ASME VVUQ 2022

Verification, Validation, and Uncertainty Quantification Symposium

CONFERENCE
May 25 - 26 , 2022

Program

https://event.asme.org/V-V

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SETTING THE STANDARD

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Dear Attendee,

On behalf of the organizing committee, I offer you a warm welcome to the ASME 2022 Verification, Validation, and Uncertainty Quantification Symposium. This is our 11th annual symposium, and we are so pleased to be able to return to in-person interactions after two challenging years of an online-only format.

Whether you are a new participant or a long-time member of the ASME VVUQ community, one of the most beneficial aspects of the VVUQ Symposium is facilitating face-to-face interactions to build and sustain the VVUQ community. These interactions are key to a health and vibrant community, where the open exchange of ideas and methods, successes and failures, compliments and criticisms help to continue to build a foundation of scientific credibility for this field.

The goal of the symposium is to bring together scientists and engineers who use computational modeling and simulation, from across many different technical disciplines, to talk about our research, applications, issues, and solutions in verification (solving the equations correctly), validation (solving the correct equations), and uncertainty quantification. We all have our own domain-specific conferences and technical communities, and we hope that this symposium can be enriching and beneficial for your work by enabling you to interact with professionals from other disciplines, to see the common framework and techniques underlying all of verification, validation, and uncertainty quantification.

The symposium grew out of the ASME VVUQ Standards development committees. The *ASME VVUQ Standards Committee: VVUQ in computational modeling and simulation* is the overarching organization for the ASME VVUQ standards work. Under the standards committee, we currently have 7 subcommittees with the following scope:

- VVUQ 10 - VVUQ in computational solid mechanics
- VVUQ 20 - VVUQ in computational fluid dynamics and heat transfer
- VVUQ 30 - VVUQ in computational simulation of nuclear system thermal fluids behavior
- VVUQ 40 - VVUQ in computational modeling of medical devices
- VVUQ 50 - VVUQ of computational modeling for advanced manufacturing
- VVUQ 60 - VVUQ of computational modeling in energy systems
- VVUQ 70 - VVUQ of machine learning

The symposium is organized around the scope of the VVUQ standards committees and these seven subcommittees to cover a breadth of topics of interest to the community.

Whether this is your first or eleventh VVUQ Symposium, I hope that this meeting brings you new insights, fresh ideas, new professional relationships, and a deeper understanding of VVUQ and how it impacts your topics of interest.

Best,


Scott W. Doebling, PhD
Los Alamos National Laboratory
Chair, VVUQ Symposium Organizing Committee

ACKNOWLEDGEMENT

The Verification, Validation, and Uncertainty Quantification Symposium (VVUQ 2022) is sponsored by ASME. All technical sessions and conference events will take place on the campus of Texas A&M Hotel and Conference Center in College Station, Texas. Please check the schedule for event times and locations.

FULL SYMPOSIUM REGISTRATION FEES INCLUDE:

- Admission to all technical sessions.
- All scheduled meals.
- Symposium program with abstracts.

NAME BADGES

Please wear your name badge at all times; you will need it for admission to all conference functions unless otherwise noted. Your badge also provides a helpful introduction to other attendees.

FREE ASME MEMBERSHIP

Non-ASME Members who pay the non-Member conference registration fee, including students who pay the non-Member student fee, will receive a four-month FREE ASME Membership. ASME will automatically activate this complimentary membership for qualified attendees. Please allow approximately 4 weeks after the conclusion of the conference for your membership to become active. Visit www.asme.org/membership for more information about the benefits of ASME Membership.

INTERNET ACCESS IN THE HOTEL

Wi-Fi is included in your guest room and in the meeting space Texas A&M Hotel and Conference Center

ACCESSIBILITY AND GENERAL QUESTIONS

Whenever possible, we are pleased to accommodate attendees with special needs. Advance notice maybe required for certain requests. For on-site assistance related directly to the conference events and for general conference questions, please visit the ASME registration desk. For special needs related to your hotel stay, please visit the Texas A&M Hotel and Conference Center front desk.

