Track-1 Acoustics, Vibration, and Phononics

Topic

1-1 Phononic Crystals and Metamaterials

Description

This symposium, which will be in its 15th year in 2019, will bring together researchers and engineers from universities, government laboratories and industry to discuss research ideas and recent findings in Phononic Crystals and Acoustic/Elastic Metamaterials with applications in wave guidance, sound focusing, imaging, thermal transport, flow control, and noise/vibration control based on interferences, resonances and possibly other phenomena. Topics solicited include, but are not limited to, elastic/acoustic wave propagation phenomena such as band-gap formation, waveguides, negative refraction, effects of nonlinearity/damping, homogenization, topological and non-reciprocal phononics, flow control, and nanoscale thermal transport.

NCAD is also sponsoring a “Best Student Paper Award”. The winners will be announced at NCAD’s Wine & Cheese reception at the IMECE Conference (Time and location to be announced in the final program). The top 3 winners will receive an acknowledgement certificate and a monetary award. To be eligible for participation in the competition, the primary author of the paper must be a student and must present at the conference. To participate, please send an e-mail to Haijun Liu (liuhj@temple.edu) with the following information no later than August 31st, 2019: (1) Student Name and Affiliation, (2) IMECE2018 Paper Number, and (3) Advisor Name.

1-2 Passive, Semi-Active, and Active Noise Control

Description

The Structural-Acoustics Committee of the Noise Control and Acoustics Division (NCAD) is sponsoring a Symposium on Passive, Semi-Active, and Active Noise Control. This symposium seeks research and application of airborne, fluid-borne, and structure-borne noise control methods through the use of passive, semi-active, and active techniques. Investigations may be experimental, theoretical, or numerical in nature and can address efforts to identify and control unwanted sound and vibration. Areas of interest include the reduction of low amplitude sound and vibration, the design of power dense actuators for active control applications, sound barriers, enclosures, mufflers, isolators, or more general work on vibration damping, or absorptive materials. Industrial experiences related to these areas are of particular interest.

NCAD is also sponsoring a “Best Student Paper Award”. The winners will be announced at NCAD’s Wine & Cheese reception at the IMECE Conference (Time and location to be announced in the final program). The top 3 winners will receive an acknowledgement certificate and a monetary award. To be eligible for participation in the competition, the primary author of the paper must be a student and must present at the conference. To participate, please send an e-mail to Haijun Liu (liuhj@temple.edu) with the following information no later than August 31st, 2019: (1) Student Name and Affiliation, (2) IMECE2018 Paper Number, and (3) Advisor Name.

1-3 Computational Acoustics

Description

The Structural-Acoustics Committee of the Noise Control and Acoustics Division (NCAD) is sponsoring a Symposium on Computational Vibroacoustics. This symposium seeks research and application of computational methods to predict the vibroacoustic response of structures and fluids subjected to mechanical and acoustic excitations. Areas of interest include computational predictive methods for low, mid and high frequency regimes, model reduction methods, noise control feature modeling and methods for addressing uncertainties in the analysis (such as excitation, material, or geometric uncertainties). Experimental validation of proposed methods and practical applications to multi-disciplinary areas are especially of interest, such as in noise and vibration control, transportation, bio-medical, electro-mechanical products and energy production.

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information no later than August 31st, 2019: (1) Student Name and Affiliation, (2) IMECE2018 Paper Number, and (3) Advisor Name.

1-4 Structural-Acoustic System Identification

Description
The Structural Acoustics Committee of the Noise Control and Acoustics Division (NCAD) is sponsoring a symposium on Structural-Acoustic System Identification. The goal of this symposium is to provide a forum for exchange of current practices, research and developments, and future trends and directions in the board area of structural-acoustic system identification and its application in structural health monitoring and controls. This symposium will also foster cross-disciplinary interactions and collaborations to seek for cutting edge solutions that can improve current detection, diagnostic, and prognostic techniques used in many applications. Topics of interests include, but not limited to the following areas:

- Novel testing, signal processing, and identification techniques for source identification and localization and noise-path identification.
- Nondestructive evaluation of material properties and damage assessment based on acoustic and vibration approaches.
- Development and application of novel acoustic testing techniques, advanced diagnostic methods, and test facilities.
- Application of system identification techniques in vibration and noise control.
- Structural health monitoring with emphasis on novel design and implementation of sensors and actuators, signal processing, and performance enhancement.

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1-5 Noise, Vibration and Harshness in Automotive Systems

Description
The Structural Acoustics Committee of the Noise Control and Acoustics Division (NCAD) is sponsoring a Symposium on Noise, Vibration and Harshness in Automotive Systems. This symposium is dedicated to noise, vibration and psychoacoustics, i.e. subjective/objective noise and vibration harshness, in automotive systems. The session is a platform for leading professionals from passenger and commercial vehicle industries as well as academia to meet and share their latest state-of-the art research and findings. This session covers various topics on automotive noise/vibration ranging from understanding the fundamentals of noise and vibration generation and propagation/transmission mechanisms in automotive systems to developing empirical and virtual models to predict noise and vibration in automotive systems. Studies on novel subsystems and materials developed for active and passive noise/vibration control can also be considered.

Different topics considered in this session include but not limited to:

- Experimental, numerical and analytical methods and techniques for studying noise/vibration generation
- Sound propagation and vibration transmission modeling and identification

- Passive and active noise/vibration control techniques in automotive systems
- Novel and cost-efficient lightweight noise/vibration control materials; e.g. hyperdampers, metamaterials, etc
- Energy harvesting in automotive systems
- Noise and vibration measurement techniques in automotive systems
- Ride comfort modeling and analysis and psychoacoustics
- Subjective and objective rating/evaluation of ride comfort and noise perception
- Automotive system level and subsystem level NVH simulation, e.g. FEA, aeroacoustics, vibroacoustics, CFD etc
- NVH for high performance cars, sports cars and electric vehicles

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1-6 Vibration and Acoustic Measurements, Signal Processing, and Test Facilities

Description

The Aero/Hydro Acoustics Committee of the Noise Control and Acoustics Division (NCAD) is sponsoring a Symposium on Vibration and Acoustic Measurements, Signal Processing, and Test Facilities. This symposium is intended to bring together engineers and researchers from industry, government laboratories, and universities to discuss ideas related to measurement techniques, signal processing, and test facilities for flow-induced vibration and acoustics. Technical papers and presentations dealing with aspects of vibration and acoustics testing are invited. Topics include, but are not limited to, experimental methods and tools for measuring sound and vibration such as laser vibrometry and velocimetry, array-based techniques, acoustic holography, inverse methods, acoustic intensity, sensor development, anechoic and reverberant methods, wind and water tunnels, imaging and velocimetry, and modal methods. Papers and presentations on new developments in measurement techniques and facilities, even as applied to specific problems, are of special interest.

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1-7 Aero-Acoustics and Sound Propagation

Description

The Aero/Hydro Acoustics Committee of the Noise Control and Acoustics Division (NCAD) is sponsoring a symposium on aero-acoustics and sound propagation. Areas of interest include: aero- acoustic source modeling and sound propagation in turbulent flow and turbulent boundary layer, effects of wind shear and vortical flow on sound propagation, aircraft noise propagation in the atmosphere, sonic boom, acoustic sensor performance under the outdoor environment, acoustic propagation at the interface of air and porous media, community noise, and noise annoyance and control. In addition, due to the recent resurging of alternative energy industry such as nuclear power plants and wind turbines, the related noise generation, propagation, and its environmental and health impacts are of a great interest to this

symposium. The symposium seeks recent contributions of both basic and applied research in these areas. These studies may be experimental, theoretical, or numerical in nature. Industrial experiences related to these areas are also of interest.

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1-8 Flow-Induced Noise and Vibration

Description
The Aero/Hydro Acoustics Committee of the Noise Control and Acoustics Division (NCAD) is sponsoring a Symposium on Flow Induced Noise and Vibration. The symposium seeks research and industry experiences on flow noise and vibration. Research studies may be experimental, theoretical, or numerical in nature and can address efforts to understand noise and vibration mechanisms and/or methods to control or reduce noise. Industrial experiences related to flow induced noise and vibration are also of particular interest. Areas of interest include noise and vibration caused by fluid flow, which may include basic research, applied research, theoretical studies from fluid flow, which can be from any type of fluid including air, water, steam, refrigerants, and gasses. Fields of study may include basic research or flow induced vibration from leakage flows, aircraft, power plants, automobiles, submersible vehicles, heat exchangers, valves, and internal or external discontinuities.

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1-9 Turbomachinery Noise

Description
The Aero/Hydro Acoustics Committee of the Noise Control and Acoustics Division (NCAD) is sponsoring a Symposium on Turbomachinery Noise. This focuses on a large segment of noise including jet, turbomachinery, propeller, pump, air and hydro turbines, and fans. Vehicles include all forms of air, land or sea transportation and commerce. Noise produced by all types of turbomachinery, e.g. centrifugal, mixed, and radial, are of interest. The symposium seeks basic and applied research contributions in these areas of flow noise. Research studies may be experimental, theoretical, or numerical in nature and can address efforts to understand noise mechanisms and/or methods to control or reduce noise. Industrial experiences related to these flow noise areas are also of particular interest.

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1-10 Human Perception of Acoustics

Description
The Noise Control and Acoustics Division (NCAD) is sponsoring a symposium on human perception of acoustics. This symposium is intended to bring together researchers and engineers from various disciplines to discuss ideas related to the scientific study of human perception of sound (e.g. loudness, noise, pitch, and source location), and how the study leads to enhanced fundamental understanding and/or improved engineered hearing devices/systems. Studies can be experimental, numerical, or theoretical in nature. Topics of

interest include but are not limited to wave propagation in hearing animals and organs, auditory signal processing, noise detection, cancellation, and mitigation, sound localization and separation, speech recognition, and biomimetic hearing devices.

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1-11 In-Situ Sound Measurement

Description
The Noise Control and Acoustics Division (NCAD) is sponsoring a symposium on In-situ Sound Measurement. Technical papers and presentations are sought from researchers and practitioners dealing with all aspects of the acquisition and processing of sound in uncontrolled or nonideal acoustic environments. Topics include, but are not limited to, accounting for reverberant boundaries in propagation prediction in far field and reconstruction in near-field; quantification of the effects of microphone or hydrophone placement, spacing, sensor array deformation and aperture; modeling of the boundaries of realistic barriers and enclosures with finite acoustic impedance; and the numerical solution for sound fields generated by targeted sound sources in the presence of reflections and interfering sources.

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1-12 Congress-Wide Symposium on NDE & SHM: Ultrasonic Waves for Material Characterization and Damage Assessment

Description
The Noise Control and Acoustics Division (NCAD) is sponsoring a congress-wide symposium on NDE & SHM: ultrasonic waves for material characterization and damage assessment. This symposium seeks research and application of ultrasonic waves to characterize materials and assess damage. Investigations may be theoretical, numerical and experimental in nature and can address efforts to conduct NDE and SHM. Topics of interest include but are not limited to NDE and SHM using ultrasonic waves, innovative instrumentation, signal processing, ultrasonic wave imaging, modeling and testing, composite materials damage assessment, industrial and biomedical applications.

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1-13 Congress-Wide Symposium on NDE & SHM: Computational Nondestructive Evaluation and Structural Health Monitoring

Description
The Noise Control and Acoustics Division (NCAD) is sponsoring a congress-wide symposium on NDE &SHM: computational nondestructive evaluation and structural health monitoring. This symposium seeks research and application of computational nondestructive evaluation and structural health monitoring. Topics of interest include but are not limited to laser ultrasonics, nonlinear phenomena, ultrafast processes, phonons interaction with particles and excitations, signal processing, material characterization, structural health assessment, industrial and biomedical application simulations, and advanced imaging methods.

NCAD is also sponsoring a “Best Student Paper Award”. The winners will be announced at NCAD’s Wine & Cheese reception at the IMECE Conference (Time and location to be announced in the final program). The top 3 winners will receive an acknowledgement certificate and a monetary award. To be eligible for participation in the competition, the primary author of the paper must be a student and must present at the conference. To participate, please send an e-mail to Haijun Liu (liuhj@temple.edu) with the following information no later than August 31st, 2019: (1) Student Name and Affiliation, (2) IMECE2018 Paper Number, and (3) Advisor Name.

Total Topics: 13

Track-2 Advanced Manufacturing

Topic

2-1 Advanced Manufacturing Plenary Speakers (by invitation)

Description
This topic will consist of an over view of current and future trends in manufacturing science and engineering the objective of highlighting potential research and funding opportunities. Topic may include: Changes to government funding Government, Industry, Academic collaboration Future restraints and opportunities, and regulations for manufacturing Laser-based manufacturing Machines and robots in manufacturing Multiscale Manufacturing New trends in manufacturing for the biomedical industry Cloud based manufacturing Adaptation and future developments in traditional manufacturing Manufacturing for X

2-2 Conference-Wide Symposium on Additive Manufacturing

Description
Researchers from industry, academia and government are encouraged to submit an Abstract for the 2019 ASME IMECE’s Congress Wide Symposium on Additive Manufacturing, which is part of Track 2: Advanced Manufacturing. Abstracts for either a Technical Presentation or a Peer-Reviewed Conference Paper are welcome. The Symposium will provide a forum to discuss the latest developments and challenges in the field of additive manufacturing (AM) and 3D printing of metals, ceramics, plastics, biomaterials, composites, and nanocomposites.

Topics of interest include, but are not limited to:

- Design and optimization of AM materials and parts
- Development of existing AM processes (e.g., 3D Printing, electrospinning, surface texturing)
- New/hybrid AM processes (e.g., 4D Printing)
- Programmable and shape memory parts
- Internet of Things (IoT) frameworks to design, fabricate, and assemble
- Fatigue, fracture, or mechanical analysis of AM parts
- Microstructure-property relationships of AM materials
- Composites and multi-functional constructs
- Architectural, medical, or optical applications of AM
- Process inspection and quality control

2-3 Measurement Science, Sensors, Non-destructive Evaluation (NDE) and Process Control for Advanced Manufacturing

Description
Measurement science, sensors, non-destructive evaluation (NDE) and process control are permeating throughout all the stages of design, in-process and postprocessing in advanced manufacturing. These pillar technologies are playing increasingly critical roles in process optimization, part quality assurance and operation safety with the ongoing manufacturing process innovations, especially with the advancement of additive manufacturing. In these sessions, recent progress will be presented on the development of novel or enhanced metrology, sensing, measurement systems and characterization techniques (e.g., NDE) for advanced manufacturing processes and materials. Accompanied advances in multi-physics big

data analytics for sensors and measurement data analysis will also be reported to monitor the manufacturing processes and to measure the part properties. Meanwhile, with the emergence of digital manufacturing, it is critical to close the digital loop of fabricating parts by advanced control technologies with the developed sensors, instrumentation systems and NDE methods providing all these essential materials lifecycle assessments. Members of academia, government labs, and industry are encouraged to submit their research in areas such as:Sensor or measurement systems or NDE methods (in-situ / real-time / offline / network, etc.) that enable novel or enhanced ability to inspect machines, monitor processes, characterize materials or evaluate parts

- Sensing / Measuring / NDE of additively manufactured parts
- Data-driven analytics to enable sensor/measurement/NDE methods
- Sensors / Measurement / NDE data based or assisted process dynamics modeling / planning / optimization
- Closed-loop process control
- Digital Manufacturing Threads integrating sensors, measurement instrument, NDE and control system

2-4 Nanomanufacturing: Novel Processes, Applications, and Process-Property Relationships

Description
Nanoscale materials have engineering properties with potentially disruptive performance metrics. The manufacture of nanoscale materials and their integration into engineering systems is a significant challenge and is at the heart of nanomanufacturing efforts. Large-scale and repeatable production of nanoscale materials, nanoscale assemblies, and nanostructures demands complex fabrication, simulation, and characterization processes. This Nanomanufacturing symposium will encompass experimental, numerical, and theoretical work leading to improved, efficient processing and manufacturing methods from the sub-micron to the angstrom dimensional scale. Contributions are sought from industry, government labs, and academia in areas including: Top-down control of bottom-up processing methods for nanoscale coatings, films, layered materials, and composites Self-assembly methods to create 3-D devices or structures from nanoscale constituent materials Synthesis and assembly of atomically-thin 2D materials and systems Additive and subtractive manufacturing of nanoscale materials Heuristic modeling of nanoscale processes Data-enabled design of nanostructures Scalable fabrication and large-area integration of nanomaterials

2-5 Advanced Machining and Finishing Processes

Description
Advanced machining and finishing processes are extensively used in automotive, aerospace and biomedical industries to manufacture complex three dimensional (3D) parts with high accuracy, surface finish and tolerance. This symposium focuses on the state-of-the-art research on macro-, micro-, and nano scale advanced machining and finishing processes and their applications. Both conventional and non-conventional machining processes are included in the scope of the symposium. Experimental investigation, analytical modeling and numerical simulations in the areas of machining and finishing processes are of interest. Process development, monitoring, and control of various machining and finishing processes are of interest. Specific topics of interest include, but are not limited to:

- Conventional machining processes, i.e. turning, milling, grinding etc.
- Non-conventional machining processes, i.e. EDM, ECM, ECDM, AWJM
- Hybrid and/or assistive machining processes
- Surface processing and finishing techniques

2-6 4th Symposium on Fastening, Adhesive bonding, and Welding Technology

Description
Fastening components in the numerous industries remains an on-going challenge requiring knowledge from mechanics and failure analysis, kinematics, and numerous other areas of

engineering and manufacturing for evaluating process quality and production. This topic will explore:

- Mechanical fasteners and joining mechanisms including bolts, rivets, clips, clamps
- Welding processes, including nontraditional methods to join product components including fusion, brazing, soldering, and friction stir welding
- Adhesive bonding for manufacturing and assembly

2-7 Advanced Material Forming - Novel Processes, Mechanics, Characterization, and Control

Description
In these sessions, new work will be presented that will lead to new and improved metal and material forming processes involving mechanics, control, as well as mechanical and microstructural characterization. It is expected that the research presented will utilize theoretical, numerical, and experimental methods to advance the current state of knowledge in material forming at multiple length scales. Members of academia, government labs, and industry are encouraged to submit their research in areas such as:

- Multiscale forming
- Materials characterization
- Rolling and pre-forming
- Sheet metal and tube forming
- Bulk metal forming including forging, wire drawing, and extrusion
- Novel processes including hybrid forming processes
- Warm and Hot forming
- New methods for improving existing processes
- Dynamic testing and crash analysis
- Constitutive modeling
- Process monitoring, optimization, and control
- Tooling and equipment design
- Tool and die wear
- Data Driven Forming 4.0

2-8 Innovative Product and Process Design

Description
As manufacturing systems evolve and become more complex, the need for novel strategies for product design and manufacturing operations, automated data interchange and coordinated seamless knowledge and behavior of large scale manufacturing systems becomes highly critical. Global manufacturing depends on the interoperability of its systems and applications, and to achieve such holistic, adaptive and seamless advanced manufacturing environment there is a need to devise strategies that leverage applied research and technological developments that lead to innovation in product design and manufacturing practices. This topic seeks to bring together novel contributions from researchers and practitioners who are exploring the definition and applicability of Advanced Manufacturing in a global perspective towards Innovative Product Design, putting focus on novel strategies, methods and tools in a research, engineering and technological standpoints. Conceptual, theoretical, empirical and technological contributions are foreseen, illustrated by manufacturing examples and convincingly demonstrating noteworthy novelty in comparison with previously reported results. Objectives Authors and presenters are invited to participate in this event to expand international cooperation, understanding and promotion of efforts and disciplines in the area of Innovative Product Design. Dissemination of knowledge by presenting research results, new developments, and novel concepts in Innovative Product Design will serve as the foundation upon which the conference program of this area will be developed. A variety of topics/sessions are available for presentations as it allows flexibility to the authors. All sessions are quality driven.

2-9 Computational Modeling and Simulation for Advanced Manufacturing

Description
High quality papers and/or presentations are invited to an annual symposium on computational modeling of advanced manufacturing. Cutting-edge work is welcomed for a variety of manufactured materials and parts. It is expected that the research presented will utilize computational methods such as finite elements, finite difference, fluid dynamics, or mesh-free methods to model advanced manufacturing techniques. Members of academia, government labs, and industry are encouraged to submit their research.

2-10 Variation Simulation and Design for Assembly Description

Description
Global competition drives the need for more efficient product realization and at the same time higher product quality. This topic reflects those needs and welcomes contributions within Design for Assembly (DFA), variation simulation, tolerancing, geometry assurance of assemblies and related areas.

Authors and presenters are invited to participate in this event to expand international cooperation, understanding and promotion of efforts and disciplines in the area of Variation Simulation and Design for Assembly. Dissemination of knowledge by presenting research results, new developments, and novel concepts in Variation Simulation and Design for Assembly will serve as the foundation upon which the conference program of this area will be developed.

2-11 Robotics and Automation in Advanced Manufacturing

Description
Authors and presenters are invited to participate in this event to expand international cooperation, understanding and promotion of efforts and disciplines in the area of Robotics & Automation in Advanced Manufacturing. Dissemination of knowledge by presenting research results, new developments, and novel concepts in Robotics & Automation in Advanced Manufacturing will serve as the foundation upon which the conference program of this area will be developed. A variety of topics/sessions are available for presentations as it allows flexibility to the authors. Representative topical areas from the previous year are listed below, however submissions are encouraged in additional areas related to Robotics & Automation in Advanced Manufacturing. All sessions are quality driven.

- Congress-Wide Symposium on Additive Manufacturing: Robotic Additive Manufacturing
  This session explores novel techniques including those related to additive manufacturing of metals and polymers with the use of control and automation to accomplish solid freeform fabrication.
- Manipulators and Interfaces
  This session explores manufacturing cells with inclusion of human-machine interfaces.
- Algorithms and Optimization
  This session explores robotics and automation systems use of algorithms and sensing including integration of machine vision with robotics.

