, Tsinghua University, Beijing, China, Shumin Fei, Southeast Univ, Nanjing, China, YangQuan Chen, Univ of California Merced, Merced, CA, United States*

**9:50AM**                      **Smart and autonomous farm field scouting service robot as an edge device under \$1000: Challenges and Opportunities**  
Technical Paper Publication. IDETC2019-98259

*Junwei Tian, Xi'an Technological University, Xi'an, China, Haoyu Niu, University of California, Merced, Merced, CA, United States, Peng Wang, Nanjing Forest Univ, China, Nanjing, China, YangQuan Chen, Univ of California Merced, Merced, CA, United States*

**10:10AM**                      **Smart agricultural in-field service robot: from toy to tool**  
Technical Paper Publication. IDETC2019-97497

*PENG WANG, Nanjing Forestry University, Merced, CA, United States, Junwei Tian, Xi'an Technological University, Xi'an, China, Haoyu Niu, University of California, Merced, Merced, CA, United States, YangQuan Chen, Univ of California Merced, Merced, CA, United States*

**MESA-10**  
**MESA/CIE JOINT SYMPOSIUM: SMART CYBER-PHYSICAL SYSTEMS**

Session MESA-10-1  
Smart Cyber-Physical Systems  
Palos Verdes A **10:50AM–12:10PM**

Session Organizer: **Po Ting Lin**, *National Taiwan University of Science and Technology, Taipei, Taiwan*  
Session Co-Organizer: **Imre Horvath**, *Delft Univ of Technology, Delft 2628 CE, Netherlands*, **Douglas L. Van Bossuyt**, *Naval Postgraduate School, Monterey, CA, United States*, **Yan Wang**, *Georgia Institute of Technology, Atlanta, GA, United States*, **Ting-Lan Lin**, *National Taipei University of Technology, Taipei, Taiwan*

**10:50AM**                      **Study Of Industry 4.0 And Its Impact On Lean Transformation In Aerospace Manufacturing**  
Technical Paper Publication. IDETC2019-98147

*Sagil James, Alejandro Cervantes, California State University Fullerton, Fullerton, CA, United States*

**11:30AM**                      **Data Analysis of Streaming Multivariate Time Series Data for Predictive Maintenance**  
Technical Presentation. IDETC2019-97856

*Chao-Lung Yang, Chin-Hsuan Liang, National Taiwan University of Science and Technology, Taipei, Taipei, Taiwan*

**MESA-12**  
**MECHATRONICS AND EMBEDDED SYSTEMS EDUCATION**

Session MESA-12-1  
Mechatronics and Embedded Systems Education  
**10:50AM–12:10PM**

Session Organizer: **Binsen Qian**, *University of California At Davis, Davis, CA, United States*



# Technical Sessions

## 10:50AM LOW-COST REAL-TIME VISION PLATFORM FOR SPATIAL TEMPERATURE CONTROL RESEARCH EDUCATION DEVELOPMENTS

Technical Paper Publication. IDETC2019-97664

*Jairo Viola*, Univ of California Merced, Merced, CA, United States, *Alberto Radici*, University of California, Merced, MERCED, CA, United States, *Sina Dehghan*, *YangQuan Chen*, Univ of California Merced, Merced, CA, United States

## 11:30AM EXTENDING EDUCATIONAL ROBOT SENSING CAPABILITIES THROUGH EQUIPPING AN EXTERNAL MICROCONTROLLER

Technical Paper Publication. IDETC2019-98470

*Binsen Qian*, University of California At Davis, Davis, CA, United States, *Harry Cheng*, University of California, Davis, Davis, CA, United States

## MESA-14 FRACTIONAL DERIVATIVES AND THEIR APPLICATIONS

### Session MESA-14-3

Applications of fractional calculus in optimizing the way to optimize

**San Clemente 10:50AM–12:10PM**

Session Organizer: **YangQuan Chen**, Univ of California Merced, Merced, CA, United States

Session Co-Organizer: **Yuquan Chen**, University of Science and Technology of China, Hefei, China

## 10:50AM ON THE UNIFIED DESIGN OF ACCELERATED GRADIENT DESCENT

Technical Paper Publication. IDETC2019-97624

*Yuquan Chen*, *Yiheng Wei*, *Yong Wang*, University of Science and Technology of China, Hefei, China, *YangQuan Chen*, Univ of California Merced, Merced, CA, United States

## 11:10AM Fractional-order extreme learning machine with Mittag-Leffler distribution

Technical Paper Publication. IDETC2019-97652

*Haoyu Niu*, University of California, Merced, Merced, CA, United States, *Yuquan Chen*, University of Science and Technology of China, Hefei, China, *YangQuan Chen*, Univ of California Merced, Merced, CA, United States