Monday 5/23/2022	Tuesday 5/24/2022	Wednesday 5/25/2022	Thursday 5/26/2022
***Committee Meetings** **Zachry Engineering Education Complex @ Texas A&M** ***125 Spence Street** **9:00 AM - 5:00 PM** *See website for room assignments*	***Committee Meetings** **Zachry Engineering Education Complex @ Texas A&M** ***125 Spence Street** **9:00 AM - 5:00 PM** *See website for room assignments*	**VVUQ 2022 Symposium** **Texas A&M Hotel and Conference Center** **Registration** **7:00 AM – 5:00 PM**	**VVUQ 2022 Symposium** **Texas A&M Hotel and Conference Center** **Registration** **7:00 AM – 1:00 PM**
		Breakfast Century III, 1st Fl. 7:30 AM – 8:30 AM	**Breakfast** Century III, 1st Fl. 7:30 – 8:30 AM
		Welcome and Plenary Speaker Century IV, 1st Fl. 8:30 AM-10:00 AM	**Welcome and Plenary Speaker** Century IV, 1st Fl. 8:30 AM-10:00 AM
		Coffee Break 10:00 AM-10:15 AM	**Coffee Break** 10:00 AM-10:15 AM
		Technical Sessions Reveille or Hullabaloo on 2nd Floor 10:15 AM-12:20 PM	**Technical Sessions** Reveille or Hullabaloo on 2nd Floor 10:15 AM-11:55 AM
		Lunch Century III, 1st Fl. 12:20 PM - 1:00 PM	**Lunch** Century III, 1st Fl. 12:00 PM - 1:00 PM
		Technical Sessions Reveille or Hullabaloo on 2nd Floor 1:00 PM - 2:15 PM	**Technical Sessions** Reveille or Hullabaloo on 2nd Floor 1:00 PM - 2:40 PM
		Coffee Break 2:15 PM - 2:30 PM	**Coffee Break** 2:40 PM - 3:00 PM
		Technical Session Century IV, 1st Fl. 2:30 PM - 3:05 PM	**Technical Sessions** Century IV, 1st Fl. 3:00 PM - 5:00 PM
		Technical Sessions Reveille or Hullabaloo on 2nd Floor 3:20 pm - 4:35 pm	**Close of Symposium**
		Symposim Reception Century Ballroom Pre Function, 1st Fl 5:00 PM - 6:00 PM	

Keynotes

David Diaz

Chief Architect
Department of the Air Force Digital Transformation Office

Presentation: Moving Out of the 90s with Digital Technologies

Mr. David Diaz is the Chief Architect for the Department of the Air Force Digital Transformation Office located at Wright-Patterson Air Force Base, OH. He has over 35 years of experience in a variety of engineering and leadership roles, 25+ in defense and 10 in the pharmaceutical and medical device industries. As an experienced Chief Engineer, Mr. Diaz brings significant program acquisition experience to provide expert advice and guidance in unleashing the power of digital technologies to deliver dominant capabilities for Air Force acquisition programs. He has worked a variety of aircraft programs like the B-2 bomber, F-16 fighter, HH-60W helicopter, and AC/HC/MC-130Js series. He serves on the board of directors of the Kittyhawk Chapter Association of Old Crows, promoting electronic warfare superiority. In his current role, Mr. Diaz is an active leader with a passion for the advancement of digital technologies, frameworks, architectures, and data initiatives.

Simone Youngblood

Principal Professional Staff, Johns Hopkins Applied Physics Laboratory

Presentation: Emerging Concepts in Rigorous Simulation Validation

Simone M. Youngblood is a member of the Johns Hopkins Applied Physics Laboratory's Principal Professional Staff. Leveraging an extensive background in simulation development and credibility assessment, Simone Youngblood has served as a DoD VV&A focal point for the past 26 years. Ms. Youngblood was the editor of the DoD VV&A Recommended Practices Guide and has chaired the development of several VV&A related standards including IEEE Standards 1278.4, 1516.4, and 1730.2 as well as MIL-STD 3022. Ms. Youngblood has served as the V&V and/or Accreditation agent for numerous M&S efforts that span a broad organizational spectrum to include PEO IWS 1, the Defense Threat Reduction Agency (DTRA), the Department of Homeland Security, the US Naval Air Systems Command, and the US Army Medical Research and Material Command. Ms. Youngblood has a B.A. in mathematics as well as a B.S. and M.S. degrees in computer science.