2-12 Laser-Based Advanced Manufacturing and Materials Processing

Description
High energy laser beams are widely used for material processing. This symposium focuses on the advance in the applications of high energy laser beams in advanced manufacturing and material processing. Both fundamental and applied studies are of interest. These include experimental observation, analytical modeling and numerical simulation. Specific topics of interest include (but not limited to):

- Novel laser-based material processing techniques

- Laser-assisted machining processes, laser bending/forming, laser ablation, laser cutting/drilling, laser welding/soldering/brazing
- Laser-based surface modification processes: laser shock peening, laser hardening, laser recrystallization, laser nitriding, laser annealing, laser coating, laser cladding, and laser-assisted deposition

2-13 Digital Manufacturing for Industry 4.0 Applications

Description
Digital manufacturing is an important simulation and validation technology to enable Next Generation Manufacturing Systems. In addition, Industry 4.0 is an important trend integrating intelligent components in a manufacturing domain for competitive advantage. This topic is focused on state-of-the-art research in advanced manufacturing exploring methods and tools implementing digital simulation and virtual validation. Experimental investigation, analytical modeling and numerical simulations in digital manufacturing implementing Industry 4.0 applications are of interest. You can present analysis at the station, cell, shop, factory and/or enterprise level. Specific topics of interest include, but are not limited to:

- Internet of Things
- Digital Twins
- Collaborative Robots
- Cloud Manufacturing
- Virtual Reality in Manufacturing

2-14 General Manufacturing

Description
If an abstract is close to an existing topic area, please submit to that topic for review, even if it is not an exact match. Work suitable for the Advanced Manufacturing track, but not matching any existing topic should be submitted here under the General Manufacturing Topic. Examples could include but are not limited to electronics manufacturing and assembly, improved or new casting methods, fabric, manufacturing using non-traditional materials such as wood.

Total Topics: 14

Track-3 Advances in Aerospace Technology

Topic

3-1 General Aerospace

Description
This topic hosts papers and presentations with high qualities, which are not covered by the following specific topics.

3-2 Advances in Aerodynamics

Description
Advances in aerodynamics accepts works based on computational, experimental and theoretical approaches. Research on internal and external aerodynamic flows is to be presented. More specific topics can include: novel experimental techniques; subsonic to hypersonic flows; unsteady flows, novel approaches for turbulent flow computation; high angle of attack and separated flows; low-Re flows; novel vehicle designs; optimization methods; boundary layer control; multi-physics; plasma and MHD flows in aerospace.

3-3 Novel Aerospace Propulsion Systems

Description
Targets works in propulsion aerodynamics and also on novel propulsion system, namely: propeller/rotorcraft aerodynamics; piston engines advances; distributed propulsion; thrust-vectoring systems; pulse detonation engines; ramjets and scramjets; air breathing propulsion

systems integration; hybrid propulsion and electrical subsystem architecture; space propulsion systems for spacecraft; thrusters for cubesats and large satellites.

3-4 Advances in Aerospace Structures and Materials

Description
The objective of this topic is to seek state-of-the-art research on the design, manufacturing, characterization, and modeling of aerospace materials and structures for next generation vehicles. Specific topics of interest include, but are not limited to: new paradigms of design, development, and fabrication of aerospace materials; manufacturing process models; novel experiments and computational tools for rapid characterization of aerospace structures including those made of polymer matrix composites, textile composites, sandwich composites, ceramic matrix composites, and lightweight alloys; damage, failure, and fatigue modeling of aerospace materials; responses of aerospace materials subjected to extreme environments; topology optimization in design of aerospace materials and structures; composite structure repair; life cycle monitoring of aircraft structures.

3-5 Beam, Plate, and Shell Structures

Description
We are encouraging international researchers from both academia and industry to submit original papers, related to the general area of beam, plates, shells. Theoretical, numerical, and experimental work will be considered for publication. The papers can include the application of these theories in general aerospace structures or theoretical development of these theories.

3-6 Lightweight Sandwich Composites and Layered Structures

Description
Mechanics of Sandwich Composites and Layered Structures including Static and Dynamic Response, Failure Mechanisms, Environmental Effects, Stability, Computational Approaches, Experimental Techniques, etc.

3-7 Dynamic Behavior of Composites

Description
To enhance energy efficiency and reduce greenhouse gas emission, application of composites on aircrafts is a promising solution. To broaden the aerospace applications of composites, it is essential to fully understand the mechanical properties, especially the dynamic behavior of these materials. Manufacturing, characterization, structural health monitoring, and damage analysis of composite materials and structures are the focuses of this topic. We are soliciting numerical and experimental researches on dynamic behavior of composites.

3-8 Dynamics and Control of Aerospace Structures

Description
The objective of this topic is to disseminate research on the dynamics and control of aerospace structures. The dynamic response of aircraft wings, helicopter rotor blades, micro-air vehicle wings, etc. is included in this topic. The vibration characteristics of both composite and metal structures are sought. The theoretical, computational, and/or experimental investigations of the structural dynamics, in fluid medium are covered in this topic. The papers on the control techniques to reduce the vibrations of structures are suitable here. The areas of interest of this topic, but not limited to, are: (1) Structural dynamics of both metal and composite structures, (2) Natural frequencies and mode shapes of aerospace structures, (3) Dynamic response of structures in fluid medium, (4) Vibrations of aerospace structures, (5) Effect of damping on the structural dynamics, (6) Control techniques to suppress the vibrations of structures, and (7) Theoretical, computational, and/or experimental investigations of the structural dynamics.

3-9 High Temperature Materials and Structures

Description
To advance the state-of-the-art of the next generation of aerospace structures materials must be able to operate at higher temperatures in extreme environments. As such, development of these materials will require advances in experimental and numerical techniques for high temperature materials and structures. The focus of this topic is on high temperature materials and structures. It is expected that the contributions to this topic are related to experimentation and/or numerical modeling of materials and structures for high temperature applications. Potential materials of interest include, but are not limited to, advanced polymer matrix composites (PMCs), ceramic matrix composites (CMCs), carbon matrix composites, advance metallics and nano-composites for engine, thermal shock, lightning strike or other high temperature applications. The papers should investigate relevant high temperature

phenomena, such as material properties, thermal degradation, oxidation, ablation, polymer pyrolysis, time-dependent non-linear deformation (i.e., creep, stress relaxation, viscoelasticity, viscoplasticity), phases changes, transport phenomena, temperature dependent processing, and advanced experimental techniques.

3-10 Impact, Damage and Fracture of Composite Structures

Description
Composites are commonly employed in modern aircraft structures and in many aerospace applications like engine casing, fan-blades, etc. This is attributed to their high strength-weight ratio and high stiffness-weight ratio, making composites extremely light, yet exceptionally strong. However, the use of composites makes them easily susceptible to impact damage, which often results in complex failure mechanisms like delamination, matrix cracking, fiber debonding, fiber fracture, etc. The issue with impact damage of composite structures remains an open problem and a challenging one.

In this topic, papers related to the broad areas of impact, damage and fracture of composite structures are solicited. Experimental work on impact test methodologies, repair strategies, damage detection/inspection techniques, physical damage phenomena on strain rate effects and ways to mitigate impact damage (i.e., interlaminar reinforcement) are especially welcomed. Numerical work on novel computational techniques to model impact behavior, impact damage and dynamic characteristics of composites structures are strongly encouraged. The objective of this topic is to enhance dissemination of information and foster discussion among international researchers regarding the latest state-of-the-art research on impact, damage and fracture of composite structures.

3-11 Advances in Mechanics, Multiscale Models and Experimental Techniques for Composites

Description
We invite state-of-the-art multiscale theoretical, computational and experimental techniques and investigations focused on composite material and structural response. The goal of this mini-symposium is to generate a focused dialogue in this area, with the aim of aligning both modeling and experimentation for the advancement of “next-generation” predictive tools. Specific topics of interest include, but are not limited to: novel experiments and numerical tools for a wide range of composite materials including polymer matrix composites, textile composites, sandwich composites, ceramic matrix composites, etc; Damage and failure responses of composites subjected to static, fatigue, and impact loading; Multi-physics behavior of composites, including hygrothermal degradation, ablation, oxidation of ceramic matrix composites, etc.

3-12 Peridynamics Modeling

Description
This topic focuses on the recent developments of peridynamic mechanical and mathematical models and its applications on the solution of multiscale and multiphysics problems including damage and fracture as well as numerical solution methods.

3-13 Computational Aerospace Structural Dynamics and Aeroelasticity

Description
Structural dynamics (SD) traditionally plays an important role in modeling and simulation of automobile, railway vehicles, and robotics, and is today widely used in modeling aircraft structural dynamics. The session focuses on all aspects of structural dynamics, aeroelasticity, as well as multibody dynamics, and papers are especially solicited on the topics of applying SD to aircraft simulations. The aircraft type includes fixed-wing, rotorcraft, full-scale, model-scale, and UAVs.

3-14 Nonlinear Problems in Aerospace Structures

Description
Nonlinear mechanics plays a crucial role in the analysis of aircraft and spacecraft structures. As an example, the effects of large displacements and rotations cannot be neglected in the case of verification and simulation of high flexible structures, such as helicopter rotor blades. On the other hand, the effects of physical nonlinearities are accounted for in the modern analysis of failure mechanics and progressive failure of composites. Papers of interest includes, but are not limited to, buckling and post-buckling analysis and testing, nonlinear vibrations, plasticity, rotors and rotating blades, nonlinear failure mechanisms, and analysis of large displacements and rotations.

3-15 Structural Health Monitoring of Composite Materials and Structures

Description
Nondestructive Evaluation (NDE) and Structural Health Monitoring (SHM) plays a significant role in design, manufacturing, and service of engineering systems and structures. The symposium will provide a venue for communication, discussion, and dissemination of ideas, advancements, and opinions on a variety of subjects related to NDE, SHM and prognosis.

3-16 Computational Design of Aerospace Materials Under Uncertainties

Description
Computational design of materials has been traditionally addressed as a deterministic problem to enhance the properties and performance of air vehicles. However, uncertainties arise from the imperfections in the manufacturing processes and/or the simplifications/lack of knowledge in numerical models. Here, several issues arise with the deterministic design models since the stochastic behavior causes deviations in material properties from the design point, and it alters the performance of the critical aerospace components. Therefore, design optimization of aerospace materials requires understanding and modeling of the uncertainties and their influences on the design criteria. This symposium will be devoted to the recent advances in the computational design of aerospace materials under uncertainties. Although the main focus is on the numerical techniques for design under uncertainty, the experimental/computational studies concentrating on the effects of manufacturing imperfections (i.e. the effects of processing uncertainties) to the material properties are also considered to be relevant with the content.

Total Topics: 16

Track-4 Biomedical & Biotechnology Engineering

Topic

4-1 Biomedical and Biotechnology Plenary Presentation

Description
In this topic, two international speakers are invited, one from academia and the other from industry to talk about the state of the art technologies in their areas of interest. The main objective of this topic is to bridge the gap between academia and industry and help develop collaborations.

4-2 Injury and Damage Biomechanics

Description
This topic is focused on: (i) techniques, either experimental or computational to understand how blunt impact forces are translated to biological damage, (ii) ballistic and blast effects typically seen in military environments; both experimental and computational techniques are used to understand the detrimental effects to biological systems. (iii) new or novel approaches to understanding the onset and progression of damage in biological systems; additional topics of interest and discourse in this topic include materials (biological as well as protective materials) characterization to develop materials models at the strains and strain rates in blast overpressure effects, blunt impacts and ballistic impacts, (iv) computational modeling and experimental studies aimed at elucidating the effects of cavitation in the brain due to external loading, both for causation as well as how such cavitation can cause damage at tissue and/or cellular levels.

4-3 Vibration and Acoustics in Biomedical Applications

Description
This topic focuses on the vibration characteristics of some biomedical devices using vibration principles, on using vibration principles for tissue and organ characterization and using the vibration principles for rehabilitation and therapy devices and methods.

4-4 Biomedical Imaging, Therapy and Tissue Characterization

Description
This topic presents papers that deal with various theoretical, experimental methods and medical devices for tissue characterizations, various biomedical imaging, diagnostics methods and biomedical therapy.

4-5 Biomaterials and Tissue: Modelling, Synthesis, Fabrication and Characterization

Description
Tissues and tissue engineered constructs express a broad range of functionality based upon their mechanical, electrophysiological, and transport properties across multiple hierarchies.

This theme area aims to capture the state of the art of modeling, measuring, and recapitulating the mechanics and physics of biological tissues as well as biomaterials synthesis and characterization. Special focus will lie on the mechanics of these tissues, on engineered materials such as porous solids and structural composites that mimic their function, and on simplified systems that enable the biophysical characterization of living cells." Examples are: Chemotherapy system development, 3D bio printing for bioceramics, modelling of cell-scaffold interaction, in situ contactless printing of cellular structures, biomedical nanofibers, laser texturing on titanium, material for cartilage repair, tissue biofabrication, cellular automan, modeling of brain tissue, multiscale modelling of tissue constructs, Buckling in grain stems, simulation of bioreactors, cell-laden hydrogels, bone mechanical properties, tumor mechanical rigidity, self-folding microgels.

4-6 Biomedical Devices

Description
This topic focuses on: (i) the development and testing of various detection and monitoring devices, (ii) detection of hypocemia, heart rates, cancer and tactile sensors, (iii) various assistive and treatment devices used in surgeries, (iv) fluid devices for biomedical applications in particular microchannel, humidification and microbubbles, (iv) various treatment devices.

4-7 Dynamics and Control of Biomechanical Systems

Description
This topic focuses on the applications of dynamics and control in biomechanical and physiological systems.

4-8 Symposium on Clinical Applications of Bioengineering

Description
This symposium is intended to provide a forum to foster multidisciplinary interaction and collaboration among researchers, scientists and practitioners in mechanical engineering, bioengineering and medicine. Authors are invited to participate in the Symposium on Clinical Applications of Bioengineering at the 2019 ASME Congress by submitting papers and making presentations in all aspects of design, analysis, experiments, modeling and control, and applications in clinical therapy and bioengineering. Possible areas include, but are not limited to:

- Diagnostic Methods
- Therapeutic Methods
- Rehabilitation
- Surgical planning
- Surgical instrumentation

4-9 Biotransport (Fluid. Heat and Mass)

Description
This topic focuses on various heat and mass transport principles in biomechanical applications.

4-10 Computational Modeling in Biomedical Applications

Description
Various models and modelling techniques for biomechanical systems and methods are presented.

4-11 Musculoskeletal and Sports Biomechanics

Description
The topic includes discussions of research on the musculoskeletal system and sports-related biomechanics problems. This includes but is not limited to biomechanics research on organs or tissues (bones, muscles, tendons, and ligaments etc.) related to the musculoskeletal system. A broad topic of sports-related biomechanics will also be discussed, including but not limited to: walking, jogging, running, or any other competitive sports. Sports related injuries such as head injuries, traumatic brain injuries (TBI), mild traumatic brain injuries (mTBI), or other soft tissue and hard tissue injuries are also included.

4-12 Sensors and Actuators

Description
This topic covers a wide range of sensor and actuator development with focus on biomedical applications.

4-13 Robotics, Rehabilitation

Description
Most of the developed countries are encountering an aging society, which brings an increasing morbidity of neuromuscular disabilities and diseases, such as stroke, Alzheimer, etc. In the recent decades, the design, analysis and control of intelligent medical devices, assisting robots as well as the development of rehabilitation methodologies have engaged researchers in mechanical and biomedical engineering to help propose novel engineering solutions to such problems. In this topic, cutting-edge work on recent advances in theoretical, experimental, or computational aspect of robotics, intelligent devices, and rehabilitation applications are welcomed.

4-14 Biotechnology and General Applications

Description
This topic includes papers in biotechnology and any general papers which do not fit in the above topics.

Total Topics: 14

Track-5 Dynamics, Vibration, and Control

Topic

5-1 Plenary Presentations

No Topic Description.

5-2 General

Description
The General Topics area invites papers on all aspects of dynamics, vibration, control theory, applied analyses of dynamic systems, experiment-based research on system response, uncertainty quantification, propagation of uncertainty in systems, and all other research areas that are not covered by the other topic areas within the Dynamic, Vibration and Control track. It is our hope that this topic area will give authors an opportunity to have their research exposed to a broader audience, as well as to gain new perspectives on their own research.

5-3 Nonlinear Dynamics, Control, and Stochastic

Description
The Symposium on Nonlinear Dynamics, Control, and Stochastic Mechanics (NDCSM) provides a forum for the discussion of dynamics, modeling, and control issues relevant to classical systems and emerging technologies, focusing on nonlinear and stochastic phenomena at both the micro- and the macro-scale. All papers will be peer-reviewed, and upon acceptance, they will be published in the Conference proceedings. Topics of interest include, but will not be limited to: Geometrically Nonlinear Vibrations; Nonlinear, Vibration-based Structural Health Monitoring; Dynamics and Control of Non-smooth and Stochastic Systems; Nonlinear Reduced Order Modeling; Nonlinear Rotordynamical Systems; System Identification and Nonlinear Behavior of MEMS; Nonlinear Modeling and System Identification Techniques in Fluid-Structure Interaction.

5-4 Design and Control of Robots, Mechanisms and Structures

Description
This symposium provides an international forum for disseminating, exchanging and discussing the recent developments and innovative ideas on designing, controlling, analyzing, modeling, simulating, fabricating and testing robots, mechanisms, structures and other related mechanical or structural systems. Papers on new theories, methods, approaches, experiments or applications are solicited in this symposium.

5-5 Fluid-Structure Interaction

Description
This Symposium is intended to provide an international opportunity for communicating recent advancements in the area of Fluid-Structure interaction (FSI). The symposium puts a special attention on flow induced vibration and stability of structures in various fields including piping, nuclear engineering, turbomachinary, aeroelasticity, offshore and marine problems, and

physiological systems. Research on sloshing, filled containers, vibrations of submerged structures and flexible structures conveying flow is also a main focus. Manuscripts addressing novel theoretical, computational and experimental researches are of interest and are encouraged to contribute to FSI symposium.

5-6 Dynamics and Control in Micro/Nano Engineering

Description
Technical Committee on Dynamics and Control of Systems and Structures of the Applied Mechanics Division, ASME, and Technical Committee on Vibration and Sound of the Design Engineering Division, ASME are soliciting papers for a Symposium on Dynamics & Control in Micro/Nano Engineering. Topics of interest include, but will not be limited to: Electrostatically Actuated MEMS and NEMS; Sensors, Actuators, and Switches for Health Monitoring, Biology and Medicine; Linear and Nonlinear Dynamics and Control of MEMS and NEMS; Dynamics and Control Multi-Body Micro- and Nano-systems; Reduced Order Modeling; Atomic Force Microscopy; Multi-Scale Modeling, and Microfluidics; Coupled Thermal, Electrostatic, Magnetic, Elastic MEMS/NEMS Systems.

5-7 Smart Structures and Structronic Systems: Sensing, Energy Generation and Control

Description
Smart materials and structures usually exhibit multi-field electro/magneto/photo/ thermo/elastic coupling behaviors. Smart structures and structronic systems provide novel solutions to real-time distributed sensing, diagnosis, static/dynamic control, energy harvesting and other precision applications. This symposium focuses on the multi-field coupling and multi-physics of smart structures and structronic systems encompassing theoretical research and applications. The topics include, but not limited to, 1) Multi-field coupling and multi-physics theories smart structures and structronic systems; 2) Numerical methods and experimental techniques in multi-field modeling; 3) Sensing, monitoring and diagnosis of structures; 4) Energy generation using smart structure systems; 5) Actuation, shape control and propulsion; 6) Active/passive control of structures; 7) Applications and case studies, etc.

5-8 Novel Control of Dynamic System and Design

Description
Manuscripts are solicited for presentation in a special symposium on the Novel Control of Dynamic System and Design. Topics of interest are the modeling, analysis, physical results, and real-world applications of innovative control methodology and robust design in advanced topical areas such as, but not limited to, the followings: • NEMS and MEMS • Robotics • Microfluidics and Nanofluidics • Manufacturing processes • Thermal systems • Discontinuous systems • Acoustics Novel Control of Dynamic System and Design is sponsored by ASME Technical Committee on Dynamics and Control of Systems and Structures of the Applied Mechanics Division and Technical Committee on Vibration and Sound of the Design Engineering Division.

5-9 Multibody Dynamic Systems and Applications

Description
This symposium may include, but are not limited to, vehicle multibody dynamics, railroad vehicle multibody dynamics, robotic systems, biomechanical systems, molecular dynamics, aerospace applications, multibody dynamics of machines and rotating flexible structures, computational and numerical methods in multibody dynamics, multibody dynamics formulations, nonlinear dynamics and vibration, mechatronics and experimental methods in multibody dynamics, impact and intermittent motion, fractional derivatives, application of multibody methodologies to real-time simulations, computer vision, and active and passive controls of multibody systems.

5-10 Vibrations of Continuous Systems

Description
This symposium deals with vibration of continuous structures. Topics of interest include modeling, analysis, and experiments for prototypical structures such as strings, cables, rods, beams, membranes, plates, shells, as well as other elastic continua. Manuscripts addressing assemblies; continuous systems with dissipative, gyroscopic, or non-linear forces; novel methods of measurement and actuation; local and global discretization strategies; and coupling phenomena are of interest, but other contributions are also welcome.