## 11:30AM IMPROVING CUCKOO SEARCH ALGORITHM WITH MITTAG-LEFFLER DISTRIBUTION

Technical Paper Publication. IDETC2019-97709

*Jiamin Wei*, Beijing Jiaotong Univ, Beijing, China, *YangQuan Chen*, Univ of California Merced, Merced, CA, United States, *Yongguang Yu*, Beijing Jiaotong Univ, Beijing, China, *Yuquan Chen*, University of Science and Technology of China, Hefei, China

## 11:50AM ONLINE IDENTIFICATION OF UNCERTAIN FRACTIONAL-ORDER NONLINEAR SYSTEMS USING A REINFORCED DIFFERENTIAL EVOLUTION OPTIMIZER

Technical Paper Publication. IDETC2019-98254

*Jiamin Wei*, *Yongguang Yu*, Beijing Jiaotong Univ, Beijing, China, *YangQuan Chen*, Univ of California Merced, Merced, CA, United States

## MESA-3 ROBOTICS AND MOBILE MACHINES

### Session MESA-3-1

Robotics and Mobile Machines

**Palos Verdes A 2:10PM–3:50PM**

Session Organizer: **Massimo Callegari**, Polytechnic University of Marche, Ancona, OO, Italy

## 2:10PM Affine ICP for Fine Localization of Smart-AGVs in Smart Factories

Technical Paper Publication. IDETC2019-97418

*Abdurrahman Yilmaz*, *Hakan Temeltas*, Istanbul Technical University, Istanbul, Turkey

## 2:30PM Indoor Testbed For Vector Field Multirobot Adaptive Navigation: Feasibility Study

Technical Paper Publication. IDETC2019-97974

*Danop Rajabhandharaks*, *Robert McDonald*, Santa Clara University, Santa Clara, CA, United States, *Michael Neumann*, Santa Clara University, Oakland, CA, United States, *Christopher Kitts*, Santa Clara University, Burlingame, CA, United States

## 2:50PM Object Detection and Localization of Autonomous Humanoid Robot in Soccer Games

Technical Presentation. IDETC2019-98489

*Chung-Hsien Kuo*, *Ken-Fun Lin*, *Yu-Cheng Kuo*, National Taiwan University of Science and Technology, Taipei, Taiwan

## 3:10PM MECHANICAL DESIGN AND PROTOTYPE OF A RECONFIGURABLE ACTUATED UNIVERSAL JOINT

Technical Paper Publication. IDETC2019-97916

*Matteo C. Palpacelli*, *Luca Carbonari*, *Giacomo Palmieri*, *Massimo Callegari*, Polytechnic University of Marche, Ancona, Italy

## 3:30PM Dual-Arm Manipulators Kinematic Control Under Multiple Constraints via Virtual Joints Approach

Technical Paper Publication. IDETC2019-98048

*Daniele Proietti Pagnotta*, *Alessandro Freddi*, *Sauro Longhi*, Università Politecnica delle Marche, Ancona, Italy, *Andrea Monteriù*, Università Politecnica Delle Marche, Ancona, Italy

# Technical Sessions

## MESA-14

### FRACTIONAL DERIVATIVES AND THEIR APPLICATIONS

#### Session MESA-14-1

##### Theoretical developments in FDTA

**San Clemente 2:10PM–3:50PM**

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Session Organizer: **Yiheng Wei**, University of Science and Technology of China, Hefei, China

Session Co-Organizer: **Riccardo Caponetto**, University of Catania, Catania, CT, Italy, **chunna zhao**, Yunnan University, Kunming, China

#### **2:10PM Formalization of Fractional Flow Component in Higher-order Logic Theorem Proving**

Technical Paper Publication. IDETC2019-97209

*chunna zhao, Mu R. Jiang, Ya Q. Huang*, Yunnan University, Kunming, China

#### **2:30PM Some Fundamental Properties on the Sampling Free Nabla Laplace Transform**

Technical Paper Publication. IDETC2019-97351

*Yiheng Wei, Yuquan Chen, Yong Wang*, University of Science and Technology of China, Hefei, China, *YangQuan Chen*, Univ of California Merced, Merced, CA, United States

#### **2:50PM Renormalization Group Method for Singular Perturbed Systems Driven by Fractional Brownian Motion**

Technical Paper Publication. IDETC2019-98258

*Lihong Guo, Shaoyun Shi*, Jilin University, Changchun, China, *YangQuan Chen*, Univ of California Merced, Merced, CA, United States

#### **3:10PM PERIODIC-DOUBLING BIFURCATION OF A CIRCUIT WITH A FRACTIONAL-ORDER MEMRISTOR**

Technical Paper Publication. IDETC2019-98178

*Yajuan Yu*, Changzhou University, Changzhou, Jiangsu, China, *YangQuan Chen*, Univ of California Merced, Merced, CA, United States

#### **3:30PM Improvement of admissibility of linear singular fractional order systems**

Technical Paper Publication. IDETC2019-98329

*XueFeng Zhang*, Northeastern University, Shenyang, China, *Zhang Yingbo*, Northeastern University, Shen yang, China