VVUQ for Biomedical Engineering (10-01)

Featured Session Speaker

Professor Michael Sacks

Presentation: Parameter Estimation and Computational Model Validation for Soft Tissue Organs

W. A. "Tex" Moncrief, Jr. Simulation-Based Engineering Science Chair
Professor of Biomedical Engineering
The Oden Institute for Computational Engineering and Sciences
Professor of Aerospace Engineering and Engineering Mechanics (Courtesy)
Professor of Mechanical Engineering (Courtesy)
Professor, Department of Diagnostic Medicine, Dell Medical School (Courtesy)
Professor, Department of Internal Medicine, Dell Medical School (Courtesy)
Director, Oden Institute James T. Willerson Center for Cardiovascular Modeling and Simulation
The University of Texas at Austin

Professor Sacks is a world authority on cardiovascular modeling and simulation, particularly on developing patient-specific, simulation-based approaches for the understanding and treatment of heart and heart valve diseases. His research is based on multi-scale modeling, quantification, and simulation of the biophysical behavior of the constituent cells and tissues and translation to the organ level in health, disease, and treatment. He has developed novel non-invasive methods to quantify pre- and post-surgical state of the mitral valve from pre-surgical clinical images. He has determined the how local stress environments of heart valve interstitial cells alter their biosynthetic responses in the context of altered heart and valvular organ-level responses. His research also includes developing novel cardiac models to simulate growth and remodeling of the myocardium in pulmonary hypertension, the first full 3D approach for left ventricular myocardium mechanical behavior. Dr. Sacks is also active in modeling replacement heart valve materials and in understanding the in-vivo remodeling processes.

WEDNESDAY, MAY 25, 2022

04-01 Verification Methods
10:15 AM to 11:55 AM - Reveille, 2nd Fl.

Chair: ***Luis Eca - IST***

Code Verification Implications for Algebraic Equations, {VVS2022-88173}
Technical Presentation Only
Aaron Krueger - Sandia National Labs
Blake Lance - Sandia National Labs
Brian Freno - Sandia National Labs

Code-Verification Techniques for the Method-of-Moments Implementation of the Electric-Field Integral Equation, {VVS2022-87460}
Technical Presentation Only
Brian Freno - Sandia National Laboratories
Neil Matula - Sandia National Laboratories
Justin Owen - Sandia National Laboratories
William Johnson - Sandia National Laboratories

Nonintrusive Manufactured Solutions for Non-Decomposing Ablation in Two Dimensions, {VVS2022-87461}
Technical Presentation Only
Brian Freno - Sandia National Laboratories
Brian Carnes - Sandia National Laboratories
Victor Brunini - Sandia National Laboratories
Neil Matula - Sandia National Laboratories

Error Estimation for Coarse Resolution Simulations, {VVS2022-88410}
Technical Presentation Only
Noah Van Dam - University of Massachusetts Lowell

07-01 VVUQ for Fluid Dynamics and Heat Transfer
10:15 AM to 12:20 PM - Hullabaloo, 2nd Fl.

Chair: ***Brandon Wilson - Los Alamos National Laboratory***

A Cfd Validation Challenge for Transonic, Shock-Induced Separated Flow, {VVS2022-88224}
Technical Presentation Only
Blake W. Lance - Sandia National Laboratories
Kyle P. Lynch - Sandia National Laboratories
Matthew F. Barone - Sandia National Laboratories
Nathan E. Miller - Sandia National Laboratories
Steven J. Beresh - Sandia National Laboratories

Assessment of Different Rans Turbulence Models in the Thermal Performance of Mini-Channels for the Cooling of Mw-Class Gyrotron Resonator, {VVS2022-88380}
Technical Presentation Only
Rosa Difonzo - Dipartimento Energia "Galileo Ferraris", Politecnico di Torino

Eleonora Gajetti - Dipartimento Energia "Galileo Ferraris", Politecnico di Torino
Laura Savoldi - Dipartimento Energia, Politecnico Di Torino
Sebastian Stanculovic - Institute for Pulsed Power and Microwave Technology, Karlsruhe Institute of Technology (KIT)
Erdi Uygun - Dipartimento Energia "Galileo Ferraris", Politecnico di Torino

Validation Analysis of Medium-Scale Methanol Pool Fire, {VVS2022-86806}
Technical Paper Publication
Jared Kirsch - University of New Mexico
Joshua Hubbard - Sandia National Laboratories
Nima Fathi - Texas A&M University

A Validation Study of Hypersonic Aerodynamics With Multiple Physics-Fidelity Models, {VVS2022-88372}
Technical Presentation Only
Blake W. Lance - Sandia National Laboratories
Jared Kirsch - Sandia National Laboratories
Aaron M. Krueger - Sandia National Laboratories
Brian A. Freno - Sandia National Laboratories
Ross M. Wagnild - Sandia National Laboratories

Verification Assessment of Thermal Models in Conjugate Heat Transfer Analysis of Small-Scale Heat Sinks, {VVS2022-86822}
Technical Paper Publication
Mahyar Pourghasemi - Mechaniacl Eng Dep, University of New Mexico
Nima Fathi - Texas A&M University

05-01 Validation Methods
1:00 PM to 2:15 PM - Hullabaloo, 2nd Fl.