5-11 Mobile Robots and Unmanned Ground Vehicles

Description

The Symposium provides a forum for presenting new research and solution in the fields of Mobile Robot (MR) and Unmanned Ground Vehicles (UGVs), considering mechanical architectures, control schemes and sensing systems. In the last years the exploitation of UGVs is rapidly increasing. Examples of application fields are agriculture, homeland security, surveillance and reconnaissance, data acquisition in dangerous or polluted environments, rescue operations, military operations, planetary exploration. Whenever possible, the application of UGVs in hazardous sites avoids risks for humans and reduces costs; therefore the demand of UGVs capable of carrying monitoring devices, environmental sensors and robotic arms is continuously growing. The dynamic performances and the obstacle climbing ability are highly dependent on the mechanical architecture. Smart mechanical structures, properly optimized and verified by means of multibody dynamics models, are leading the innovation. For some applications is required the development of innovative suspensions systems designed and analyzed by means of vibration analysis techniques. Finally, UGV and MR are systems that can benefit of innovative control algorithms and they are one of the most challenging topic in this field. Papers that deal with those solutions are expected to propose an interesting forum of discussion and evaluation.

5-12 Control Theory and Applications

Description
The demand for efficiency and performance in modern systems call for better control algorithms to be used in controlling such systems. Over the years there has been many developments in the field of control theory with introduction of many control algorithms. This symposium provides a platform for researchers and practicing control engineers to exchange ideas and discuss various topics that cover new developments in control theory and their applications on real world systems. Topics of interest will include but not limited to: modelling and control of large scale systems, control of nonlinear systems, control and optimization of microsystems, applications of robust and optimal control theories on real world systems.

5-13 Stochastic Optimization, Uncertainty and Probability

Description
This symposium aims to bring together researchers from both academy and industry to discuss the latest advances in stochastic optimization, uncertainty, probability and related fields (non-probabilistic analysis of uncertainty) with emphasis on applications to dynamics, vibration and control problems. Contributors are invited to present recent theoretical and computational developments focusing on their applicability in the field of real mechanical engineering problems. The topics to be covered may include, but are not limited to: stochastic programming; robustness; sensitivity; reliability-based optimization; uncertainty quantification (probabilistic approaches, interval model, convex models, fuzzy sets, Bayesian model, etc.); stochastic analysis; reliability assessment.

5-14 Measurement and Analysis Techniques in Nonlinear Dynamic Systems

Description
The Measurement and Analysis Techniques in Nonlinear Systems topic invites papers on all aspects of experimental analysis of dynamic systems, research on development of novel measurement methods and systems. The goal of this topic is to offer authors a venue to share their research and collaborate on employing emerging technologies.

5-15 Multi-Physics Dynamics-Control & Diagnostics-Prognostics of Structures and Devices

Description
The symposium focuses on modeling and analysis of coupled linear and nonlinear dynamical problems occurring in multi-physics engineering systems. The topics include: nonlinear modeling and analysis (numerical, experimental) of energy harvesting devices and mechanisms exhibiting coupling of thermal, electrical, magnetic, and mechanical effects; nonlinear phenomena in flexible multi-body systems due to dry friction in joints and bearings; nonlinear phenomena in interactions of flexible structures with fluids and granular media; nonlinear dynamics of ball and journal bearings; nonlinear dynamics of fluids and granular media under transportation; nonlinear phenomena and failure of critical control devices in engines; nonlinear dynamics and chaos in electric propulsion machinery and control devices; nonlinear dynamics in impacting and slamming of flexible structures; nonlinear acoustics in structure-fluid and structure-thermal interactions; modeling and simulation of multi-scale dynamics of turbulent flows, combustion flows, corrosion, dry friction, fatigue-induced material damage, and cavitation; innovative exploitations of nonlinear phenomena for control, vibration isolation, noise reduction, and diagnostics; measuring techniques of coupled multi-physics vibrations. Applications include (but not limited) Marine, Aerospace and Mechanical Engineering Technology Areas.

5-16 Renewable Energy, Structural Health Monitoring, and Distributed Structural

Description
This symposium aims to bring together researchers in academia, industry, and government labs to discuss recent advances in such emerging fields as renewable energy, especially wind and water energy and energy harvesting, and structural health monitoring; and in distributed structural systems. Papers in, but not limited to, the following areas are solicited: design, modeling, analysis, control, monitoring, and diagnosis of wind turbines, water turbines, and air-borne turbines; continuously variable transmissions; generator design, analysis, and control; vibration, wind, and water flow energy harvesting; sensing, inverse modeling, and signal processing as applied to vibration-based structural health monitoring; linear or nonlinear system identification; model- and non-model-based damage detection methods; ultrasonic and wave-based damage detection methods; finite element modeling; modeling of structures with bolted, welded, and riveted joints and interference pins; modal testing and model updating; laser vibrometry; vibration and control of linear or nonlinear, time-invariant or time-varying distributed-parameter systems; and flexible multibody dynamics. Analytical, numerical, and experimental investigations, as well as case studies, are welcome.

5-17 Dynamics and Control of Soft Structures

Description
Soft structures such as PVDF, MFC and LaSMP has wide applications in engineering and fabrication. This symposium focuses on dynamics and control of soft structures encompassing theoretical research and engineering applications. Topics include, but not limited to, 1) Dynamics modeling of soft structures vibration; 2) Vibration control of soft structures; 3) Sensing, monitoring and diagnosis of soft structures; 4) Actuation, shape control and propulsion; 5) Active/passive control of soft structures; 6) Applications and case studies, etc.

5-18 Multi-Field Coupling and Control

Description
Smart materials and structures usually exhibit multi-field electro/magneto/photo/thermo/elastic coupling behavior. Based on the multi-field coupling mechanism, the smart materials accomplish the energy exchange among electrical energy, potential energy, kinetic energy, photonic energy, etc. Therefore, smart materials and structures can be used for in-situ sensors and actuators in sensing and control applications. Smart structures with integrated sensors and actuators made of smart materials provide a novel solution to real-time distributed sensing, diagnosis, static/dynamic control and energy harvesting. They satisfy the stringent requirements for weight, space and reliability in mechanical, civil, aeronautic and astronautic systems, and even MEMS and Nano structures. This symposium focuses on the multi-field coupling of smart structures encompassing theoretical research and applications. The topics include, but not limited to, 1) General multi-field coupling theory; 2) Numerical method in multi-field modeling; 3) Sensing, monitoring and diagnosis of structures; 4) Energy generation using smart structures; 5) Actuation and propulsion; 6) Active control of structures.

5-19 Congress-Wide Symposium on NDE &SHM: Dynamics, Vibration, and Control for Structural Health Monitoring Applications

No Topic Description.

Total Topics: 19

Track-6 Energy

Topic

6-1 Energy-Related Multidisciplinary

Description
The purpose of this topic is to provide a forum for information about innovation, research, development and demonstration on energy-related multidisciplinary. Papers, extended abstracts and technical presentations are solicited in areas that are not specifically included in other topics of track Energy.

6-2 Fundamentals and Applications of Thermodynamics

Description
The purpose of this topic is to provide a forum for information on innovation, research, development and demonstration on fundamentals and application of thermodynamics. Papers,

extended abstracts and technical presentations are solicited in areas including but not limited to:

- Thermodynamic properties of pure working fluids and their mixtures as well as innovative materials
- Equations of state
- Phase-change processes of working fluids
- Energy and exergy analysis
- Adsorption, Desorption and Absorption cycles
- Entropy generation minimization
- Thermodynamic analysis of direct and inverse thermodynamic cycles
- Thermodynamic analysis of combustion processes
- Chemical and phase equilibrium
- Compressible flow (stagnation properties, shock waves and expansion, steam nozzles)
- Statistical thermodynamics
- Quantum thermodynamics
- Non-equilibrium thermodynamics
- Teaching thermodynamics

6-3 Thermoeconomics

Description
The purpose of this topic is to provide a forum for information on innovation, research, development and demonstration on thermodynamics. Papers, extended abstracts and technical presentations are solicited in areas including but not limited to:

- Thermoeconomic/exergoeconomic analysis: theory and application
- Thermoeconomic diagnosis
- Thermoeconomic/exergoeconomic approach to the environmental analysis

6-4 Design and Analysis of Energy Conversion Systems

Description
The purpose of this topic is to provide a forum for information about innovation, research, development and demonstration on energy conversion systems. Both design and management issues are discussed, with the aim of achieving significant primary energy savings and conversion efficiency improvements. This symposium brings together the work of prominent researchers in the field for exploring methodologies and techniques to analyze, improve and optimize energy conversion systems. Papers, extended abstracts and technical presentations are solicited in areas including but not limited to:

- Design and modeling the energy conversion systems
- Evaluation and optimization of energy conversion systems
- Economic and ecologic analysis of energy conversion systems
- Experimental analysis
- Steam, gas-turbine, combined-cycle, CHP, and CCHP power systems
- Co-generation systems
- Innovative energy conversion systems
- Energy conversion systems applications

6-5 Energy Systems Components

Description

Currently, scientific context is considered of primary importance to study energy efficient systems and their components that also meet minimum environmental impact criteria with acceptable costs. Therefore, studies or researches should be developed in order to determine the optimal configurations of energy systems components that convert primary energy into mechanical (electrical) with minimal fuel consumption and/or energy resources, with high efficiency, to reduce polluting emissions and structured in such a way as to obtain an acceptable cost to make competitive from an economic point of view these realizations.

Another strategic aspect, which accompanies the selection of these components, is related to the analysis of these systems in terms of off-design (operation at partial loads) and their monitoring and diagnostics in order to predict and verify, with the aid of appropriate experimentation, actual operating conditions the lifetime expected for the energy system.

6-6 Low-Temperature Energy Conversion Systems

Description
The purpose of this topic is to provide a forum for information about innovation, research, development and demonstration on low-temperature energy conversion systems. The amount of low-temperature heat resources in many industrial processes and energy conversion systems is really huge. Their efficient recovery and use is a very important issue for improving energy efficiency, saving primary energy resources and protecting environment. Papers, extended abstracts and technical presentations are solicited in areas including but not limited to:

- Low-temperature waste heat recovery
- Refrigeration applications
- Electricity generation from low temperature heat

6-7 Thermal Energy Storage

Description
The purpose of this topic is to bring together academics and industry to review recent advances in the field of thermal energy storage, discuss future research directions and development priorities, and build collaborations in this research area. Papers, extended abstracts and technical presentations are solicited in the following areas

- Thermal energy storage materials (sensible, latent, thermochemical materials),
- Thermal energy storage units (modules, components, devices) and heat transfer enhancement
- Thermo-mechanical energy storage (CAES, liquid air energy storage, pumped thermal energy storage, etc.)
- Cold thermal energy storage for low temperature applications including air conditioning, refrigeration, cold chains, cryogenic processes
- System integration, optimisation and techno-economic analysis of thermal energy storage for applications including, but not limited to, renewable energy integration, buildings, industrial processes
- Thermal energy storage for concentrated solar power plants
- Novel concepts for thermal energy storage

6-8 Environmental Aspects of Energy Systems

Description
The necessity of energy systems that exploit the available resources in an optimal way is urgent. This can be achieved only if technical and environmental aspects of energy systems are both carefully considered. This symposium brings together the contributions of researchers in the field of energy systems and related environmental aspects. Papers are solicited in the following areas:

- Environmental constraints on energy systems
- Thermal, air-quality, acoustic, etc. impact of energy systems on the environment
- Emissions reduction and control
- Life cycle analysis
- Energy-related aspects of waste management
- Material recycling
- Energy process modification for pollution prevention

Paper submitted should address environmental aspects of energy systems using a range of techniques, e.g. experimental and theoretical analyses, numerical modeling, case studies, with the aim of informing the researchers and practitioners.

6-9 Energy Systems for Buildings

Description
The purpose of this topic is to provide information on innovation, research, development and demonstration on energy systems for buildings. Main focus of this topics are conventional and non-conventional cooling, heating, and power technologies for buildings. Papers, extended abstracts and technical presentations are solicited in areas including but not limited to:

- Air-conditioning, Refrigeration and Heat Pump Systems
- Ab- and Ad-sorption Refrigeration Machines and Heat Pumps
- Not-in-kind Cooling and/or Heating Technologies
- Combined Cycle, CHP, and CCHP for Buildings
- Energy Storage Technology for Buildings
- Renewable Energy for Buildings

6-10 Renewable Energy

Description
Papers submitted should address energy-related aspects of renewable energy systems, as well as integration of renewable energy systems using a range of techniques; e.g., experimental and theoretical analyses, numerical modeling, case studies, with the aim of informing the researchers and practitioners. Contributions are encouraged in areas including, but not limited to:

- Wind Power
- Solar Energy
- Geothermal Energy
- Hydropower
- Tidal Energy / Wave Power
- Ocean and Hydropower Technologies

6-11 Electrochemical Energy Conversion and Storage

Description
The diffuse nature of sustainable energy supply and demand requires the development of flexible and scalable energy storage and conversion technology. Electrochemical systems are increasingly meeting this requirement in mobile and stationary applications. Researchers are encouraged to contribute papers addressing the science, design, and application of batteries, electrolyzers, and capacitors. Contributions are encouraged in areas including, but not limited to:

- Li-ion and Beyond Li-ion Batteries

- Li-air and Metal Air Batteries
- Materials for Electrochemical Energy Conversion and Storage
- Modeling and Analysis of Electrochemical Systems
- Advanced Electrochemical Energy Conversion and Storage

6-12 Fuel Cell Systems Design and Applications

Description
The diffuse nature of sustainable energy supply and demand requires the development of flexible and scalable energy storage and conversion technology. Fuel cells are increasingly meeting this requirement in mobile and stationary applications. Researchers are encouraged to contribute papers addressing the science, design, and application of fuel cells. Contributions are encouraged in areas including, but not limited to:

- High Temperature Fuel Cells
- Low Temperature Fuel Cells
- Materials for Fuel Cells
- Modeling and Analysis of Fuel Cells
- Advanced Fuel Cell Conversion and Hydrogen Storage

6-13 Carbon Capture and Storage

Description
Carbon capture and storage (CCS) is one of the technologies expected to reduce greenhouse gas emissions. Efficient, economic, and environmentally friendly solutions are always being sought. This symposium brings together the work of prominent researchers in the field with the emphasis on both CCS fundamentals and applications. Main areas of interest are engineering challenges of CCS, and progress made in recent years in terms of novel materials, processes and applications. Papers, extended abstracts and technical presentation are solicited in areas including but not limited to:

- CCS system - general (control, behavior, response, interaction with power generation and transmission systems, etc.)
- Materials developed for CO2 capture, separation, purification, transport, storage, and applications
- Gas capture (separation) from large point sources (power generation, natural gas processing, heavy industries, hydrogen production, etc.)
- Gas compression/dehydration
- CO2 transport and transport system maintenance
- Beneficial reuse of CO2 (e.g. enhanced oil recovery (EOR), urea application, food industry, beverage carbonation, carbonate/bicarbonate, biomass processing)

6-14 Nuclear Power Plants: Design, Analysis, and Safety

Description
ASME Nuclear Engineering Division (NED) brings a group of experts from academia, research institutions and industry to discuss current research activities and technical challenges related to the nuclear energy field. The intent of NED topical sessions is to allow sharing of these experiences and their solutions by researchers, practicing engineers, technical support analysts, plant owners and operators worldwide. This in turn will expand international cooperation and understanding of the common issues facing nuclear plants. Papers related to Nuclear Engineering and Technology, and Radiation Sciences are sought. Topical sessions will consider operational, theoretical, experimental and numerical works including, but not limited to:

- Plants, Operations, Safety and Security: Codes and Standards, Licensing and Regulatory Issues, Protection and Shielding, Life Cycle Management, Systems Performance, Maintenance and Operational issues, Systems Modifications, Instrumentation and Controls, Online Monitoring, Accident Tolerant Core Concepts, Materials Security, Safeguarding, Nonproliferation
- Materials & Structures: Structural and Functional Materials, Reactor Internals, Fuel Elements, Post Irradiation Examination, Irradiation Effects, Creep, Swelling, Material Degradation, Embrittlement, Microstructural Evolution, Corrosion Mechanics, Vibration, Fatigue, Fracture Mechanics, Crack Propagation, Stress Corrosion Cracking, Irradiation Assisted Fracture
- Modeling and Simulations: Computational Methods, Reactor Physics, Neutronics, Thermal-Hydraulics, Computational Fluid Dynamics, Coupled Codes, Multiphase Flow, Thermal Fluids, Conjugate Heat Transfer, Fuels Performance Modeling, Multi-Physics Coupling, Validation and Uncertainty Quantification, Severe Accidents Phenomena, Best Estimate LOCA.
- Advanced Reactor Concepts: Next Generation Systems and Near-term Deployment, Emerging Technologies, Super Critical Water Reactors, Liquid Metal Sodium or Lead Cooled Reactors, Small Modular Reactors.
- Research Reactors: Research Reactor Operations and Safety, Research Reactor Fuel Cycles, LEU Fuels, Fuel Development and Qualification, Fuel Fabrication Technology, Fuel Testing and Characterization, Reactor Conversions, Conversion Analysis, HEU Removal and Operations, International Conversion Programs

6-15 CMS-Biomass and Waste Gasification and Combustion

Description
This topic is part of the Combustion Mini-Symposium co-sponsored by the Aerospace, Advanced Energy Systems, and Heat Transfer Divisions of ASME with topics listed under all 3 track areas. All topics in the mini-symposium are listed with CMS at the start of the title and will be co-located at the IMECE meeting. Please consult the mini-symposium announcement for a complete list of topics and submit to whichever topic area is most appropriate. The topics cover a wide range of combustion phenomena and applications, and we anticipate a significant turn-out. Plenary and/or panel discussions will be added as registration warrants.

Technical focus for this topic: Biomass and municipal solid waste (MSW) can be used directly via combustion to produce heat, or secondarily after transforming it to various forms of biofuel. Thermochemical conversion of biomass to biofuel can be attained by methods including combustion, gasification, pyrolysis and etc. The sessions in this topic will focus on conversion technologies, gasifier design and operation, biomass pre-treatment and processing, syngas upgrading and tar clean-up, combine gasification-combustion systems, syngas combustor design and performance, sustainable feedstock development, and environmental and economic aspects of biomass and MSW utilization.

6-16 CMS-Biofuels Production, Conversion, and Simulation

Description
This topic is part of the Combustion Mini-Symposium co-sponsored by the Aerospace, Advanced Energy Systems, and Heat Transfer Divisions of ASME with topics listed under all 3 track areas. All topics in the mini-symposium are listed with CMS at the start of the title and will be co-located at the IMECE meeting. Please consult the mini-symposium announcement for a complete list of topics and submit to whichever topic area is most appropriate. The topics cover a wide range of combustion phenomena and applications, and we anticipate a significant turn-out. Plenary and/or panel discussions will be added as registration warrants.

Technical focus for this topic: The need for affordable, sustainable and renewable energy is self-evident. Intense research in the areas of biofuel production, conversion, combustion and application has intensified in recent years. This symposium brings together the work of prominent researchers in the field with the emphasis on biofuels and their use in technological applications. Main areas of interest are biofuel production including instrumentation, extraction and conversion of biofuels, combustion and related topics in the use of biofuels, and application of biofuels in various areas. Papers, extended abstracts and technical presentation are solicited in areas including but not limited to:

- Biofuel production, conversion and characterization
- Biofuel applications
- Hydrocarbon fuels from algal oils
- Thermal hydrolysis and thermo-catalytic decarboxylation
- Solid fuel conversion, biodiesel combustion and utilization
- Effects of various oils on compression ignition engines
- Performance and emission characteristics of duel fuel and DI diesel engines
- Conversion of diesel engines to biogas operation
- Life cycle analysis biodiesel reactors

6-17 CMS-Coal and Novel Combustion Schemes

Description
This topic is part of the Combustion Mini-Symposium co-sponsored by the Aerospace, Advanced Energy Systems, and Heat Transfer Divisions of ASME with topics listed under all 3 track areas. All topics in the mini-symposium are listed with CMS at the start of the title and will be co-located at the IMECE meeting. Please consult the mini-symposium announcement for a complete list of topics and submit to whichever topic area is most appropriate. The topics cover a wide range of combustion phenomena and applications, and we anticipate a significant turn-out. Plenary and/or panel discussions will be added as registration warrants.

Technical focus for this topic: A large portion of energy generation in the world comes from fossil fuel combustion, and coal is still extensively used to generate base-load power. The current power generation systems, while well understood, are still far away from the performance and cost goals currently envisioned, and achieving the targeted performance requires continued research. Aspects such as coal clean utilization, coal gasification, emission control, pulverized coal combustion, fluidized bed combustion, and carbon capture and storage are all of interest. Also, novel combustion schemes that envision pushing performance beyond the current limits through mixed fuels, combined cycles, new technology, and other innovative methods are strongly encouraged. Experimental, computational, and theoretical work is welcome, and work on systems from lab, to pilot, to full scale is of great interest.

6-18 CMS-Fire Behavior and Sensing

Description
This topic is part of the Combustion Mini-Symposium co-sponsored by the Aerospace, Advanced Energy Systems, and Heat Transfer Divisions of ASME with topics listed under all 3 track areas. All topics in the mini-symposium are listed with CMS at the start of the title and will be co-located at the IMECE meeting. Please consult the mini-symposium announcement for a complete list of topics and submit to whichever topic area is most appropriate. The topics cover a wide range of combustion phenomena and applications, and we anticipate a significant turn-out. Plenary and/or panel discussions will be added as registration warrants.

Technical focus for this topic: The ability to predict fire behavior, detect the existence of a fire, and the ability to make measurements in the harsh environments of fire testing is of key importance for conducting research in the fire field and designing fire protection systems to protect life and property. Some potential sensing applications include being able to detect fires more rapidly/accurately, particularly using UAVs or drones, or being able to collect more data during testing which can be used improve the understanding of fire behavior and potentially improve the applicability of codes and standards along with improving the capabilities of performance based designs. This session topic will focus on results of experiments involving fire behavior and new/improved technology which can be used to detect fire and/or make

measurements in the fire environment. Potential applications include, but are not limited to, compartment fires, wild-land fires, aerial monitoring, and industrial facility fires.