## MESA-14

### FRACTIONAL DERIVATIVES AND THEIR APPLICATIONS

#### Session MESA-14-2

##### Applications of fractional calculus in controls

**San Clemente 4:10PM–5:50PM**

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#### **4:10PM Model Predictive Control of General Fractional Order Systems Using a General Purpose Optimal Control Problem Solver, RIOTS**

Technical Paper Publication. IDETC2019-97489

*Sina Dehghan*, Univ of California Merced, Merced, CA, United States, *Tiebiao Zhao*, University of California, Merced, Merced, CA, United States, *YangQuan Chen*, Univ of California Merced, Merced, CA, United States, *Taymaz Homayouni*, University of California Merced, Merced, CA, United States

#### **4:35PM ACTUATOR RATE LIMIT EFFECTS ON PROPORTIONAL-INTEGRAL CONTROLLER FOR FIRST-ORDER PLUS TIME-DELAY SYSTEMS**

Technical Paper Publication. IDETC2019-97662

*Zhenlong Wu*, Tsinghua University, Beijing, China, *Jie Yuan*, Southeast Univ, Nanjing, China, *Donghai Li, Yali Xue*, Tsinghua University, Beijing, China, *YangQuan Chen*, Univ of California Merced, Merced, CA, United States

#### **5:00PM SATISFACTORY OPTIMIZATION DESIGN FOR FRACTIONAL ORDER PID CONTROLLER**

Technical Paper Publication. IDETC2019-98342

*TIANYU LIU, YUANJUN JIA*, University of Science and Technology of China, Hefei, China, *Weidong Jin*, Southwest Jiaotong University, Chengdu, China, *Yong Wang*, University of Science and Technology of China, Hefei, China

#### **5:25PM Chattering-free Finite-time Stability of A Class of Fractional-order Nonlinear Systems**

Technical Paper Publication. IDETC2019-97674

*Bin Wang*, Northwest A&F University, Yangling, China, *YangQuan Chen*, Univ of California Merced, Merced, CA, United States, *Ying Yang*, Northwest A&F University, Yangling, China

## MESA-17

### MECHATRONICS AND EMBEDDED TECHNOLOGIES IN INTELLIGENT TRANSPORTATION SYSTEMS

#### Session MESA-17-1

##### Mechatronics and Embedded Technologies in Intelligent Transportation Systems

**Palos Verdes A 4:10PM–5:50PM**

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Session Organizer: **Primo Zingaretti**, Università Politecnica delle Marche, Ancona, Italy

#### **4:10PM Research On An Intelligent Diagnostic Equipment Suitable For Rail Traffic Braking System**

Technical Paper Publication. IDETC2019-97600

*Changzheng Fang*, CRRC Zhuzhou Locomotive Co.,LTD, Zhuzhou, China, *Jing Yang, Quan Liu*, CRRC Zhuzhou Locomotive Co.,Ltd, Zhuzhou, China, *Furen Feng*, Tongji University, Shanghai, China, *Jianyong Zuo*, Tongji Univ., Shanghai, China

# Technical Sessions

**4:30PM**            **Model-Based Combustion Duration and Ignition Timing Prediction for Combustion Phasing Control of A Spark-Ignition Engine Using In-Cylinder Pressure Sensors**  
Technical Paper Publication. IDETC2019-97703

*Xin Wang, Amir Khameneian, Paul Dice, Bo Chen, Mahdi Shahbakhti, Jeffrey Naber, Michigan Technological University, Houghton, MI, United States, Chad Archer, Qiuping Qu, Chris Glugla, Garlan Huberts, Ford Motor Company, Dearborn, MI, United States*

**4:50PM**            **MPC-BASED CONTROL OF AUTONOMOUS VEHICLES WITH LOCALIZED PATH PLANNING FOR OBSTACLE AVOIDANCE UNDER UNCERTAINTIES**  
Technical Paper Publication. IDETC2019-97712

*Sai Rajeev Devaragudi, Bo Chen, Michigan Technological University, Houghton, MI, United States*

**5:10PM**            **A Cloud Computing Architecture to Map Trawling Activities using Positioning Data**  
Technical Paper Publication. IDETC2019-97779

*Alessandro Galdelli, Adriano Mancini, Università Politecnica delle Marche, Ancona, AN, Italy, Anna N. Tassetti, Carmen Ferrà Vega, Enrico Armelloni, Giuseppe Scarcella, Gianna Fabi, Institute of Marine Biological Resources and Biotechnologies - National Research Council, Ancona, AN, Italy, Primo Zingaretti, Università Politecnica delle Marche, Ancona, Italy*

**5:30PM**            **MODEL ORDER REDUCTION VIA NON INTEGER ORDER SYSTEMS**  
Technical Presentation. IDETC2019-98349

*Riccardo Caponetto, Emanuele Murgano, University of Catania, Catania, Italy*