Chair: ***Aaron Koskelo - Los Alamos National Laboratory***

On the Application of the Area Metric to Validation Exercises of Stochastic Simulations, {VVS2022-86809}
Technical Paper Publication
Luis Eca - IST
Kevin Dowding - Sandia National Laboratories
Patrick Roache - Consultant

Validation of Multivariate Model Outputs With Sparse Measurements, {VVS2022-88290}
Technical Presentation Only
Andrew White - Rolls-Royce Corporation
Jason Schmucker - Rolls-Royce Corporation
Sankaran Mahadevan - Vanderbilt University
Alexander Karl - Rolls-Royce Corporation

Uncertainty in Input Conditions and Model Form Errors Using Probability Bounds Analysis, {VVS2022-88620}
Technical Presentation Only
Brandon Wilson - Los Alamos National Laboratory
Aaron Koskelo - Los Alamos National Laboratory

10-01 VVUQ for Biomedical Engineering
1:00 PM to 2:15 PM - Reveille, 2nd Fl.

Chair: ***Marc Horner - ANSYS, Inc.***

An End-to-End Example of the Asme Vvuq-40 Standard: Enabling Fea in the Review of Spinal Implants, {VVS2022-89920}
Technical Presentation Only
Marc Horner - ANSYS, Inc.
Srin Nagaraja - G.RAU Inc.
Andrew P. Baumann - US FDA CDRH OSEL Division of Applied Mechanics
Galyna Loughran - DePuy Synthes Joint Reconstruction
Kumar Kartikeya - ANSYS Software Pvt. Ltd.
Anup Gandhi - Zimmer Biomet Spine

Sensitivity of Derived Quantities Due to Different Pre & Post Processing Techniques for Internal Fluid Flows: Case Studies Using the Fda Benchmark Nozzle Model Geometry and Flow Conditions, {VVS2022-88394}
Technical Presentation Only
Christopher Basciano - BD
Siva Balasubramanian - BD
Shelby Bieritz - BD
Nathan Spagenberg - BD
Siddharth Nagarajan - BD

Credibility Assessment of Patient-Specific Computational Modeling Using Patient-Specific Cardiac Modeling as an Exemplar, {VVS2022-88496}
Technical Presentation Only
Pras Pathmanathan - US Food and Drug Administration
Suran Galappaththige - US Food and Drug Administration
Richard Gray - US Food and Drug Administration
Caroline Mendonca - King's College London
Steven Niederer - King's College London

01-01 VVUQ 30 Benchmark Challenge Problem
3:20 PM to 4:35 PM - Hullabaloo, 2nd Fl.

Chair: ***Yassin Hassan - Professor, Texas A&M***

High Resolution Measurements of a Heated Jet in Upper Plenum: Benchmark Challenge Problem, {VVS2022-97990}
Technical Presentation Only
Blake Maher - Texas A&M University
Noah Sutton - Texas A&M
Yassin Hassan - Texas A&M

Nekrs Simulations of the Flow in the Upper Plenum of a High Temperature Gas Reactor Experiment, {VVS2022-97986}
Technical Presentation Only
Elia Merzari - Pennsylvania State University
Victor Coppo Leite - Pennsylvania State University

High Temperature Test Facility Benchmark Experiments for Dcc and Pcc Analysis, {VVS2022-97934}
Technical Presentation Only
Tommy Moore - Oregon State University
Brian Woods - Oregon State University

12-01 VVUQ for Advanced Manufacturing
3:20 PM to 4:10 PM - Reveille, 2nd Fl.

Chair: ***Brian A. Freno - Sandia National Laboratories***

Anomaly Detection for Industrial Automation and Quality Assurance, {VVS2022-88203}
Technical Presentation Only
Anthony Garland - Sandia National Laboratories
Matthew Smith - Sandia National Laboratories
Kevin M Potter - Sandia National Laboratories

14-01 VVUQ for Computational Electromagnetics, Plasma, Radiation
5/25/2022
3:20 PM to 4:10 PM - Reveille, 2nd Fl.