Total Topics: 18

Track-7 Engineering Education

Topic

7-1 Curriculum Innovations, Pedagogy and Learning Methodologies

Description
This topic welcomes submissions that focus on the following issues: curriculum innovations, pedagogical experiences in engineering education, project led engineering education (PLEE), project/problem based learning (PBL), research on project approaches, preparing teachers and students for a project approach, partnerships with business, hands-on projects and educational games and other learning methodologies.

7-2 Globalization of Engineering

Description
This topic is directed at the technologies, applications, issues and interfaces associated with engineering, among others, on a world scale and in a global economy. All engineering disciplines will have an impact and are needed to contribute to well designed, manufactures and delivered products. We are expecting sessions for the following subjects on:

Global Engineering Research Collaborations, Technology Impacts on Global Societies and Engineering, Industry Frontier and Global Engineering, Globalization of Energy, Economy and Engineering, Regulatory Engineering in the Global Economy, and Global Engineering Impacts on the Developing World.

7-3 Engineering Accreditation, Data Collection, Assessment and ABET

Description
This topic deals with assessment of student learning, accreditation related self-study aspects and where the future lies with continuous improvement in both undergraduate and graduate programs.

7-4 Systems Engineering and Sustainable Engineering Education

Description
This topic covers, but is not limited to, the advances and educational endeavors in the areas of systems engineering and sustainable engineering. Papers on integrative undergraduate and graduate education are also included here. Papers on issues related to women in engineering are welcomed.

7-5 Applied Mechanics, Dynamic Systems and Control Engineering

Description
This topic deals with innovative curriculum and pedagogical tools dealing with applied mechanics, dynamic systems and control. Methods of teaching effectiveness in both classroom and laboratory are ideal for presenting under this topic.

7-6 Fluid Mechanics, Heat Transfer, Experiments and Energy Systems

Description
This topic deals with innovative curriculum and pedagogical tools dealing with fluid mechanics, thermodynamics, heat transfer and energy systems. Methods of teaching effectiveness in both classroom and laboratory are ideal for presenting under this topic.

7-7 Problem Solving in Engineering Education, Research and Practice

Description
This topic deals with problem based learning and effective practices in the classroom.

7-8 Distance/Online Engineering Education, Models and Enabling Technologies

Description
This topic accepts papers and presentations in novel ways of online course developments. Papers dealing with new software for course and labs for distance learning are welcomed.

7-9 Pre-College (K-12) STEM, RET - University, School and Industry Alliance

Description
This topic welcomes K-12 outreach efforts by Universities and its industry partners. Modules of research and principles of engineering presented to the middle and high school students and teachers will be particularly beneficial to the audience. Similarly outreach to high school students in the form of innovative engineering activities on college campuses can also be presented to the peers attending the sessions. Research experiences for teachers would be appropriate under this topic.

7-10 Teaching Laboratories, Machine Shop Experiences, and Technology-Aided Lecturing

Description
This topic focuses on teaching laboratories and hands-on experience. Also innovative teaching-aids and tools that are used in lecturing are included. Authors are welcomed to submit papers in the above examples and similar hands-on teaching methods.

7-11 Societal and Ethical Dimensions of Engineering and Safety Issues

Description
This topic covers all non-technical areas in engineering education. Authors and presenters are invited to participate in this topic and help expand knowledge, understanding, and efforts in the area of engineering ethics, professionalism, societal impact, outreach in connection to engineering, and its education dimensions. Papers and presentations are sought from researchers, educators in all related areas, ranging from research and investigation to pedagogies and application methods.

7-12 Engineering Research Innovation and Research Experiences for Undergraduates

Description
This topic covers engineering education design and research developments. It includes interactive design experience and scientific computing, and other topics such as geometric tolerance and analysis, robotics engineering education and industry design experiences. Research experiences for Undergraduates would be an appropriate focus under this topic. Other undergraduate research programs are also welcomed.

Total Topics: 12

Track-8 Fluids Engineering

Topic

8-1 17th Symposium on Electric, Magnetic and Thermal Phenomena in Micro and Nano-Scale Systems

Description
The purpose of this Symposium is to bring together researchers from academia, industry, and government to promote further development in this broad field. This Symposium provides a platform to report the latest developments in the use of Electric and Magnetic Phenomena for the design and optimization of micro-devices for a wide variety of mechanical, chemical and biological applications.

- Micro-analytical systems
- Transport in biological and molecular systems
- Electric and magnetic fields for fluid transport
- Electrokinetic phenomena
- Dielectrophoresis and Magnetophoresis
- Ferrofluids, Magneto- and Electro-Rheological fluids
- Electro and Magneto-Mechanics of Colloids and Suspensions
- Measurements and on-line diagnostics
- Electrochemical machining
- Electric and magnetic fields for mechanical cleaning and finishing.

Topics of interest include, but are not limited to:

- Design
- Modeling
- Performance
- Materials
- Characterization
- Applications

8-2 26th Symposium on Fluid Mechanics and Rheology of Nonlinear Materials and Complex Fluids

Description
The purpose of this Symposium is to provide a platform for the reporting of the latest results concerning issues related to various aspects of the rheological and flow properties of nonlinear materials, and in particular advanced materials for the 21st century. Fundamental issues such as flow instabilities, inverse problems in rheology and constitutive formulations appropriate for electro-magneto-rheological fluids, thin films, suspensions, slurries, emulsions, oil field fluids, paper making fluids such as black liquor, laminar and turbulent flows of polymeric and other non-Newtonian liquids, are included as well as various transport processes, bubble motions, sprays, extrusion phenomena, fiber spinning, film blowing, industrial coatings, etc. Areas of interest are not limited to these issues. Theoretical, numerical and experimental contributions are solicited.

8-3 25th Symposium on Fundamental Issues and Perspectives in Fluid Mechanics

Description
The Symposium seeks fundamental research contributions to the general area of fluid mechanics. Papers enhancing our understanding of incompressible and compressible fluid mechanics are sought in areas that include, but are not limited to:

- Vortex flows
- Laminar/transitional/turbulent
- Unsteady flows
- Three-dimensional flows
- Separated flow
- Supersonic Hypersonic flows
- Wake flows
- Bifurcation and Hysteresis
- Boundary-layer flows
- Oscillating and Pulsing flows

Papers presenting analytical, experimental and/or numerical results are encouraged. Papers should emphasize practical solutions to the difficulties associated with acquiring, presenting, analyzing, and interpreting experimental and/or computational results. Experimental and computational studies employing unique diagnostic and computational methods to extract new information are also encouraged.

8-4 Symposium on CFD Applications for Optimization and Controls

Description
The Computational Fluid Dynamics Technical Committee (CFDTC) of the Fluid Engineering Division (FED) is sponsoring a symposium on CFD algorithms and applications for flow optimization and controls. Areas of interest include: different optimization schemes and control theories used for and combined with CFD simulation, procedures and applications of CFD to achieve optimized systems and designs, control systems, devices, or materials using CFD, and CFD applications to achieve optimization and controls of fluid flow at different scales (micro or macro) or involving multi-physics. The symposium seeks recent contributions of both basic

and applied research in these areas. Industrial applications related to these areas are also of particular interest.

8-5 Panel: CFD/EFD Choice? - A Dilemma for Industries

Description
The panel is intended to discuss the status and progress or lack of, in CFD & EFD, as well as issues important to industries for product development, in addition to identifying the scope for progress in fluid flow modeling, simulation and experimentation.

8-6 Microfluidics 2019 - Fluid Engineering in Micro- and Nanosystems

Description
The Micro/Nanofluidics 2019 forum provides a means of reporting the latest developments in the uses of fluid for micro-and nano-devices in mechanical, chemical and biological applications across research and industry. Topics of interest include, but are not limited to:

- Micro-total-analysis systems (MicroTAS) and lab-on-a-chip applications;
- Transport in biological and molecular systems;
- Fluid mechanics issues in micro-heat engines, micro-fuel cells, other micro-power sources, and micro-propulsion;
- Electrokinetic, electrohydrodynamic, and magnetohydrodynamic modeling and applications;
- Fluid handling systems;
- Flow and transport diagnostic and measurement techniques;
- Multi-component and multi-phase flow;
- Complex fluids and nano-particles;
- Micro- and nanoscale thermofluid science and devices;
- Fundamental flow phenomena in micro- and nanosystems;
- Optics and photonics in micro- and nanofluidic systems;
- Biologically enabled microfluidics;
- Sensors and transducers for microfluidic applications.
- Micro fuel cell and microfluidic/nanofluidic based energy storage

8-7 15th Forum on Recent Developments in Multiphase Flow

Description
The Forum on Recent Developments in Multi-Phase Flow is intended to provide an opportunity for engineers and scientists to present recent developments in multi-phase flow. Papers are solicited in all aspects of multi-phase flow. Types of multi-phase flow may include (but are not limited to): particulate, gas/liquid, gas/solid, cavitation, complex physics, and boiling. Such topical areas of multi-phase flow may span experiments, computation, and theory.

8-8 5th Forum on Multiphase Flow with Bio-applications

Description
Biological systems and their applications are attracting more and more interests from the multiphase flow community. Typical examples include boiling or cooling using bio-inspired approaches, targeted drug delivery with magnetic nanoparticles, thrombus formation in cardiovascular systems, bubble cloud cavitation in ultrasonic surgery, cavitating jets for biomass processing, etc. These or similar kinds of applications substantially enrich the spectrum of multiphase research activities, while at the same time pose challenges and urge the new developments of both computational models and experimental techniques of multiphase flows. This forum aims to create a multi-disciplinary platform to exchange new ideas and review recent progresses among researchers and engineers dedicated to the development of computational or experimental multiphase fluid dynamics with focuses on bio-applications. Subtopics of interests include, but are not limited to

- Biological particulate or bubbly flow
- Biomedicine, biodevice

- Bio-inspired multiphase heat transfer system
- Bioenergy; Bio-environmental engineering
- Other systems and applications involving biological and multiphase fluid dynamics.

8-9 28th Symposium on Industrial Flows

Description
This symposium promotes the discussion and information exchange on developing and state-of-the-art applications involving any type of single- or multiphase industrial flows/heat transfer. Relevant flow types include both internal and external and may include heat or mass transfer components. Papers are solicited on works in progress, novel applications of existing technology, and new concepts in all areas of thermal fluids engineering in which industrial flows are present. Both experimental and computational works are welcome. Opportunities to interact with expert guest speakers are available. Specific applications include blowers/compressors/pumps, bubble columns, extruders, fluidized beds, furnaces/combustors/gasifiers, pulse detonation systems, reciprocating engines, solids conveying/drying, trickle bed reactors, turbines.

8-10 Symposium on Wind Turbines Aerodynamics and Control

Description
The goal of this symposium is to address the issues concerning wind turbine aerodynamics and control, including the power transfer mechanisms. Papers are solicited on the areas of wind turbine aerodynamics and design, site selection, wind potential, system optimization, controls and power transfer mechanisms including gear boxes, etc.

8-11 19th International Symposium on Measurement and Modeling of Environmental Flows

Description
The 19th International Symposium on Measurement and Modeling of Environmental Flows is intended to provide a broad coverage of current experimental, analytical, and numerical studies related to all aspects of environmental flows. Appropriate topics include but are not limited to the following: submerged and surface discharges, cooling tower and stack plumes, jets and wakes, thermal discharges, heat disposal from power generation, thermal pollution, gravitational convection from boundary sources, smoke plumes, entrainment in free shear flows, atmospheric dispersion, atmospheric transport of fine particles, waste discharges, entrainment and deposition of soil, groundwater and surface water flows, flow around stationary structures, and experimental, analytical, and numerical methods in environmental flows.

8-12 12th Forum on Fluid Measurements and Instrumentation

Description
The 12th Forum on Fluid Measurements and Instrumentation is intended to provide a forum for academic researchers, practitioners and industrial engineers in the topical area of experimental fluid mechanics, to present new developments, and to discuss the state-of-the-art and science. Current developments on state-of-the-art flow measurement techniques devoted to any area of fluid measurements is encouraged. Contributions related but are not limited to Global Volumetric techniques (i.e. Planar PIV, Stereoscopic PIV, V3V, Tomographic, etc.), Planar Laser Induced Fluorescence (PLIF), Laser Doppler Velocimetry or Anemometry (LDV or LDA), Phase Doppler Velocimetry, Hot-wire/Hot-film anemometry, Pressure Sensitive Paints or Pressure Probes and instrumentation, Metering of Gas, Liquid, and multiphase flows, Flow Visualization, Ultra-Sonics, and any other topic for flow regimes ranging from low speed liquids to hypersonic gas flow are welcomed. Additional emphasis includes multiphase flow characterization and techniques to measure slurry properties such as phase, density, and viscosity.

8-13 Fluids Engineering Plenaries

No Topic Description.

8-14 Young Engineers Paper (YEP) Contest

Description
The YEP Contest is sponsored by the ASME Fluids Engineering Division (FED). It may be entered by undergraduate students, recent baccalaureate engineers (i.e., graduation after April 2018), and beginning graduate students (i.e. start of graduate studies after April 2018). Contest participants submit an abstract (maximum of 400 words) describing their research

paper, which should have its major focus on a fluids engineering topic. Based on the abstract, contestants will be invited to submit a full-length (approximately 6,000-word) paper following ASME publication guidelines. These papers are formally reviewed by the FED Young Engineer Paper Contest Committee, according to criteria including technical merit, paper quality, and adherence to YEP Contest entry requirements. The authors of up to five of the best papers will be selected as finalists. Based on the recommendations of the reviewing committee, selected finalists will have an opportunity to revise their papers prior to final submission; however, finalist selection will be based on the original full paper submission. Authors of papers selected as finalists are invited to present their papers at a special session held at IMECE where final judging and selection will be made for the following awards: First Place: $500, Second Place: $300, Third Place: $200, and Honorable Mentions: $100 for being selected as a finalist and presenting their paper. In addition, conference registration will be waived for ONE presenting author for each finalist paper, and travel expenses up to $750 will be provided to the presenting author to help defray costs of attending IMECE 2019. All finalist papers will receive certificates acknowledging the First Place, Second Place, Third Place, and Honorable Mention award winners.

Total Topics: 14

Track-9 Heat Transfer and Thermal Engineering

Topic

9-1 K6-1 Simulation and validation methods of mixed convection and conjugate heat transfer analyses in annular or ducting systems

No Topic Description.

9-2 K6-2 Numerical Analysis and Performance Assessment of Energy Systems

No Topic Description.

9-3 K6-3 Heat transfer analysis in waste heat recovery systems

No Topic Description.

9-4 K6-4 Heat transfer in solar power systems

No Topic Description.

9-5 K6-5 Thermal management of battery systems

No Topic Description.

9-6 K6-6 Radiative heat transfer and radiative properties of energy systems

No Topic Description.

9-7 K6-7 Heat transfer in passive thermal control systems

No Topic Description.

9-8 K6-8 Transient management of energy systems

No Topic Description.

9-9 K6-9 Two phase transport in energy systems and non-equilibrium and dynamic energy systems

No Topic Description.

9-10 K6-10 Panel on The key role of heat transfer analysis in energy systems research

No Topic Description.

9-11 K6-11 Mini-symposium on heat transfer in power & refrigeration systems

No Topic Description.

9-12 K6-12 Heat transfer in high temperature power generation systems

No Topic Description.

9-13 K6-13 Heat Transfer in waste heat recovery systems

No Topic Description.

9-14 K6-14 Radiation Heat transfer and Radiation Properties

No Topic Description.

9-15 K7-1 Spatially resolved thermophysical property measurements

No Topic Description.

9-16 K7-2 Thermophysical properties of next-generation thermal storage materials

No Topic Description.

9-17 K7-3 Invited Session with Discussion Systems for Thermophysical Property Measurement: System Details and User Insights

No Topic Description.

9-18 K8-1 Fundamentals of Boiling/Condensation including Micro/Nano-scale effects

No Topic Description.

9-19 K8-2 Fundamentals of Single Phase Convection

No Topic Description.

9-20 K8-3 Fundamentals of Electron-Phonon Coupled Non-equilibrium Transport (joint with K-9)

No Topic Description.

9-21 K8-4 Fundamentals of Radiation (joint with K-6 and K-9)

No Topic Description.

9-22 K8-5 Fundamentals of Thermal Rectification and Asymmetric Thermal Transport (joint with K-9)

No Topic Description.

9-23 K8-6 Panel: Women in Engineering

No Topic Description.

9-24 K9-1 Thermal transport across hard/soft interfaces

No Topic Description.

9-25 K9-2 Thermal transport in 2D and anisotropic materials

No Topic Description.

9-26 K9-3 Thermal transport in metamaterials

No Topic Description.

9-27 K9-4 Thermoelectrics

No Topic Description.

9-28 K9-5 Nanoscale phase change heat transfer

No Topic Description.

9-29 K9-6 Nanoscale modeling and simulation

No Topic Description.

9-30 K9-7 Nanoscale thermal radiation

No Topic Description.

9-31 K9-8 Nanoscale materials for thermal energy systems

No Topic Description.

9-32 K10-1 Single phase heat transfer equipment

No Topic Description.

9-33 K10-2 High heat flux heat transfer equipment

No Topic Description.

9-34 K10-3 Heat pipe and thermosiphon technology

No Topic Description.

9-35 K10-4 Heat exchangers

No Topic Description.

9-36 K10-5 Advances in heat exchangers design and analysis

No Topic Description.

9-37 K10-6 Multi-scale multi-phase enhanced heat transfer

No Topic Description.

9-38 K10-7 Additive manufacturing in heat transfer equipment

No Topic Description.

9-39 K11-1 CMC- Combustion Power Systems

No Topic Description.

9-40 K11-2 CMC- Sprays and Emissions

No Topic Description.

9-41 K11-3 CMC- Applied Combustion

No Topic Description.

9-42 K11-4 CMC- Fundamental Processes - Laminar and Turbulent Flames

No Topic Description.

9-43 K13-1 Boiling

No Topic Description.

9-44 K13-2 Phase Change Materials

No Topic Description.

9-45 K13-3 Condensation

No Topic Description.

9-46 K14-1 Gas Turbine Heat Transfer and Cooling

No Topic Description.

9-47 K15-1 Transport Phenomena in Manufacturing and Materials Processing

No Topic Description.

9-48 K15-2 Processing of Frontier Materials

No Topic Description.

9-49 K15-3 Transport Phenomena in Additive Manufacturing

No Topic Description.

9-50 K15-4 Processing of Battery Materials

No Topic Description.

9-51 K16-1: Heat Transfer in Electronic Equipment

No Topic Description.

9-52 K17-1: Bioheat and Mass Transfer

No Topic Description.

9-53 K18-1 Thermal transport under high temperature and/or pressure conditions

No Topic Description.

9-54 "K18-2 Heat transfer analysis of processes under chemically reacting, explosive, UV exposed and/or corrosive medium "

No Topic Description.

9-55 K18-3 Heat transfer and transport analysis of multicomponent plasma processes

No Topic Description.

9-56 K18-4 Thermal analysis of industrial equipment and systems operating under extreme process conditions

No Topic Description.

9-57 K19-1 Heat and Mass Transfer in the Natural and Built Environment

No Topic Description.

9-58 K19-2 Heat and Mass Transfer Associated with Thermal Comfort and Indoor Environmental Quality (IEQ)

No Topic Description.

9-59 K19-3 Advances in Water and Wastewater Processing and Water Desalination Technologies

No Topic Description.

9-60 K19-4 Energy Efficiency Issues in Smart Buildings and Cities

No Topic Description.

9-61 K19-5 Panel on Environmental Issues Associated with Natural and Controlled Fires

No Topic Description.

9-62 K20-1 Inverse Problems in Heat Transfer

No Topic Description.

9-63 K20-2 Applications of Computational Heat Transfer

No Topic Description.

9-64 K20-3 Methods and Algorithms in Computational Heat Transfer

No Topic Description.

9-65 K20-4 Computational Analysis of Energy Management in Buildings (Joint with K-19)

No Topic Description.

9-66 K21-1 Panel on Recent advancements and discussions in heat transfer and thermal science education

No Topic Description.

9-67 K21-2 Panel on Broad-based experiences and discussions in mentorship to tenure-track faculty in thermal science programs

No Topic Description.

9-68 K22-1 Heat and Mass Transport Photogallery

No Topic Description.

Total Topics: 68

Track-10 Advanced Materials: Design, Processing, Characterization and Applications

Topic

10-1 In-Situ Techniques in Experimental Mechanics

Description
In situ techniques provide a wealth of information for the understanding of mechanical performance and behavior. Techniques including in situ digital image correlation (DIC) with optical or scanning electron microscope imaging, in situ neutron diffraction, in situ synchrotron imaging, and tomography can allow for the observation and identification of failure mechanisms across a wide range of length and time scales. The usefulness of in situ experimental data has been recognized and is becoming the standard for validation of models and qualification of components.

This symposium will bring together researchers using in situ experimental techniques to address common issues, share novel in situ experimental techniques, and to present methods for in situ data analysis. In addition to fatigue and fracture, in situ experiments on other topics such plasticity, creep, dynamic effects, and engineering development are welcome.

10-2 Multiscale Modeling for Materials Design

Description
This symposium will focus on leveraging the Integrated Computational Materials Engineering (ICME) platform to advance multiscale materials modeling and design for a variety of applications. A primary focus of the ICME vision is establishing a knowledge base accessible to the community-at-large for solving a plethora of disparate issues in materials science, applied mechanics, and engineering. This knowledge base requires collection of experimental data describing phenomena at different scales (exploratory experiments, calibration of material models, and validation of models), performing simulations at different scales (atomic, molecular, dislocation, crystal-plasticity, macro-scale FEA), and linking all this information together to determine structure-properties relationships, thereby leading to concepts and designs for new materials [https://icme.hpc.msstate.edu/]. The technology development is now commonly rooted in the sophisticated design of engineered materials with specific and optimized chemical, physical and mechanical properties, which increasingly demands systematic search, benchmarking and high-throughput materials simulation. In this perspective, ICME bridging different length/time scales to access large scale materials properties, and machine learning which harvests cumulated simulation data to extrapolate and obtain the optimal materials for targeted applications have become essential decision-making tools for boosting industrial innovation. This symposium solicits abstracts in the following areas (but not limited to):

- Computational modeling studies at different length scales for fundamental understanding of materials structure, properties, processing and performance
- Computational models linking different length and/or time scales to simulate the design and manufacture of new materials and products
- Uncertainty Quantification – verification and validation of computational models; Computational methodology validation, as well as uncertainty evaluation for computational approaches at various length scales
- Artificial Intelligence Frameworks for Materials Discovery and Design; Machine Learning, Computational and Experimental Big Data Analysis, etc

10-3 Mechanics and Materials of Soft Electronics

Description
The goal of this symposium is to bring together researchers in the growing area of soft electronics and structures, including but not limited to printed electronics, polymer electronics, hard/soft materials integration, soft biomedical devices, soft robots, adaptive structures, and the related materials and manufacturing. The objective is to enhance interactions among active researchers from both academia and industry working on soft electronics and materials, and related aspects in applied mechanics, materials science, manufacturing strategies, and emerging technologies. Both fundamental research and applied device applications in related advanced technologies are welcome.

A number of sessions will be organized for the following topics:

- Flexible and stretchable electronics and devices: mechanics, materials, and manufacturing
- Bio-integrated electronics and photonics
- Transient electronics
- Printed electronics
- Soft composite materials and devices
- Heterogeneous materials
- Hard/soft integration
- Bio-electronics interfaces
- Soft robots
- Shape adaptive devices

10-4 Mechanical Metamaterials

Description
Mechanical metamaterials are the rationally designed artificial structures whose properties are not found in nature. The properties of mechanical metamaterials are defined by their geometric architecture guided design rather than their composition. Their mechanical properties can be designed to have unusual or reverse values compared to those found in natural materials. This symposium invites fundamental studies on mechanics and design of mechanical metamaterials and their engineering applications across various scales. The aim of this session is to provide a forum to bring together investigators to discuss and disseminate the research findings in mechanical metamaterials and architectural structures with unusual properties. Examples of topics to this symposium include (but are not limited to):

- Reconfigurable mechanical metamaterials, tunable mechanical metamaterials, and mechanics of mechanical metamaterials.
- The design of mechanical metamaterials on negative Poisson's ratio, negative thermal expansion, negative stiffness, negative compressibility, reverse Saint-Venant effect, and other tailored engineering properties.
- Analytical, numerical, and experimental studies on the behaviors of architected structures; e.g., polygon/polyhedral lattices, tessellated structures, granular structures, tensegrity lattices, origami/kirigami structures, etc.
- Added intelligent design with programmable functions to achieve particular shapes or mechanical properties upon command.
- Advanced technologies such as 3D/4D printing to manufacture mechanical metamaterials

10-5 Multifunctional and Micro/Nano-structured Materials: Modeling and Characterization

Description

The objective of this topic is to discuss recent advances in multifunctional and micro/nano-structured materials and to identify future research opportunities in the subject areas. Innovative theoretical, computational and experimental approaches will be discussed.

10-6 Biomaterials and Tissue: Modelling, Synthesis, Fabrication and Characterization

Description
Tissues and tissue engineered constructs express a broad range of functionality based upon their mechanical, electrophysiological, and transport properties across multiple hierarchies. This theme area aims to capture the state of the art of modeling, measuring, and recapitulating the mechanics and physics of biological tissues as well as biomaterials synthesis and characterization. Special focus will lie on the mechanics of these tissues, on engineered materials such as porous solids and structural composites that mimic their function, and on simplified systems that enable the biophysical characterization of living cells.

10-7 Materials and 3D Printing for Biology and Medicine

Description
This symposium will bring together experts across the range of engineering science disciplines to discuss the state-of-the-art in development of materials and 3D/4D printing for biology and medicine. The symposium will highlight challenges spanning from design of advanced materials and innovative additive manufacture techniques, to fabrication, and to implantation. Computational and analytical challenges will be a special focus. Topics of interest include but are not limited to:

- Smart materials and nanomaterials for medicine
- 3D/4D bioprinting for tissue and organ regeneration
- Design, analysis, and applications of printing materials
- Advanced additive manufacture techniques
- Simulation of material, cell-material interaction or 3D tissue constructs
- 3D printed tissue models for cancer study
- 3D/4D printing for health

*Good quality papers will be considered for publication in the *ASME Journal of Engineering and Science in Medical Diagnostics and Therapy*, which is sponsored by the Materials Division.

10-8 Materials and Fabrication Techniques for Bio-robotics

Description
This symposium will bring together experts across the range of engineering science disciplines to discuss the state-of-the-art in development of materials and fabrication techniques for bio-robotics. Sensing and control, harnessing passive properties of material combinations and mechanisms, will be a special focus. Topics of interest include but are not limited to:

- Unconventional materials for bio-inspriation in robotics (including but not limited to smart and nanomaterials)
- 3D/4D bioprinting for bio-inspiration and materials optimization in biorobotics
- Numerical shape and materials optimization
- Stretchable sensors and electronics for bioinspired applications
- Flexible and reconfigurable robots for bio-inspired applications
- Advanced additive manufacturing techniques
- Multi-material fabrication processes targeting intrinsically responsive robots
- Modeling and simulation of biorobotic systems
- Functional materials for adaptive robotic systems

- Bio-inspired/biomimetic robots, with a focus on passive dynamics

*Good quality papers will be considered for publication in the *ASME Journal of Engineering and Science in Medical Diagnostics and Therapy*, which is sponsored by the Materials Division.

10-9 Modeling, Simulation, and Design of Multifunctional Materials

Description
This symposium will provide a forum that highlights exciting scientific developments in the modeling, simulation, and design of multifunctional materials, hybrid materials, and engineering material systems. Topics of interest include but are not limited to:

1. Novel concepts of multifunctional materials, hybrid materials, and engineering material systems
2. Materials physics to understand the functioning of materials
3. Materials design (e.g. topology optimization, data-driven design, simulation-based design) for improved performance
4. Modeling and design of the manufacturing process and service-induced changes

10-10 Multifunctional Composite Materials and Structures

Description
Composite material possesses excellent performance by taking advantage of two or more phases combined together. By achieving the multifunctional goal, structure functionality may be expanded or complicity can be reduced. This symposium aims to bring scholars and engineers from various background related to materials and mechanics together to discuss the most exciting and recent progress of the discovery and development for multifunctional composite materials and structures.

10-11 Multifunctional Nanomaterials

Description
Multifunctional nanomaterials have played a critical role in enabling and enhancing solutions to the inherent challenges of energy, environmental applications, biotechnology, etc. This topic will focus on the multifaceted research issues and perspectives pertaining to multifunctional nanomaterials that may include but are not limited to:

- Multifunctional nanomaterials synthesis and characterization of the mechanical/electrical/thermal properties, i.e. soft robotics, etc
- Multifunctional nanomaterials for more than one application, for example:
    - Energy conversion and storage, such as solar cell, super capacitor, lithium battery, fuel cells, wind energy, wave energy, etc.
    - Environmental applications, such as water treatment, air pollution treatment, soil treatment, etc.
    - Biotechnology, such as biomimetic nanomaterials, etc.
    - Other Areas

Topics of interest include but are not limited to

- Multiscale Modeling and Experiments on nanomaterials
- Synthesis and Characterization of Multifunctional Nanomaterials

- Multifunctional Nanomaterials for Energy conversion and Storage
- Multifunctional Nanomaterials for Environmental Applications
- Multifunctional Nanomaterials for Biotechnology
- Scalable Manufacturing of Multifunctional Nanomaterials

The “Multifunctional Nanomaterials” TC plans to invite high-profile researchers to contribute invited talks followed by regular talks in each session to increase visibility and attendance.

10-12 Mechanics in Manufacturing of Multifunctional Materials and Structure

Description
Manufacturing is a broad field that includes techniques ranging from classical processes, such as casting and machining, to more recent digital- and printing-based processes. The ever-increasing demand for the next-generation high-performance functional materials, structures and devices of relevance to energy, environment, healthcare and security is driving the development of new manufacturing techniques. At the root of nearly all manufacturing processes are elementary steps that rely on material deformation and/or assembly due to mechanical interactions. The symposium aims to provide an interdisciplinary forum for discussing the mechanics that underpins manufacturing of advanced materials, structures and devices. Mechanics is central to optimizing existing techniques and to guiding the development of future advanced manufacturing with unique capability, cost-efficiency, and high-precision. Papers, extended abstracts or technical presentation are solicited in the areas including but not limited to:

- Mechanics-driven manufacturing and integration (e.g. self-assembly, microtransfer printing, folding, crack/buckling/delamination-driven templating techniques) of functional materials, structures and devices
- Mechanics in manufacturing of functional materials, structures and devices under extreme conditions (e.g. liquid environment, laser/nuclear radiation, high temperature/pressure, rapid phase transformation, constrained boundaries)
- Mechanical properties of functional materials, structures and devices manufactured via advanced manufacturing techniques (e.g. additive manufacturing, self-assembly, electrospinning, rolling/joining technologies)
- Modeling and simulations of mechanics and material deformation in manufacturing of advanced materials, structures and devices

10-13 Bioinspired Materials, Structures and Applications

Description
Bioinspired materials science and technology is among the growing fields that attract both academia and industry. Efforts to mimic tooth and bone, mother of pearl, body tissues and other biological structures has culminated in new structures and devices. Papers, extended abstracts or technical presentation are solicited in the areas including but not limited to:

- Combinatorial Bioinspired Composites
- Bioinspired materials fabrication instrumentation, characterization and modeling
- Self-Oscillating mechanical models for biological response of human tissues
- Phono-mimetic stimulation, characterization and modeling
- Synthesis and characterization of hybrid actuators
- Self-cleaning properties of carbon nanotube composites

- Biomimetics applications
- Elastomeric larynx, characterization of servo-biomimetics for muscles
- Mechanical properties of biomimetic composites
- Tough structures inspired by natural fish scales
- Mimicking spider silk, tooth, bone, nacre, body skin
- Biomimicked structural materials including biomimicked composites for construction

10-14 Soft Robotics and Soft Machines

Description

Soft robotics is becoming an emerging research area due to its great potential of safe and adaptive interaction with humans and environments. It has recently attracted growing research interest from the broad communities of materials, mechanics, sensors, robotics, dynamics, and control. Soft continuum robots are often made of highly deformable soft materials, thus allowing extreme compliance, endurability, elasticity, as well as theoretically infinite number of degrees of freedom. It has witnessed recent rapid advances in the multidisciplinary soft robotics area, including but not limited to bioinspired soft-bodied systems for multitasks and functionality, as well as integration of new active soft materials for design of untethered soft robots.

This symposium invites both fundamental and applied researches on modeling, design, fabrication of soft robotics and soft machines composed of soft active/non-active materials at all length scales. The purpose of this symposium is to discuss and showcase recent advances in the multidisciplinary soft robotics areas, as well as outlook for future potential collaborations and directions. Examples of the topics include (but are not limited to):

- Design, fabrication, and modeling of soft actuators at all scales (e.g. linear, bending, or rotary actuators)
- Locomotive soft robots on land or underwater, including but not limited to crawling, rolling, climbing, jumping, swimming, and swinging soft robots
- Tethered or untethered soft robots composed of non-active or stimuli-responsive soft materials, including hydrogels, liquid crystals, shape memory polymers, magnetic elastomers, and dielectric elastomers or other emerging active materials
- Design of high-performance soft robots with high strength, high force, and fast response (e.g. origami/kirigami-inspired soft robots, fiber/fabric/envelope-reinforced soft robots etc)
- Dynamics and control of reconfigurable soft robotics
- Artificial muscles, grippers, wearable soft robots, e-skin and sensors for soft robots, and rehabilitation soft robots etc.
- Manufacturing and fabrication of soft robotics and soft machines

10-15 Lithium-ion battery safety under abusive conditions

Description

Lithium-ion battery safety upon various abusive (e.g. mechanical, thermal and electrochemical) conditions becomes a priority in its further wide application in electric vehicles and other electric portable devices. The complexity nature of lithium-ion battery safety stems from the multi-physics coupled behaviors at multi-scale where mechanics, electrochemistry and physics. This topic aims to bring together researchers and engineers working on all types of possible scales and physics domains of lithium-ion battery. It seeks to synthesize recent advances in theoretical modeling, computational methodology development and experiment characterization/observation.

10-16 Multi-Scale and Plasticity Models of Energy related Materials

Description
The current topic covers a broad field of modern theory and modeling methods for predicting and understanding the properties of energy related materials. In particular it will cover; multi-physical and multi-scale methods for materials modeling, which include, but not limited to; advanced models for piezoelectric materials for energy harvesting; advanced models for energy storage and photovoltaic materials; hydrogen embrittlement and failure in engineering materials and fuel-cell devices; as well as predictive and multiscale models for damage and failure of wind and water turbine-blades materials, natural fiber composites and nuclear-energy related materials.

10-17 Constitutive Modeling of the Mechanical Behavior and Performance of Electronic, Photonic, MEMS, and NEMS Materials, Assemblies, Packages, Modules, and Systems

Description
The objective of this symposium is to bring in specialists in applied mechanics, materials science, and related areas of engineering and applied science (physics, electrical engineering, computer science, and others) to address the state-of-the-art and advance knowledge in the field of constitutive modeling, weather analytical or simulation-based, deterministic or probabilistic, etc., of the mechanical behavior and performance of the today's and emerging electronic, photonic and micro- and nano-electro-mechanical systems (MEMS and NEMS) for all the aspects and at all the stages of their conception and lifetime: research, development, manufacturing, accelerated and qualification testing, burn-in, field (operation) conditions, etc. The symposium has a comprehensive scope. Its major topics include, but are not limited to, the following areas:

- Vehicular (aerospace, automotive, maritime) and medical materials, devices and systems
- Semiconductor electron and optical devices; sensors and actuators
- Composite and smart electronic and photonic (active and passive components) materials and structures
- Fiber optics mechanics and static fatigue (delayed fracture)
- Nano-scale materials, technologies, devices, and systems; nano-electronics and nano-photonics
- Human-made energy sources, including safer and more energy-dense rechargeable batteries
- Advanced polymer semiconductors in high-performance electronics and photonics
- Information and communication devices and systems
- Embedded devices and systems
- Solder materials and solder joint interconnections in electronic and photonic packaging
- Photovoltaic and thermo-electric modules
- Stretchable (large area) electronics and photonics and flexible media (tape) mechanics
- Lattice-misfit and thermal mismatch structures
- Analog and digital functional printing materials and technologies
- Robotics and automation technologies and systems
- Advanced packaging in electronics, optoelectronics, photonics, interconnections, and RF systems
- Probabilistic risk analysis methods and approaches
- Structural optimization and application of multidisciplinary approaches and techniques
- Interfacial phenomena: mechanics, physics, nondestructive testing and in-situ monitoring
- Multi-functional materials: design and characterization using embedded micro- and nano-sensors and actuators, piezoelectric materials, shape memory alloys, etc.
- Thermoelectric materials, devices, and applications

- Thermal management in electronics and photonics, and thermo-elasticity and thermo-plasticity
- Advanced continuum theories and constitutive models
- Dynamic response of electronic, photonic, MEMS and NEMS materials and structures to shocks and vibrations
- Technical diagnostics, prognostics and health monitoring in electronics, photonics, MEMS and NEMS systems
- Tribology issues: contact mechanics, lubrication, friction, wear, contamination, corrosion
- Thin film mechanics and physics
- Novel technologies in imaging/printing consumer electronics
- “Human-in-the-Loop”: human-equipment-interaction

10-18 Multiscale Modeling for Materials Design

Description

This symposium will focus on leveraging the Integrated Computational Materials Engineering (ICME) platform to advance multiscale materials modeling and design for a variety of applications. A primary focus of the ICME vision is establishing a knowledge base accessible to the community-at-large for solving a plethora of disparate issues in materials science, applied mechanics, and engineering. This knowledge base requires collection of experimental data describing phenomena at different scales (exploratory experiments, calibration of material models, and validation of models), performing simulations at different scales (atomic, molecular, dislocation, crystal-plasticity, macro-scale FEA), and linking all this information together to determine structure-properties relationships, thereby leading to concepts and designs for new materials [https://icme.hpc.msstate.edu/]. The technology development is now commonly rooted in the sophisticated design of engineered materials with specific and optimized chemical, physical and mechanical properties, which increasingly demands systematic search, benchmarking and high-throughput materials simulation. In this perspective, ICME bridging different length/time scales to access large scale materials properties, and machine learning which harvests cumulated simulation data to extrapolate and obtain the optimal materials for targeted applications have become essential decision-making tools for boosting industrial innovation. This symposium solicits abstracts in the following areas (but not limited to):

- Computational modeling studies at different length scales for fundamental understanding of materials structure, properties, processing and performance
- Computational models linking different length and/or time scales to simulate the design and manufacture of new materials and products
- Uncertainty Quantification – verification and validation of computational models; Computational methodology validation, as well as uncertainty evaluation for computational approaches at various length scales
- Artificial Intelligence Frameworks for Materials Discovery and Design; Machine Learning, Computational and Experimental Big Data Analysis, etc.

10-19 Design of engineered materials and components for additive manufacturing

Description

This symposium focuses on design approaches and algorithms for additive manufacturing in terms of the development of printing materials and/or the printed component. This includes design at all scales with the common theme being a performance-driven design scheme that highlights features specific to additive manufacturing. Abstracts encompassing computational and experimental efforts for a variety of applications are welcome.

- Design for AM
- Architected materials (lattice structures), metamaterials
- Topology optimization
- ICME
- FDM, DMLS, DED, SLA, SLS
- Experimental validation

10-20 Perspectives from Program Managers and Center Directors on Materials by Design Challenges

Description
This symposium will feature all invited talks from program managers at several funding agencies (including NSF, AFOSR, DOE) and related Center Directors to highlight the interdisciplinary integration necessary to address open challenges in engineering-materials-by-design. In addition, the role that this kind of integration has played in developing cutting edge technology will be shown through recent success stories and lessons learned. The symposium will end with a Question & Answer Panel with the invited speakers.

10-21 Designs Integrating Soft-Hard Materials for Multifunctional Applications

Description
Soft-hard material integration is ubiquitous in natural materials and has underpinned the achievement of many extraordinary properties. Leveraging these unique soft-hard integration mechanisms could result in intelligent design principles to create man-made functional materials with adaptive performance. This symposium is intended to provide a forum for researchers from academia, industry, and national labs to present, discuss, and exchange the latest developments in the design of multifunctional materials through soft-hard material integrations and their enabled applications. Papers or technical presentations are solicited in the areas including but not limited to:

- Soft-hard integration design theory, optimization and algorithm development
- Functional materials and structures featuring soft-hard integration designs
- Electronics and functional devices enabled by soft-hard material integrations
- Adaptive structures and soft robotics via soft-hard integration designs

10-22 Emerging Topology and Shape Optimization Techniques in Computational Design of Materials and Structures

Description
Motivated by key advances in manufacturing techniques, the tailoring of materials with desired macroscopic properties and structures with desired end-use performance has been the focus of active research in engineering and materials science over the past decade. For materials and structures architectured at length scales that can be controlled by the manufacturing process, the goal is to determine the optimal spatial layout of one or more constituent materials to achieve a desired macroscopic constitutive response and multifunctional performance. Topology and shape optimization methods provide a systematic means to achieve this goal. The objective of this symposium is to bring together researchers working on state-of-the-art topology and shape optimization techniques with direct application in materials and multifunctional design to exchange ideas, present novel developments and discuss recent advances. Topics of interest concern shape and topology optimization techniques, and they include, but are not limited to:

- Simultaneous material and structural optimization
- Optimization under uncertainty
- Design of metamaterials
- Multiscale, multifunctional design of materials and structures

- Design of lattice materials and structures
- Design of nonlinear materials
- Design optimization for additive manufacturing
- Reduced-order multiscale modeling for design
- Bioinspired design of composites
- Smart material design

10-23 Nanoengineered, Nano Modified, Hierarchical, Multi-Scale Materials and Structures

Description
The goal of this symposium is to provide a forum for exchange of current practices, research and developments, future trends and directions in the areas related to processing, new manufacturing methods including additive manufacturing, characterization, mechanics, modeling, analysis, design, and applications. Of particular interest are nanoengineered, nanomodified, hierarchical, and multi-scale material systems and structures, and tailored material configurations at, and consisting of different length scales from nano to engineering scale. Material systems are highly multi-scale in nature with their properties and mechanical behavior dictated by their multi-scale morphology, materials and features, and their variations including their fundamental molecular structure and associated material genome, as well as interaction and influence of material components at different scales. This symposium will also provide a forum for fostering cross-disciplinary interactions and collaborations integrating research and developments with targeted applications in this field. Topics of interest include but are not limited to the following areas related nanoengineered, hierarchical, multi-scale crystalline, amorphous, polymeric, biological/bio-inspired, ceramic, and cementitious materials.

- Processing developments
- Characterization
- Nano to Continuum Modeling
- Multi-functional materials
- Nano enabled and modified materials
- Multi-Scale Mechanics
- Design and Analysis
- Engineering Applications
- High Performance Materials
- Tailored Material Configurations

10-24 Fracture and Damage: Nano- to Macro-Scale

Description
New materials are increasingly gaining importance in several fields of engineering, in view of the property advantages they offer. The scope of this session is to understand the fracture and damage response of engineering and engineered materials at different size-scales through analytical, numerical and experimental approaches. Papers dealing with the effect of material processing on fracture and damage would be highly appreciated. Papers are solicited on the following topics to include but not limited to:

- Material process induced fracture and damage (conventional and additive manufacturing, etc.,)
- Damage mechanics at different size-scales (micro-mechanics to macro-fracture mechanics).
- Fracture and damage due to plastic deformation, fatigue, creep, corrosion in engineering materials and engineered materials with heterogeneous microstructures and properties.
- Damage evaluation in coatings, thin structural films, electronic- and bio-materials and micro-electromechanical systems.

- Application of numerical, analytical methods in damage monitoring and life predictions.
- Invasive and non-invasive experimental methods of damage evaluation, both in-situ and in laboratory.
- Damage prognostics and health monitoring methods.

10-25 Material Processing of Flexible Electronics, Sensors, and Devices

Description

This topic/symposium will cover experimental, design-related, and mechanics-based efforts toward manufacturing or fabricating flexible electronics, sensors, and devices. Sessions might include materials research or processing techniques related to the following areas:

- Modified conventional semiconductor-based processing for large-scale flexible devices
- Materials for biological/human-based monitoring of performance or other factors
- Contact printing/soft lithography and printed electronics
- Additive manufacturing of 3D architected electronics
- Design/fabrication of elastomeric actuators
- Electroactive polymers
- Transparent electronics
- Novel stretchable or flexible substrates
- Energy harvesting
- Wearable devices
- Skin-like sensors

The organizers plan to invite high-profile researchers to contribute invited talks followed by regular talks in each session to increase visibility and attendance.

10-26 Materials Processing and Characterization

Description

Technical session on Materials Processing and Characterization invites papers on state-of-the-art, theoretical and practical aspects of the structure and property correlation of materials and on new methods employed to characterize properties. Emphasis will be on establishing mechanical properties that are relevant to scaling of materials from atomistic level to large structures.

Range of materials includes the following:

1. Metals and alloys – Tension, compression, shear, fatigue, fracture, creep, wear, corrosion responses and its correlation with microstructure
2. Ceramics – Conventional and Technical ceramics
3. Nano-materials – Structure property correlation
4. Bio-medical materials – New as well as restorative materials
5. Optical materials
6. Composites – Metal matrix, polymeric, natural and special forms of composites
7. Natural Materials

10-27 Phase Transformations in Materials Processing

Description

Solidification and solid-state phase transformations in materials occur in different materials processing, such as in casting, welding, and additive manufacturing, and understanding, controlling and utilizing phase transformations can guide developing new processing avenues to tailor microstructures and properties of materials. Today we have the opportunity to explore the diverse phenomena displayed by materials with specialized theoretical, computational, and experimental tools. Advances in multiscale characterization techniques and computational simulations provide new perspectives into microstructural relationships at the nano and micro scales, enabling a fundamental understanding of the effect of phase transformations on mechanical and other properties of materials during different processing.

This symposium solicits theoretical, computational, data driven, and/or experimental works in the following areas:

- Solid-liquid interface properties and solidification/crystallization phenomena and their effects on microstructures and properties of materials.
- Diffusional phase transformations, such as second phase precipitation or dissolution, and their effects on mechanical and other properties of materials.
- Martensitic phase transformations in ferrous, non-ferrous, shape memory, and superelastic materials, and their effects on mechanical and other properties of materials.
- Uncertainty quantification, model verification and validation, machine learning and data analysis helping developing physics-based models and microstructure quantification.

10-28 Online Monitoring of Materials Processing Parameters

Description
This topic is devoted to all online, in-situ methods of materials processing parameters, applicable to metals, composites or any class of materials through the use of techniques that help control the final quality of material. The techniques could span from simple optical microscopy, spectroscopy methods, viscosity, and flow measurements on one side to sophisticated NDE methods like Infrared thermography, X-ray, ultrasonic or any other novel technique.

For metals, monitoring of Additively Manufactured components, solidification characteristics, machining parameters, welding (conventional as well as friction processing), or any other wrought and mill process are considered under this topic. In respect of composite materials, curing process monitoring at intermediate stages and mid-process corrections to help get final quality component is considered as pertinent to this theme.

10-29 Recent Developments in Tribology

Description
No human activity could be conducted without the expenditure of energy. The machines and devices that we use need energy to operate, and part of this energy is wasted through friction in the moving parts of mechanical and electromechanical components. Friction, wear, and lubrication in engineering systems have a major influence on the economy of a country. It is estimated that between 1 and 1.55% of a country's Gross Domestic Product (between $170 billion - $300 billion in the United States) could be saved by reducing friction and wear losses in mechanical components. Advances in these areas could lead to significant economic and environmental benefits. This topic will focus on the state of the art and future trends in tribology including both the fundamental and experimental aspects of wear and friction of materials. Areas of interest may include but are not limited to:

- Friction and wear of mechanical transmissions
- Tribology of metals, ceramics, polymers and composites
- Bio-tribology
- Nanotribology
- Metalworking fluids

- Tool wear
- Coatings and surface modifications
- Tribo-chemistry
- Ordered fluids as lubricants and additives of lubricants
- Textured surfaces for friction and wear reduction
- Case studies

10-30 Nanomaterials for Energy

Description
Nanomaterials are anticipated to play a critical role in enabling solutions to the next-generation materials challenges associated with energy harvesting, conversion, and storage technologies. This topic will focus on new developments in areas that include, but are not limited to, nanomaterial engineering, mechanics-enabled performance enhancements in energy nanomaterials, material characterization, system integration, and computational techniques / tools. Session topics will include:

- **Next-generation nanomaterials**: synthesis and engineering of high-performance, low-dimensional (0-D, 1-D, and 2-D) materials for batteries, thermoelectrics, and photovoltaics
- **Mechanics of nanomaterials**: nanomechanics-enabled performance enhancement in lithium-ion and beyond-lithium technologies, supercapacitors, and fuel cells
- **Design, fabrication, and reliability/failure analysis**: scalable integration of nanomaterials into energy conversion and storage systems
- **Characterization techniques and Computational methods**: current advances in computational tools (DFT, molecular dynamics, machine learning, artificial intelligence, etc.) and characterization techniques (incl. in-situ/in-operando methods) for energy nanomaterials

Total Topics: 30

Track-11 Mechanics of Solids, Structures and Fluids

Topic

11-1 Mechanics of Soft Materials

Description
This topic covers the characterization, prediction, modeling, and application of mechanics in soft materials. This topic seeks abstracts for individual sessions in:

- Active Materials
- Mechano-Chemistry
- Mechano-Biology
- Gels
- Mechanical Characterization
- Degradation, Fracture, and Fatigue
- Soft Structures, Machines, and Robots

The symposium brings researchers from a variety of backgrounds together in order to exchange and discuss ideas related to theory and experimentation of the mechanics of soft materials. When submitting your

abstract please include a sentence indicating which session you would like to take part in.

11-2 Functional Soft Composites - Design, Mechanics, and Manufacturing

Description
Functional soft composite materials are recently becoming an emerging field in scientific research and engineering innovation that is distinct from traditional materials and composites, due to their unprecedented potential of large deformation, property tuning, shape changing, and self-adaptivity. By integrating soft matrix with functional ingredients such as stimuli-responsive particles and mechanophores, soft composites could enable advanced material and structural systems with multifunctionalities in the field of soft actuator, soft robotics, flexible electronics, and biomedical engineering. The development of functional soft composites synergistically integrates design, mechanics, and manufacturing. This symposium will represent the emerging and recent advances in soft composite materials with a focus on the design concept, design method, modeling, simulation, and fabrication, as well as their novel engineering applications across a wide range of engineering fields. Specific topics of interest include, but are not limited to:

- Design concept and methodology of soft composites with novel properties and functionalities
- Constitutive modeling of soft composite material behavior
- Advanced manufacturing of soft composites
- Multiphysics coupling of soft composites and their applications
- Stimuli-responsive soft composites and their applications

11-3 3D Printed Soft Materials

Description
Additive manufacturing, also known as 3D printing, offers unique opportunities to explore novel properties and mechanics of soft materials. This topic calls papers from research efforts related to soft materials with novel properties realized or created using 3D printing techniques. Specific areas of interest include, but are not limited to:

- Soft metametarials with novel properties
- Printed active composites
- Novel printing technologies with new printable soft materials?
- Design theory or methodology for soft materials that will be realized through 3D printing
- Mechanics of 3D printed materials
- Applications of printed soft materials

11-4 Mechanics and Materials of Soft Electronics

Description
The goal of this symposium is to bring together researchers in the growing area of soft electronics and structures, including but not limited to printed electronics, polymer electronics, hard/soft materials integration, soft biomedical devices, soft robots, adaptive structures, and the related materials and manufacturing. The objective is to enhance interactions among active researchers from both academia and industry working on soft electronics and materials, and related aspects in applied mechanics, materials science, manufacturing strategies, and emerging technologies. Both fundamental research and applied device applications in related advanced technologies are welcome. A number of sessions will be organized for the following topics:

- Flexible and stretchable electronics and devices: mechanics, materials, and manufacturing
- Bio-integrated electronics and photonics
- Transient electronics

- Printed electronics
- Soft composite materials and devices
- Heterogeneous materials
- Hard/soft integration
- Bio-electronics interfaces
- Soft robots
- Shape adaptive devices

11-5 Mechanics and Manufacturing of Soft Materials and Soft Robots

Description
Soft materials such as elastomers, hydrogels, shape-memory polymers, etc., can deform largely when subjected to external stimuli, such as mechanical, thermal, electrical, magnetic, or chemical loadings, leading to novel functions in soft structures, machines and robotics. This topic is aiming at exchanging and discussing the current theoretical, experimental and computational advances in mechanics and manufacturing of soft materials and machines, as well as their broad applications. The topics of particular interest include but not limited to:

- Constitutive relations of soft materials
- Computational methods for soft materials
- Experimental characterization of soft materials
- Design and application of soft materials and soft robots
- Failure of soft materials and soft robots
- 3D/4D printing and fabrication of soft materials and soft robots

11-6 Mechanics modeling of soft robots

Description
Soft robots have been attracting intensive research interests over the past few years and a variety of soft robots driven by different mechanism have been proposed to mimic the locomotion and manipulation mechanisms of soft biological organisms. Soft robots, when interacting with humans, animals, or human tissues/organs, are safe to operate even without sophisticated force control. They are primarily made of soft (active) materials, such as elastomers, polymers, hydrogels etc., and can undergo large continuum deformations that allow them to conform to objects and squeeze through gaps in unstructured environments.

Mechanics, modeling and optimization of soft robots is of great importance to the design, simulation, analysis, and control of soft robots. Soft robots have virtually infinite number of degree of freedom, which leads to the shift of mechanics of soft robots from rigid body to structural and continuum mechanics. Mechanics of soft robots is further complicated by the nonlinear material properties, novel actuator forces, contact interactions with environments, and efficiency requirement for real-time control. The aim of this symposium is to provide a forum for researchers involved in the mechanics, modeling, manufacturing and applications of soft robots to share and disseminate their work.

11-7 Symposium on Plasticity, Damage, and Fracture

Description
Understanding the response of textured and microstructurally heterogeneous materials through complex loadings (e.g. sheet metal forming) up to and including failure remains a challenge. Addressing this challenge requires integration of both the inelastic material response (e.g. plasticity) and appropriate descriptions of the damage and failure. This symposium will highlight key challenges and recent advances in constitutive modeling, experimental characterization, and computational simulation of plastic anisotropy and damage of materials to address this need. The aim is to bring together experts at the forefront of the field in academia, government laboratories, and industry with the goals of assessing existing modeling and experimental approaches, exchanging ideas for addressing technical challenges, and developing guidelines for future research directions.

Theoretical, numerical, and experimental contributions describing the behavior of materials, such as metallic and geological materials, as well as strongly heterogeneous materials

obtained by non-conventional processing (e.g. additively manufactured materials; structural foams) are welcome. Topics of interest to the symposium include, but are not limited to, contributions in the following areas:

- Experimental characterization of anisotropic material response and complex hardening behaviors (such as rate and temperature dependent, cyclic, and distortional)
- Experimental exploration of failure in microstructurally heterogeneous materials
- Constitutive and multiscale modeling of inelastic materials
- Numerical exploration of coupled plasticity-damage material models
- Development of, and procedures for, identification of model parameters for non-linear material models
- Non-linear finite element analysis of structures (e.g. metal forming)
- Numerical implementation and integration schemes of advanced constitutive models (e.g. coupled plasticity and damage)

11-8 Symposium on Perspective on Fracture and Failure Mechanics

Description

In the field of solid mechanics, the studies on fracture and failure of materials and structures provide physical and mechanistic insights on the linkage between material's microstructure, applied boundary and loading conditions, and structural performance and integrity. Both fracture and failure processes are guided by the spatial and temporal evolutions of defects and damages in the material and the structure. It is commonly accepted that Leonardo da Vinci provided the first insights of material fracture during the Renaissance era. In the 20th century, largely driven by the technological needs, the field advanced significantly through the development of new theories, computational methods and experimental techniques, and matured as a corrective, diagnostic and preventive tool. But the recent developments of complex materials with hierarchical microstructures, advanced manufacturing techniques with the possibility to control microstructural features, high resolution characterization techniques, and small scale in-situ experimental techniques, calls for revolutionary advancements in the field of fracture and failure mechanics. While it is difficult to predict the course of the fracture and failure mechanics over the next hundred years, we hope that our symposium will serve as a forum at ASME to share experience, knowledge and prospects, relevant to the field of fracture and failure mechanics. The symposium will feature a number of invited talks from Early-, Mid- and Distinguished-career level researchers and scientists to cover a broader spectrum of scientific minds in the field.

11-9 Symposium on Modeling of Growth, Dissolution, and Fracture

Description

The topics of growth, dissolution, and fracture have been treated separately by the modeling community but their physical basis share a common thread: bonds between material points form or get destroyed. Recent developments in modeling of mechanobiology of cells and tissue, or of corrosion damage and stress-corrosion cracking, make it clear that these physical phenomena would benefit from a unified modeling treatment since their mutual interactions would otherwise be impossible to capture computationally. This symposium aims to provide a platform for discussions on unified computational models for growth, dissolution, and fracture. The focus of this new symposium will be on the following areas:

1. Computational models for biomechanics and mechanobiology of cells and tissues (e.g. growth and rupture of cells and tissue)
2. Modeling of mechanics and electrochemistry of energy materials (e.g. dendrite formation and fracture in Li-ion batteries; corrosion damage and stress-corrosion cracking)
3. Growth, fracture, erosion, and dissolution in ice and geo-materials (rock, concrete, etc). This symposium is dedicated to understanding

the intricate couplings between growth, dissolution, and fracture, and to advancing novel computational models for such problems

11-10 Dynamic Failure of Materials & Structures

Description
The growing use of advanced materials in impact and crash applications of aerospace, automobile, defense, and other structures requires accurate mechanics understanding of their dynamic responses and failure. This topic/symposium addresses all research areas of dynamic failure in terms of experiments, modeling, and simulation under all loading conditions such as impact, blast and crash. The objective of this topic is to pull together a group of scientists and engineers to discuss the challenges and research needs of dynamic failure of materials and structures from nanoscale to structural scales. Only technical presentations (no papers) will be accepted.

11-11 Multiscale Mechanics of Ductile Failure

Description
The advent of novel synthesis, processing and manufacturing techniques have created unprecedented avenues for the development of superior materials and structures with desirable mechanical properties. Yet, predicting failure of these materials is not yet fully mature from the viewpoint of designing damage tolerant materials and structures. Failure of advanced engineering materials arises from complex interactions between mechanisms of inelasticity, loading rates and states, and defect distributions. The advent of high-resolution experimental and computational frameworks is instrumental in improving our understanding on the nexus between failure evolution and intrinsic material characteristics (e.g. chemistry, defect statistics, plastic anisotropy, and more). Concurrently, the development of more sophisticated continuum models that appeal to the physics and statistics of failure mechanisms provide avenues for more realistic prediction of failure maps. Our symposium will serve as a forum at ASME to share knowledge on experiments and modeling of damage evolution in advanced engineering materials over a range of length- and time-scales. Modeling frameworks of interest include: atomistic, discrete dislocation dynamics, crystal plasticity and homogenized continuum micromechanics. We welcome approaches that embed statistical features in failure micromechanics. Of particular interest are talks that provide fundamental insights into the physics of failure from state-of-the-art experiments. We also encourage contributions that provide insights into ductile-brittle failure transitions and failure of architected microstructures as well as biological/bio-inspired materials.

11-12 Symposium on Modeling of the Fracture, Failure and Fatigue in Solids

Description
With the rapid development of advanced manufacturing processes and methodologies, new materials including composites, alloys and metamaterials are developed to meet the wide spectrum of application needs, such as high strength and toughness, light weight, corrosion resistance, high temperature resistance and etc. Other than the desired material properties, the behavior of fracture, failure and fatigue of these advanced materials is essential to be understood in order to exam their reliability and durability in real applications. The development of theoretical models and computational methodologies, as well as numerical characterizations of the material behavior have significant impact on the fundamental understanding of the complex material system behind the fracture, failure and fatigue behavior. It will potentially benefit the reliability analysis, uncertainty analysis of the applications in the area of aerospace, automobile, construction, energy, healthcare and etc.

The focus of the symposium is aligned in the following areas:

1. Computational methodology development on fracture and fatigue modeling.
2. Theoretical model development, such as constitutive relations, crystal plasticity, failure theory and etc.
3. Numerical characterization of material properties by adopting multi-scale simulation techniques, such as molecular dynamics simulations, phase field theory, finite element analysis, statistical analysis, and etc.

4. Numerical simulation and experimental validation of the material's fracture, failure and fatigue behavior in real applications.

This symposium is dedicated to understanding the mechanism behind fracture, failure and fatigue in advanced solid materials.

11-13 Quantitative Visualization of Fracture and Failure

Description
The aim of this symposium is to provide a forum to showcase the recent contributions in the areas of full-field experimental techniques for analysis of multi-scale mechanics of materials. Full-field methods for strain analysis are in continuous development for applications in the aerospace, biomedical, oil, gas and civil infrastructure sectors. Full-field methods can be coupled with analytical approaches to resolve the behavior of materials at different length scales. Example submissions include (but are not limited to):

- Experimental studies of coupled mechanical and non-mechanical behaviors; high temperature, diffusion and reaction induced deformation
- Coupled experimental and analytical approaches for material characterization
- Application of full-field strain methods for strain analysis, repairs or non-destructive testing.
- Inverse methods to extract properties from full-field measurement techniques

11-14 High Strain-Rate Phenomena: Modeling and Experiment

Description
We are interested in integrated experiments and modeling that span from nano to macro scales with specific focus on experimental and modeling techniques applied to novel materials and applications for dynamic materials response, failure and fracture, texture and geometry effects, phase transformation under dynamic loadings and characterization techniques for high strain-rate material response.

11-15 Mechanical Characterization in Extreme Environments

Description
Extreme temperatures play a critical role in a growing number of engineering applications, including the energy, aerospace, nuclear, and defense sectors. In order to advance designs for such applications, the coupled thermomechanical response of materials must be characterized and understood under relevant operating conditions. The aim of this symposium is to provide a forum to showcase recent contributions combining experimental and theoretical solid mechanics under extreme operating conditions.

Example topics of interest include (but are not limited to): (i) High temperature measurement techniques—especially the application of image correlation techniques at high temperatures. (ii) Understanding material and mechanical response in extreme environments. (iii) Radiation effects on the mechanical performance of materials. (iv) Thermal stresses and temperature-dependent material behavior.

11-16 Mechanics of Materials for Energy Storage and Conversion

Description
Mechanics has emerged as a crucial area in all aspects of energy conversion, storage, and harvesting, particularly in the context of ever increasing global energy needs. With recent advances in experimental and modeling techniques for characterization of advanced energy materials, tremendous opportunities now exist to further understanding of the mechanics of deformation and fracture in these materials. This symposium aims to bring together experts from the mechanics, materials science, chemistry, and engineering communities to discuss

research work from varied perspectives in the fields of energy materials and mechanics of materials. Topics of interest include but are not limited to:

- Mechanics of materials for energy storage, conversion, and harvesting, including but not limited to: batteries, fuel cells, photovoltaics, supercapacitors, electrocatalysts, thermoelectrics, etc.
- Experimental and theoretical studies focused on coupling between mechanics and electrochemistry
- Measurements of mechanical properties, e.g., fracture toughness and fatigue properties of lithium-ion battery electrode materials
- Advanced characterization techniques
- Simulations of electrochemical and mechanical phenomenon in energy materials: density functional theories, molecular dynamics simulations, continuum models, etc.
- Development of constitutive models for various energy materials.
- Structural design to mitigate fracture and failure
- Mechanics-guided material design and optimization

Interested authors should submit a (maximum) 400-word abstract via the web tool at the Congress 2019 website.

11-17 Mechanics of adhesion and friction

Description
Adhesion and friction are of significant interest to colloidal scientists, biologists, chemists, physicists, and engineers. These surface phenomena are not only used in nature for locomotion and climbing, but are also used to advantage in technological applications for self-assembly of microstructures, heterogeneous integration of nanostructures on diverse substrates, and moving small droplets on surfaces. Adhesion and friction also have strong implications on the behavior of nanomaterials and biological systems. This symposium is devoted to the mechanics of adhesion and friction, encompassing both experimental and theoretical studies of adhesion and friction at length scales ranging from macro- to molecular. Topics to be addressed include, but are not limited to:

1. New methodologies/instrumentation for studying mechanics of adhesion and friction
2. Continuum and atomistic simulations and theoretical studies of adhesion and friction
3. Mechanics of adhesion and friction in biological (e.g., geckos, insects, cells, ECMs) and bio-inspired systems
4. Mechanics of adhesion and friction for technological applications (e.g., MEMS/NEMS and flexible/stretchable electronics)
5. Mechanics of adhesion and friction in nanomaterials (e.g., nanowires, nanotubes, graphene)

11-18 In-Situ Techniques in Experimental Mechanics

Description
In situ techniques provide a wealth of information for the understanding of mechanical performance and behavior. Techniques including in situ digital image correlation (DIC) with optical or scanning electron microscope imaging, in situ neutron diffraction, in situ synchrotron imaging, and tomography can allow for the observation and identification of failure mechanisms across a wide range of length and time scales. The usefulness of in situ experimental data has been recognized and is becoming the standard for validation of models and qualification of components.

This symposium will bring together researchers using in situ experimental techniques to address common issues, share novel in situ experimental techniques, and to present methods for in situ data analysis. In addition to fatigue and fracture, in situ experiments on other topics such plasticity, creep, dynamic effects, and engineering development are welcome.

11-19 Multiscale Models and Experimental Techniques for Composite Materials and Structures

Description
Numerical tools that can truly predict the behavior of advanced composite materials must incorporate the underlying physics governing the response of the individual constituents, as well as the interactions between the constituents. This interactive effect is directly linked to the subscale-architecture of the constituents in the composite. As such, multiscale modeling has emerged as a popular technique for integrating the effects of the microstructure into the higher scales. The experimental data required to characterize, calibrate and validate multiscale models are often "non-standard," and challenging to obtain. In fact, typical coupon level tests, often used to characterize composites, also serve as validation experiments for multiscale models. Thus, as multiscale modeling becomes increasingly popular, there must also be a paradigm shift in experimentation to facilitate modeling. We invite state-of-the-art multiscale theoretical, computational and experimental techniques and investigations focused on composite material and structural response. The goal of this mini-symposium is to generate a focused dialogue in this area, with the aim of aligning both modeling and experimentation for the advancement of "next-generation" predictive tools. Specific topics of interest include, but are not limited to:

- Novel experiments and numerical tools for a wide range of composite materials including polymer matrix composites, textile composites, sandwich composites, ceramic matrix composites, etc.
- Damage and failure responses of composites subjected to static, fatigue, and impact loading
- Multi-physics behavior of composites, including hygrothermal degradation, ablation, oxidation of ceramic matrix composites, etc.

11-20 Symposium on Multiphysics Simulations and Experiments

Description
Symposium will focus on complex multiphysics interactions including stress, temperature, electrical and magnetic fields, moisture, mass transport, and reaction kinetics, across a wide spectrum of materials and applications, ranging from nanostructured materials in electronics, piezoelectric, ferroelectric, and thermoelectric materials in energy conversion, to soft matters for drug delivery, nanomedicine, and tissue engineering. The computational modeling and simulation (e.g. continuum finite element analysis, atomistic molecular dynamics/tight-binding simulations and multiscale simulations) and experimental investigations (e.g. micro/nanoscale fabrication and electron and scanning probe microscopy, digital image correlation, etc.) of such multiphysics systems, have significant impact on the understanding of the complex physics, and in turn will potentially benefit the general areas including electronics, manufacturing processes and additively manufactured materials, energy applications such as fuel cells and lithium ion batteries, to healthcare and biomedical applications..

11-21 Symposium on Modeling and Testing of Molecular-level Fracture of Materials

Description
Applications of interest are models and experiments that improve our fundamental understanding of fracture processes at the nanoscale, so that the toughening effect can be transferred to the macroscale. Topics include but are not limited to:

- Effect of notch-insensitivity on fracture toughness in materials at the nanoscale and development of nanoscale cohesive laws
- Is the application of LEFM valid at the nanoscale?
- Modeling and in-situ testing of fracture in hierarchical materials and bio-inspired materials
- Length-scale and time-scale effects at the nanoscale

- Hierarchical and concurrent coupling to determine fracture metric at the nanoscale

This symposium is dedicated towards understanding the mechanisms behind fracture, failure and fatigue in nanoscale materials for the improvement of macroscale structural properties.

11-22 Computational Modeling of Extreme Events

Description
Extreme events that occur as the result of manmade and natural disasters (blast, impact and penetration, earthquake, tsunami, landslide) pose severe threats to our society's well-being. As such, computational analyses coupled with purpose-designed experimental verification and validation (V&V) are crucial to predict, understand and mitigate these complex events; research in this area is essential for the safeguarding of the manmade and natural environment. This session aims to promote collaboration among academia, government, and industry engineers in the development and application of advanced computational and experimental methods for the study of extreme events. Those working in the fields of computational solid mechanics, fluid dynamics and fluid-structure interaction, constitutive model development, material characterization under high-rate or high-pressure loading, and other computational and/or experimental methods related to the prediction and analysis of extreme events are cordially invited to exchange their ideas and research results in this session. The minisymposia will solicit all subjects related to computational modeling and related experimental V&V for the study of extreme events, which include, but are not limited to, the following:

- Method and algorithm development for the simulation of problems involving harsh dynamic loading, high strain-rate, large material deformation, fracture and failure, or material breakup
- Fluid dynamics and fluid-structure interaction in disaster-driven material and structure failures
- Constitutive modeling and characterization of materials under high pressure and strain rate
- Constitutive modeling and characterization of disaster debris fields
- Simulation of multi-phase flow fields resulting from disaster events
- Applications of computational methods to simulation of natural and manmade disasters
- Computational investigations on infrastructure resiliency to include predictions of residual strength and prevention of progressive collapse
- Computational and experimental investigations on material high-rate damage and failure mechanisms
- Computational and experimental investigations on soil liquefaction, foundation failure and debris flow
- Computational and experimental investigations on novel materials and structural systems for mitigation of extreme events
- Verification and validation of disaster simulation models
- Numerical algorithm implementation and simulation software development

11-23 Multi-Scale Computations in Fluids, Structures, and Materials

Description
The symposium will address some of the emerging themes in the computational applied mechanics. Due to the enormous recent advances in computer hardware, software, and algorithms, many researchers are now able to obtain the numerical solutions for even more complex problems than before. One of the key developments in this ongoing process is the

multi-scale and multi-physics computations. The contributions will include (but not limited to) atomistic/continuum computations, peridynamics, fast multipole method (FMM), acoustic and optical metamaterials, fluid-structure interactions, two-phase flow, lattice Boltzmann method, magneto-electro-mechanical systems, computations in biological systems such as protein and cortical folding modeling and cell mechanics, high performance computing using MPI or OpenMP, etc. Cross-disciplinary contributions are particularly welcome.

11-24 Processing and Performance of Nanocomposites

Description
Due to their small size and high surface to volume ratio, nanomaterials exhibit unique properties and may result in significant performance enhancement, when used as reinforcements in traditional composite materials. However, observed properties enhancements are considerably less compared to what expected theoretically, because of non-homogeneous dispersion, poor interface quality, and insufficient load transfer at the nanomaterial-matrix interface. This symposium aims at opening a forum for researchers from academia and industry who work on analytical, numerical and experimental methods to investigate the processing, properties, and performance of nanocomposites. The topics include but not limited to scientific principles and mechanisms of processing and manufacturing with relation to the properties, performance enhancement and optimization, and critical issues for production and scale-up. Papers are invited on all aspects of processing and performance of nanocomposites, including:

- Processing-structure-property relationships with emphasis on mechanical performance
- Nanocomposites thin films and coatings
- High-performance nanocomposite fibers
- Novel processing techniques to control interactions across different length scales
- 3-D reinforced nanocomposites
- Heterogeneous modular nanocomposites
- High-performance Nanocomposite materials systems
- Multi-scale modeling of nanocomposites

11-25 High-Performance Nanostructural Materials and Nanocomposites

Description
This topic covers manufacturing, characterization, modeling, and application of mechanics in nanostructured materials and nanocomposites with the emphasis on structural applications and multi-functional applications where mechanical performance is important.

11-26 Modeling and Experiments in Nanomechanics and Nanomaterials

Description
The symposium will address recent trends in nanomechanics and nanomaterials. Since the late eighties starting from the invention of atomic force microscopy (AFM) in 1986, the investigation into the realm of atomistics has become more and more prominent. At the same time, the number of the academic disciplines affected by the emergence of atomistics has steadily increased encompassing physics, chemistry, materials, mechanics, and biology. Two of the key disciplines in this area are nanomechanics and nanomaterials. The contributions will include, but will not be limited to, atomistic/continuum computations, atomistics and fracture, nanocomposites, novel experimental techniques, applications to microelectronics, nanomechanics in biology, etc. The cross-disciplinary contributions are particularly welcome.

11-27 Mechanics of Thin-Film and Multi-Layer Structures

Description
Authors and presenters are invited to participate in this event to expand international cooperation, understanding and promotion of efforts and disciplines in the area of Mechanics of Thin Film and Multi-Layer Structures. Dissemination of knowledge by presenting research results, new developments, and novel concepts in Mechanics of Thin Film and Multi-Layer Materials will serve as the foundation upon which the conference program of this area will be developed.

A variety of topics/sessions are available for presentations as it allows flexibility to the authors. All sessions are quality driven and technical presentation only.

11-28 Recent Advances and Applications in Meshfree and Particle Methods

Description

Meshfree and particle methods have added a new dimension to contemporary numerical methods for solving challenging engineering and scientific problems. These methods generally utilize a point-based approximation and discretization constructed directly in the physical domain without fixed nodal connectivity. This, in turn, releases the strong tie between the quality of the discretization and the accuracy of the numerical solution. In addition, the approximations employed allow controllable orders of continuity and completeness. These unique properties offer versatility in constructing proper approximation functions to capture rough or smooth characteristics in physical problems. These methods offer paradigms in incorporating mechanics and physics of both solid- and fluid-like material behaviors in a single computational framework.

The aim of this minisymposium is to bring together experts working on these methods, share research results and identify the emergent needs towards more rapid progress in advancing the important fields of meshfree and particle methods. Topics of interest for this minisymposium include, but are not limited to the following:

- Recent advances in meshfree, peridynamics, material point methods, and smoothed particle hydrodynamics
- Recent advances in formulations for extreme material distortion, fragmentation, contact and impact, and material instability
- Recent advances in numerical integration
- Characterization and stabilization of numerical instabilities
- Strong form collocation meshfree methods
- Simulations involving multiple and coupled physics
- Simulations involving multiple time and/or length scales
- Simulation of multi-phase interactions
- Simulation of structural responses to extreme loading
- Simulation of microstructural behavior and microstructure evolution
- Simulation of manufacturing processes
- Simulation of bio and nano mechanics and material system responses
- Applications of meshfree methods to simulation of natural disasters
- Nonlocal mechanics and computation
- New applications for which meshfree and particle methods are superior to conventional mesh-based methods
- Parallel-computing, scalable algorithms, and large-scale simulations

11-29 Hybrid Materials Enabled by Cross-disciplinary Sciences: Fabrication, Characterization, and Applications

Description

Hybrid materials enabled by cross-disciplinary sciences have drawn significant interests from chemists, physicists, and materials scientists. As one of the most growing new material classes, hybrid materials have unique possibilities to create novel material properties by synergetic combination of inorganic and organic components at the nanoscale or molecular level. Inorganic clusters or nanoparticles with specific optical, electric or magnetic properties can be incorporated in organic polymer matrices, which may greatly advance hybrid materials over traditional composites. This symposium is devoted to hybrid materials functionalized by unique mechanical-electrical, mechanical-optical, mechanical-optical behaviors, etc. Both experimental and theoretical studies of fabrication, behaviors, and performance of hybrid materials are welcome. Topics to be addressed include, but are not limited to:

- Fabrication and characterization of hybrid materials enabled by cross-disciplinary sciences (e.g. mechanical-electrical, mechanical-thermal, mechanical-optical…)
- Experimental investigation and theoretical study of working mechanism of hybrid materials
- Mechanics, interface mechanics, performance stability of hybrid materials
- Application of hybrid materials (e.g., stretchable electronics, piezo electronics, ionic hydrogels enabled soft robotics, sensing, energy harvest…)

11-30 Modeling and Experimentation of Geomaterials

Description
Geomaterials (concrete, soils, sand, rocks, etc.) exhibit well known pressure-dependent material behavior. Concrete is the most widely-used man-made material in the world. Other geomaterials such as soils, sand and rocks are widely used in many engineering applications. Understanding the static and dynamic behavior of these geomaterials is essential in solving many problems engineers routinely come across. This symposium provides a platform for engineers and scientists to share new ideas on modeling and experimental techniques for these materials at different length and time scales. Targeted themes include, but not limited to: Concrete modeling and experimentation under quasi-static and dynamic loading Soils, sand and rocks modeling and experimentation under quasi-static and dynamic loading. Geomaterials characterization techniques at different length scales.

11-31 Emerging Topology and Shape Optimization Techniques in Computational Design of Materials and Structures

Description
Motivated by key advances in manufacturing techniques, the tailoring of materials with desired macroscopic properties and structures with desired end-use performance has been the focus of active research in engineering and materials science over the past decade. For materials and structures architectured at length scales that can be controlled by the manufacturing process, the goal is to determine the optimal spatial layout of one or more constituent materials to achieve a desired macroscopic constitutive response and multifunctional performance. Topology and shape optimization methods provide a systematic means to achieve this goal. The objective of this symposium is to bring together researchers working on state-of-the-art topology and shape optimization techniques with direct application in materials and multifunctional design to exchange ideas, present novel developments and discuss recent advances. Topics of interest concern shape and topology optimization techniques, and they include, but are not limited to:

- Multiscale, multifunctional design of materials and structures
- Design of lattice materials and structures
- Design of nonlinear materials
- Design optimization for additive manufacturing
- Reduced-order multiscale modeling for design
- Simultaneous material and structural optimization
- Optimization under uncertainty
- Bioinspired design of composites
- Design of metamaterials
- Smart material design

11-32 Congress-Wide Symposium on Additive Manufacturing: Failure of Additively Manufactured Materials

Description
Additive manufacturing or commonly known as 3D printing is a manufacturing technique that builds 3D objects by adding materials layer-by-layer. Stereolithography (SLA), Fused Filament Fabrication (FFM), Multi-Jet Modeling (MJM), Powder based Method such as 3DP, Selective

Laser Sintering (SLS) and Selective Laser Melting (SLM) are commonly used techniques to build 3D structures out of metal, polymer, ceramics, biomaterials and many other form of materials. As we are advancing towards building 3D printed structures for large-scale biomedical, aerospace, automobile, electronics and many other industrial applications, we still have limited understanding about the process-structure-property relations of 3D printed materials and structures. This mini-symposium is intended to solicit abstracts that will showcase recent research advances in the areas including but not limited to damage, failure and fracture analysis and experimental/computational methods of 3D printed structure, mechanics of 3D printed materials and structures etc. Studies that include effects of processing parameters, geometry/process-induced defects and other process-induced issues that lead to unexpected failure are also welcome.

11-33 Multiscale Methods for Simulation and Design of Materials Including Machine Learning and Other Emerging Methods

Description

This mini-symposium will provide a forum for engineers, mathematicians and computer scientists to discuss recent developments in the broad field of Multiscale Methods for Simulation and Design of Materials. A challenge in this important is to get real materials integrated with computational mechanics to aid in materials design and applications. The symposium will also emphasize Uncertainty Quantification, Machine Learning and other Data Analytics methods applied to multiscale modeling. Applications in the field of Additive Manufacturing and other emerging methods will be of significant interest.

The topics to be covered will include:

- Advanced computational and mathematical models and algorithms in spatial and temporal multi-scaling
- Multi-scale models for predicting performance and life, e.g. fatigue, ductile failure
- Design of materials systems for structural needs
- Image based modeling for real materials at multiple scales
- Uncertainty Quantification in multiscale modeling
- Integration of Machine Learning and data analytics with multiscale modeling
- Use of advanced methods in industrial applications

11-34 Phase-field Modeling and Simulation in Mechanics

Description

There are many processes in engineering and natural sciences that involve the evolution of interfaces. Typically, such systems evolve towards a thermodynamic equilibrium. Prime examples include interfaces between two (or more) distinct states arising in mixtures and multi-phase systems such as in two-phase flows, binary alloys, fluid phase transition, grain growth, solidification, dendritic crystal growth and polymer blends. Propagating cracks or domain walls are classical examples of moving interfaces within solids, while biomembranes are soft material interfaces evolving in a fluid. Phase-field modeling refers to a particular mathematical description of a system with evolving interfaces. The key idea is that interfaces are described by a smoothly changing phase field. In other words, we are dealing with diffuse-interface models. The phase field is governed by a partial differential equation, which tracks the diffuse interfaces and encodes the interfacial physics at once. The systems are inherently nonlinear equations with higher-order spatial derivatives that account for the interfacial forces. Phase-field models bring a new set of challenges for numerical simulations, such as, for example, stiff semi-discretizations, stable time-stepping algorithms and the treatment of sharp internal layers. In this minisymposium, we invite contributions on all aspects of phase-field modeling techniques. We welcome abstracts on new modeling and discretization techniques, their numerical analysis, but also their application to problems of fluid mechanics, solid mechanics, and the life sciences or related research areas. We expect a multidisciplinary audience with experts from computational mechanics, theoretical and applied mechanics, materials science, numerical analysis and applied mathematics.

11-35 Mechanics and Design of Cellular Materials

Description
Cellular materials such as periodic lattice solids or stochastic foams have received much attention due to their unique properties; ultra-lightweight combined with high stiffness and strength. These materials have potential for multifunctional uses with a combination of structural strength, blast protection, ballistic protection and thermal management.

This symposium invites fundamental studies in mechanics and design of cellular materials and their engineering applications. The aim of this session is to provide a forum to bring together researchers to discuss and disseminate the research on cellular materials. Examples of topics to this symposium include (but are not limited to):

i) Analytical and/or experimental studies of mechanical behaviors of cellular materials - investigation of failure mechanisms or macroscopic properties such as stiffness, strength, and fracture toughness.
ii) Multifunctional design of cellular materials with a combination of structural strength, blast protection, ballistic protection, and thermal management.
iii) Advanced technologies to manufacture cellular materials.

11-36 Multifunctional and Micro/Nano-structured Materials: Modeling and Characterization

Description
The objective of this topic is to discuss recent advances in multifunctional and micro/nano-structured materials and to identify future research opportunities in the subject areas. Innovative theoretical, computational and experimental approaches will be discussed.

11-37 Instabilities in Solids and Structures

Description
Instabilities are important features of many of today's engineered materials and structures. Often instabilities represent failure of a material or structure, and thus it is important to identify and understand the types and behavior of instabilities that can occur in a given application area. More recently scientists and engineers have been taking advantage of the presence of instabilities in order to design materials and structures that have advantageous properties. This symposium will aim to bring together top researchers interested in instability phenomena, from a broad variety of application areas within the context of solids and structures, in order to exchange knowledge and ideas on theory and experimentation in this vital and timely area of investigation.

11-38 Peridynamic Modeling of Materials' Behavior

Description
The peridynamic theory departs from classical continuum mechanics in its treatment of problems with discontinuities under a nonlocal multi-scale framework. Since its initial development almost two decades ago, the peridynamic theory has been applied to address a multitude of complex engineering problems including but not limited to dynamic fracture, fatigue failure, impact damage, penetration mechanics, failure in fiber-reinforced composites, and soft matter mechanics. Theoretical development of peridynamics is still a highly active and growing research area involving the academia, government labs and private industry. A symposium on peridynamic modeling brings together the peridynamic community from around the globe with the latest developments, as evidenced by the attendance to previous peridynamic symposia under ASME IMECE.

The following focus areas will be considered:

1. Theoretical developments of peridynamics, including modeling material behavior, failure, and multi-scale problems.
2. Fracture and failure of materials using peridynamic approaches applied to metals, ceramics, glasses, composites, soft materials, etc., under static, dynamic, penetration, and fatigue type loading conditions.
3. Applications of the peridynamic theory to material evolution (micro-structure, etc.).

4. Computational aspects of peridynamic implementations, including discretizations, parallelization, and interactions with other numerical methods such as FEM.

This symposium aims to cover the latest developments in peridynamic approaches and applications and provide a forum for discussion of current advances and challenges.

11-39 Symposium on Multiphyics Simulations and Experiments for Solids

Description

Symposium will focus on complex multiphysics interactions including stress, temperature, electrical and magnetic fields, moisture, mass transport, and reaction kinetics, across a wide spectrum of materials and applications, ranging from nanostructured materials in electronics, piezoelectric, ferroelectric, and thermoelectric materials in energy conversion, to soft matters for drug delivery, nanomedicine, and tissue engineering. The computational modeling and simulation (e.g. continuum finite element analysis, atomistic molecular dynamics/tight-binding simulations and multiscale simulations) and experimental investigations (e.g. micro/nanoscale fabrication and electron and scanning probe microscopy, digital image correlation, etc.) of such multiphysics systems, have significant impact on the understanding of the complex physics, and in turn will potentially benefit the general areas including electronics, manufacturing processes and additively manufactured materials, energy applications such as fuel cells and lithium ion batteries, to healthcare and biomedical applications..

11-40 Mechanical Metamaterials

Description

Mechanical metamaterials are intelligently designed material systems with exotic properties rarely found in nature. Interesting properties of mechanical metamaterials are usually defined by their geometric architecture and internal structure, rather than composition. These mechanical properties can be designed to have unusual or even opposite values compared to those found in natural materials.

This symposium invites fundamental studies on the mechanics and design of mechanical metamaterials and their engineering applications across various scales. The aim of this symposium is to provide a forum for investigators to discuss and disseminate novel research findings in mechanical metamaterials and architected structures. Examples of topics to this symposium include (but are not limited to):

- Metamaterials with negative Poisson's ratio, negative thermal expansion, negative stiffness, negative compressibility, reverse Saint-Venant's effect, and other anomalous mechanical properties.
- Analytical, numerical, and experimental studies on the behaviors of architected structures, lattice materials, foams, granular structures, origamis, kirigamis, tessellations, tensegrities, and minimal surfaces.
- Design and application of reconfigurability, tunability, multistability, symmetry breaking, and other interesting functional properties of mechanical metamaterials.
- Responses to impact loads, strain energy transformation, superdamping performance, and in situ control of the metamaterial functionality, such as reconfiguration upon command.
- Advanced technologies such as 3D/4D printing to manufacture mechanical metamaterials.

11-41 Congress-Wide Symposium on NDE &SHM

Description

- Computational Wave Propagation in Solids and Fluids
- Nondestructive characterization of Solids, Structures and Fluids
- Quality Control of Material Joints and Welds
- Active and Passive Health Monitoring of Structures
- Invited

Nondestructive Evaluation (NDE) and Structural Health Monitoring (SHM) plays a significant role in design, manufacturing, and service of engineering systems and structures. This congress?wide symposium will provide a venue for communication, discussion, and dissemination of ideas, advancements, and opinions on a variety of subjects related to NDE, SHM and prognosis.

11-42 Nonlinear Dynamics, Control, and Stochastic Mechanics

Description
The Symposium on Nonlinear Dynamics, Control, and Stochastic Mechanics (NDCSM) provides a forum for the discussion of dynamics, modeling, and control issues relevant to classical systems and emerging technologies, focusing on nonlinear and stochastic phenomena at both the micro- and the macro-scale. All papers will be peer-reviewed, and upon acceptance, they will be published in the Conference proceedings. Topics of interest include, but will not be limited to: Geometrically Nonlinear Vibrations; Nonlinear, Vibration-based Structural Health Monitoring; Dynamics and Control of Non-smooth and Stochastic Systems; Nonlinear Reduced Order Modeling; Nonlinear Rotordynamical Systems; System Identification and Nonlinear Behavior of MEMS; Nonlinear Modeling and System Identification Techniques in Fluid-Structure Interaction.

11-43 Fluid-Structure Interaction

Description
This Symposium is intended to provide an international opportunity for communicating recent advancements in the area of Fluid-Structure interaction (FSI). The symposium puts a special attention on flow induced vibration and stability of structures in various fields including piping, nuclear engineering, turbomachinary, aeroelasticity, offshore and marine problems, and physiological systems. Research on sloshing, filled containers, vibrations of submerged structures and flexible structures conveying flow is also a main focus. Manuscripts addressing novel theoretical, computational and experimental researches are of interest and are encouraged to contribute to FSI symposium.

11-44 Keynote Lectures on Computational Mechanics

Description
Keynote lectures on the state-of-art in new and emerging methods and approaches in computational mechanics.

11-45 Medalist Symposium

Description
Symposium will feature speakers receiving Division and Society Awards given by the Applied Mechanics Division.

11-46 Young Medalist Symposium

Description
Symposium will feature speakers receiving a variety of Young Investigator Awards in Mechanics, given either by the Applied Mechanics Division or organizations close to the Division.

11-47 Drucker Medal Symposium

Description
TBD after the medal winner is announced.

Symposium will feature speakers that are friends and close collaborators of the 2018 Drucker Medal recipient of ASME.

Total Topics: 47

Track-12 Micro- and Nano-Systems Engineering and Packaging

Topic

12-1 General Topics of MEMS/NEMS

Description
The fields of MEMS and NEMS are inherently multi-discipline and/or cross-discipline. This topic is for authors interested in peer-reviewed conference publication and presentation at the 2019 ASME IMECE, Track 11 Micro- and Nano-Systems Engineering and Packaging, but without a direct fit to a specific topic. All topics relating to the micro and nano domain are welcomed for submission, review, and dissemination.

12-2 Plenary Presentations in MEMS/NEMS Engineering and Packaging

Description
This high-level plenary session will bring speakers from industry, government, and academia who will deliver presentations on emerging technologies in MEMS/NEMS and their research, industry needs, etc.

12-3 Design and Fabrication, Analysis, Processes, and Technology for Micro and Nano Devices and Systems

Description
The objective of this symposium is to advance the state of the art in the design and fabrication of Micro and Nano devices and systems, including design/fabrication methodologies, tools, and technologies.

The aim of this symposium is to bring researchers from multiple disciplines to present their work in, but not limited to, the following focus areas:

- Design processes
- Design technologies
- Design and analysis tools
- Novel fabrication processes
- Fabrication technologies
- Fabrication tools
- Fabrication yield monitoring and enhancement
- Emerging technologies capable of meso-, micro-, and/or nano-scale fabrication, such as direct digital and additive manufacturing

12-4 Computational Studies on MEMS and Nanostructures

Description
The mini symposium focuses on the applications of computational modeling principles and results for the design, processing, manufacturing, development and analysis of nano-scaled materials and systems (e.g. nanowires, nanotubes, thin films, nanocrystalline materials, biological materials, polymers, composites, NEMS, nanoscale fluid flows) and micron-scaled materials and systems (e.g. sensors, actuators, transducers, MEMS, microscale fluid flows). Authors are invited to participate in this topic by presenting novel computational developments applied to nanostructures and MEMS, both at the MEMS and NEMS device level and for multi-scale modeling of microscopic systems of nanostructures. The aim of this symposium is to bring researchers from multiple disciplines to present their work in, but not limited to, the following areas:

- Computational models and methods that enable multiphysics and multiscale modeling of nanomaterials and MEMS, such as coupling transport phenomena, mechanical deformation, electrical, thermal, or optical properties.

- Advances in simulation of transport phenomena during the processing or manufacturing of nanomaterials and MEMS.
- Advances in spatial and temporal multiscale computational methods.
- Computational models for MEMS actuation principles (capacitive, piezoelectric, piezoresistive etc.)
- Modeling studies aimed for extending MEMS device actuation and detection limitations.
- Interactions of nanostructures, such as adhesion, tribology and energy dissipation.
- Size and surface effects on the behavior and properties of nanomaterials.
- Micro and nano scale fluid flows and devices related to MEMS and NEMS.
- Reliability analysis for MEMS and NEMS devices.

12-5 Applications of Micro and Nano Systems in Medicine and Biology

Description
Microfabricated and nanofabricated systems have the potential to make significant contributions to improved quality and timeliness in health care. The Symposium on Applications of Micro and Nano Systems in Medicine and Biology focuses on the design, fabrication and characterization of microfabricated devices and systems for a wide variety of applications in biomedicine including, but not limited to:

- Bio/micro/nano-fluidics applications in Biomedicine
- Sensors and actuators
- Cell culture and tissue engineering
- Drug delivery and therapeutics
- Medical diagnostics
- Minimally-invasive surgical instruments and medical implants
- Tools for cellular and molecular biology studies
- Materials and biocompatibility
- Other bioMEMS devices and systems

12-6 Micro and Nano Devices

Description
Micro and Nano Systems (MEMS and NEMS) include miniature devices or an array of devices combining electrical, mechanical, optical, chemical and/or biological components fabricated via integrated circuit or other similar manufacturing techniques. These are, by their very nature, multidisciplinary fields, where innovative concepts in transducers, sensors, actuators and instruments can be developed in a diverse array of disciplines that includes physics, engineering, medicine, and biology. Research, insight and then applications will shape the basis for the creation of technologies that will impact areas as diverse as computing, information technology, and biomedical technology along with energy, transportation, manufacturing, deep space studies, and national security.

The topic includes:

- **Fabrication and Integration of Micro/Nano Devices**:
  The focus of these sessions is on methods or the optimization of such, both applied and theoretical, as well as development of instruments and systems which relate to the fabrication and integration of micro/nano devices. Thus, the topic is about fabrication and integration in building system level devices. Detail topics of interest may include:

-Microfluidic devices with integrated sensing ability
-Nanostructures integration into systems
-Lithography for polymer-based structures to build systems
-Designing and fabricating innovative MEMS and NEMS based devices that can characterize nanowires, nanotubes, and graphene sheets.
-Microassembly encompassing robotic pick-and-place, fluidic assembly, self-assembly, transfer printing using polymeric stamps, and novel interconnections of micro assembled devices to build systems.

- **Modeling and Experimental Analysis of Micro/Nano Sensors and Devices**:
  The work in these sessions addresses modeling and analysis issues/challenges as well as optimization schemes pertaining to the design and realization of micro/nano sensors and devices. Topics of interest include finite element techniques, efficient numerical approaches, and novel design optimization strategies which factor in the geometric considerations as well as other important design aspects.

- **Control and Dynamics of Micro/Nano Sensors and Devices**:
  These sessions include issues relevant to control of dynamic micro and nano systems. Topics of interest include dynamics of MEMS, dynamic considerations in design, modeling and model validation, measurement techniques, device characterization and system identification, novel control strategies.

- **Physical and Chemical Micro/Nano Sensors**:
  These sessions emphasize the design, development, and application, both physical and chemical, of micro/nano sensors. Theoretical and applied work encompasses, for example, the following: capacitive strain sensors, accelerometers, microcantilevers, as well as novel semiconductor-based microfluidic sensors and systems.

12-7 Applied Mechanics and Materials in Micro- and Nano-Systems

Description
The objective of this symposium is to promote and disseminate original ideas and investigations on mechanics and materials issues involved with micro- and nano-systems. Theoretical, computational and experimental contributions highlighting small-scale mechanics and materials will be considered. Interactions of such small-scale materials with target environments and their influence on the device mechanics and operations will be of great interest as well.

Specific areas of interest include, but are not limited to:

- Application of continuum and nanoscale mechanics in MEMS and NEMS design, e.g. sensors, actuators, resonators, etc.
- Mechanics of micro-electronic, thermo-electric, thermo-elastic, and multi-functional materials
- Linear/nonlinear and dynamic behavior of soft materials, such as polymers, biofilms and soft tissues, under different affecting factors, such as growth factors and loading conditions
- Mechanical behavior of functional nanoscale objects such as biological and biomolecular component
- Experimental techniques in micro and nanoscale materials characterization
- Nanoscale mechanics of multilayered nanostructures
- Fracture mechanics in micro- and nano-systems

12-8 Microfluidics 2019: Microfluidics in Micro- and Nanosystems

Description
The Micro/Nanofluidics 2019 forum provides a means of reporting the latest developments in the uses of fluid for micro-and nano-devices in mechanical, chemical and biological applications across research and industry. High quality submissions related to nanotechnology can be recommended for fast-track publication in a special issue of the ASME Journal of Nanotechnology in Engineering and Medicine.

Topics of interest include, but are not limited to:

- Micro-total-analysis systems (MicroTAS) and lab-on-a-chip applications
- Transport in biological and molecular systems
- Fluid mechanics issues in micro-heat engines, micro-fuel cells, other micro-power sources, and micro-propulsion
- Electrokinetic, electrohydrodynamic, and magnetohydrodynamic modeling and applications
- Fluid handling systems
- Flow and transport diagnostic and measurement techniques
- Multi-component and multi-phase flow
- Complex fluids and nano-particles
- Micro- and nanoscale thermofluid science and devices
- Fundamental flow phenomena in micro- and nanosystems
- Optics and photonics in micro- and nanofluidic systems
- Biologically enabled microfluidics
- Sensors and transducers for microfluidic applications
- Micro fuel cell and microfluidic/nanofluidic based energy storage

12-9 Convergence of Additive Manufacturing with Micro/Nano-Technologies

Description
The objective of this symposium is to advance the state of the art in the enabling of, and/or vice-versa, additive manufacturing with micro/nano technologies.

The aim of this symposium is to bring researchers from multiple disciplines to present their work in, but not limited to, the following focus areas:

- Additive manufacturing with micro/nano-sized features
- Additive manufacturing enabled by micro/nano-devices
- Micro/nano-devices fabricated using additive manufacturing

- Applications of additive manufacturing for micro/nano-technologies

12-10 Inertial Navigation: MEMS/NEMS to Bio-Inspired

Description
The topic focuses on advancements of novel inertial sensors, systems, and techniques pertaining to navigation ranging from pedestrian tracking to precision guided munitions. Authors are invited to participate in this topic by presenting novel inertial based sensors, systems, and techniques applied to navigation both at the MEMS/NEMS sensor and system level. Additional areas of interest include inertial measurement units, bio-inspired inertial navigation, novel algorithm techniques as well as the design, fabrication, and modeling of advanced inertial sensors and systems.

The aim of this symposium is to bring researchers from multiple disciplines to present their work in, but not limited to, the following areas:

- Bio-inspired guidance, navigation, and control related to scientific principles such as neural signaling, magnetoreception, vision, olfaction, etc.
- Polymer based sensors/systems for wearable electronics, fitness trackers, etc.
- 1D/2D material based sensors/systems for inertial navigation; graphene and beyond
- Miniaturization, sensor fusion, and novel packaging techniques for accelerometers, gyroscopes, magnetometers, and other complementary sensors for improved performance
- Navigation of unmanned/autonomous platforms for sea, air, and land; farming to filming
- Unique inertial sensing topics; optical/laser interferometry, cold atom, space-based, etc.
- Advances in modeling, design, and manufacturing of MEMS/NEMS inertial sensors/systems
- Computational models for MEM/NEMS actuation/detection principles including capacitive, piezoelectric, piezoresistive, optical, mechanical, thermal, magnetic, etc.
- Kalman filter algorithms for improved accuracy and precision of inertial sensors/systems
- Principles, methods, and advancements in azimuth, elevation, and surveying sensors/systems
- Micro/Nano fluidic flow based inertial sensor/system devices related to navigation
- Atomic clock technologies for improved position, navigation, and timing
- Advanced inertial measurement units in precision guided munitions and missiles
- Innovative testing and characterization of inertial sensors/systems
- New methods/techniques for improving gravity and magnetic field models for navigation
- Novel navigation methods/techniques during degradation or jamming of GPS signals
- Inertial sensors/systems in extreme environments; oil-drilling to space-based platforms

12-11 Flexible and Multifunctional Electronic System

Description
This topic will cover a comprehensive range of flexible, multifunctional biomaterials and degradable electronic systems. The fundamental materials science, materials degradation kinetics, novel device systems, and fabrication techniques to integrate multifunctional biomaterials will be the area of interest. Interdisciplinary topics related to physics, chemistry, materials science, and electrical engineering will shed important insights and inspire possible new areas for multifunctional electronic system. Topics to be addressed include, but are not limited to:

- Stretchable electronic system
- Inorganic based biocompatible/biodegradable materials and devices
- Environmentally sustainable electronics
- Fabrication and characterization of green and biocompatible materials
- Bio-interfaced electronic systems
- Dissolvable metals and alloys, dielectrics, semiconducting materials, and/or organic materials
- Flexible multifunctional sensors and actuators

Total Topics: 11

Track-13 Safety Engineering, Risk and Reliability Analysis

Topic

13-1 Reliability Methods

Description
Authors and presenters are invited to participate in this event to expand international cooperation, understanding and promotion of efforts and disciplines in the area of Reliability Methods. Dissemination of knowledge by presenting research results, new developments, and novel concepts in Reliability Methods will serve as the foundation upon which the conference program of this area will be developed. This session will address the research on the reliability modeling on both side of statistical reliability as well as physics of failure analysis. Sponsor: Safety Engineering & Risk Analysis Division

13-2 Failure and forensic analysis

Description
Authors and presenters are invited to participate in this event to expand international cooperation, understanding and promotion of efforts and disciplines in the area of Failure and Forensic Analysis. Dissemination of knowledge by presenting research results, new developments, and novel concepts in Failure and Forensic Analysis will serve as the foundation upon which the conference program of this area will be developed.

13-3 Testing for Product Reliability and Safety

Description
Authors and presenters are invited to participate in this event to expand international cooperation, understanding and promotion of efforts and disciplines in the area of Testing for Product Reliability and Safety. Dissemination of knowledge by presenting research results, new developments, and novel concepts in Testing for Product Reliability and Safety will serve as the foundation upon which the conference program of this area will be developed.

13-4 Reliability and risk in energy systems

Description
Authors and presenters are invited to participate in this event to expand international cooperation, understanding and promotion of efforts and disciplines in the area of Reliability and Risk in Energy Systems. Dissemination of knowledge by presenting research results, new developments, and novel concepts in Reliability and Risk in Energy Systems will serve as the foundation upon which the conference program of this area will be developed.

13-5 Reliability and risk in manufacture systems

Description

Reliability and risk analysis has become an essential but challenging task in planning, construction and operation of manufacturing systems. The use of such techniques gives chances to designers, manufacturers and end users to minimize the occurrence and recurrence of unavoidable failures. The main objective of reliability and risk analysis is to identify potential failure modes, evaluate the causes and effects when different failure modes happen, and determine the actions to be taken that can reduce the chance of future failures. This symposium aims to demonstrate the most recent theoretical and experimental studies for performing reliability and risk analysis in complex manufacturing systems. Topics to be addressed include, but are not limited to:

- New approaches of assessing reliability and risks
- Strategies for reliability and risk management and institutional responses to risk challenges
- Models of collective decision making in improve reliability/reduce risks

This topic covers the modeling, assessment and management of reliability and risk analysis in manufacturing systems. This topic seeks abstracts for individual sessions in:

- Product Quality Control
- Failure Detection, Isolation and Identification
- Scheduling and Planning

The symposium brings researchers from a variety of backgrounds together in order to exchange and discuss ideas related to theory and experimentation of the mechanics of soft materials. When submitting your abstract please include a sentence indicating which session you would like to take part in.

13-6 Prognostic and health management

Description

Prognostics and Health Management (PHM) is an emerging field that links studies of failure mechanisms to system lifecycle management. It has the ability of fault detection and isolation, fault diagnosis, failure risk prediction, health management, and the remaining useful life tracking by using the comprehensive utilization of modern information technologies and artificial intelligence technologies. To promote cross-fertilization and facilitate the development of this field, we welcome papers mainly related, but not limited to:

- Artificial intelligence in PHM
- Big data in PHM
- PHM in manufacturing industry
- PHM for rotating machinery, electric system, nuclear power system, energy system, civil structure and other systems
- Data-driven or model-based methods in PHM
- Numerical modeling and methods in PHM
- Multi-source information fusion in PHM
- Performance evaluation strategy in PHM
- Nondestructive evaluation technologies in PHM
- Use of sensors and devices in PHM
- New methods and technologies in PHM

13-7 Safety, risk and reliability of emerging technologies

Description

Authors and presenters are invited to participate in this event to expand international cooperation, understanding and promotion of efforts and disciplines in the area of Safety, Risk and Reliability of Emerging Technologies. Dissemination of knowledge by presenting research results, new developments, and novel concepts in Safety, Risk and Reliability of Emerging Technologies will serve as the foundation upon which the conference program of this area will be developed. This session will address the challenges and advancement of the safety, risk and reliability analysis for emerging technologies.

13-8 General topics on risk, safety and reliability

Description
Authors and presenters are invited to participate in this event to expand international cooperation, understanding and promotion of efforts and disciplines in the area of General Topics on Risk, Safety and Reliability. Dissemination of knowledge by presenting research results, new developments, and novel concepts in General Topics on Risk, Safety and Reliability will serve as the foundation upon which the conference program of this area will be developed.

13-9 Safety in transportation, agriculture, and off-road vehicles

Description
Authors and presenters are invited to participate in this event to expand international cooperation, understanding and promotion of efforts and disciplines in the area of Safety in Transportation, Agriculture, and Off-Road Vehicles. Dissemination of knowledge by presenting research results, new developments, and novel concepts in Safety in Transportation, Agriculture, and Off-Road Vehicles will serve as the foundation upon which the conference program of this area will be developed.

13-10 Crashworthiness, occupant protection, and biomechanics

Description
This topic covers research and development in the area of vehicle crash energy management, restraint systems, and occupant injuries mitigation. Authors and presenters are invited to participate in this event to expand international cooperation, understanding and promotion of efforts and disciplines in the area of Crashworthiness, Occupant Protection, and Biomechanics. Dissemination of knowledge by presenting research results, new developments, and novel concepts in Crashworthiness, Occupant Protection, and Biomechanics will serve as the foundation upon which the conference program of this area will be developed. A structural crashworthiness session with papers on developing structural methods and concepts to enhance crash energy management and occupants protection. And a protection session is dedicated to occupant protection and vehicle crashworthiness with papers on developing methods and concepts to enhance pedestrian, occupant protection, and full vehicle crashworthiness.

13-11 Reliability, Safety, and Risk Plenary

Description
Authors and presenters are invited to participate in this event to expand international cooperation, understanding and promotion of efforts and disciplines in the area of Reliability, Safety, and Risk Plenary. Dissemination of knowledge by presenting research results, new developments, and novel concepts in Reliability, Safety, and Risk Plenary will serve as the foundation upon which the conference program of this area will be developed.

Total Topics: 11

Track-14 ASME International Undergraduate Research and Design Expo (Posters Only)

14-1 General

Description
The ASME International Mechanical Engineering Congress and Exposition (IMECE) is seeking student entrants for the 2018 Undergraduate Research and Design Expo Student Poster Competition. The poster forum provides undergraduate mechanical engineering students with a professional and technical forum for presenting their research, design project, and other engineering solutions and endeavors. IMECE provides the unique environment for students to interact with fellow researchers from single-focus, multidisciplinary, and/or international backgrounds. Entrants will submit an abstract following the requirements listed below. ASME is sponsoring monetary awards for first, second and third place. Competition Abstract Requirements Abstracts should be at least 300-400 words and should include the following elements: An introduction that provides the motivation and purpose of the

research. The contribution of the work toward advancing science and/or engineering. The methodology used (e.g., experimental techniques, analytical, computational, etc.). Preliminary results and conclusions. A minimum of one student author per poster must register after the abstract is accepted. The student registrant will be provided access to the conference. Information for the poster format will be posted in July. Please note that this is a POSTER PRESENTATION competition, only. A paper is not required nor will it be accepted or will it be an option.