Chair: ***Brian A. Freno - Sandia National Laboratories***

Planar Laser Physics Verification With Xrage, {VVS2022-88310}
Technical Presentation Only
Steven Anderson - Los Alamos National Laboratory

THURSDAY, MAY 26, 2022

08-01 VVUQ for Solid Mechanics, Structures, Impact, and Blast
10:15 AM to 11:55 AM - Reveille, 2nd Fl.

Chair: ***David Moorcroft - Federal Aviation Administration***

Sensitivity Analysis and Bayesian Calibration of a Holmquist-Johnson-Cook Material Model for Cellular Concrete Subjected to Impact Loading, {VVS2022-86800}
Technical Paper Publication
Brad Davis - US Military Academy
Gregory Langone - United States Military Academy, Nicholas Reisweber - United States Military Academy

Linking Material Models Between Codes: Establishing Thermodynamic Consistency, {VVS2022-86808}
Technical Paper Publication
Joanne Budzien - Los Alamos National Laboratory
James Byerly - Los Alamos National Laboratory
Rob Aulwes - Los Alamos National Laboratory
Rao Garimella - Los Alamos National Laboratory
Angela Herring - Los Alamos National Laboratory
Jon Woodring - Los Alamos National Laboratory

Dynamic Characterization of a Construction Vehicle Substructure Using a Combined Deterministic and Stochastic Analysis, {VVS2022-88419}
Technical Presentation Only
Hongan Xu - VCE
Santoshkumar Borkar - VCE
David Clark - VCE

Validation and Uncertainty Quantification in Predictive Multiphase Modeling of Silica Aerogels Building Insulations, {VVS2022-86932}
Technical Presentation Only
Jingye Tan - University At Buffalo
Danial Faghihi - University at Buffalo

09-01 VVUQ for Nuclear Power Applications
10:15 AM to 11:30 AM - Hullabaloo, 2nd Fl.

Chair: ***Joshua Kaizer - U.S. Nuclear Regulatory Commission***

High-Fidelity Experiments for the Validation of Computational Models for the Flow of Coolant in Nuclear Fuel Rod Assemblies, {VVS2022-97906}
Technical Presentation Only
Camila Freitas Matozinhos - Texas A&M University
Yassin Hassan - Texas A&M University

Generation of a Dataset of Cfd Simulations of Wire-Wrapped Nuclear Fuel Rod Bundles Using Star-Ccm+ and Modeling of Pressure Drop and Flow Split Using Artificial Neural Networks, {VVS2022-97913}
Technical Presentation Only
Gabriel Caio Queiroz Tomaz - Texas A&M University
Yassin Hassan - Texas A&M University

Process Data Reconciliation ("Pdr") - the Future in Plant Optimization, {VVS2022-89460}
Technical Presentation Only
Magnus Langenstein - BTB Jansky GmbH
Manuel Banowski - BTB Jansky GmbH

03-01 Topics in Verification, Validation & Uncertainty Quantification
1:00 PM to 2:40 PM - Reveille, 2nd Fl.

Chair: ***Nima Fathi - Texas A&M University***

Verification and Validation Using the Null Hypothesis as a Philosophical Grounding, {VVS2022-87890}
Technical Presentation Only
William Rider - Sandia National Laboratories

Development of an Intuitive, Numerical Measure for the Credibility of Model Predictions, {VVS2022-88361}
Technical Presentation Only
Jakob Hartl - Purdue University
William Crossley - Purdue University
Alexander Karl - Rolls-Royce Corporation

Simulation-Informed Decision Making: Business and Government Experiences, {VVS2022-88390}
Technical Presentation Only
William Oberkampf - W L Oberkampf Consulting

Measuring the Thermal Conductivity of Buried Substrates by Steady-State Thermoreflectance, {VVS2022-89128}
Technical Presentation Only
MD SHAFKAT BIN HOQUE - University of Virginia

15-01 VVUQ for Artificial Intelligence and Machine Learning Models
1:00 PM to 2:15 PM - Hullabaloo, 2nd Fl.

Chair: ***Katherine Lewis - Lawrence Livermore National Laboratory***

A Reference Problem for Examination of Verification, Validation, and Uncertainty Quantification Methods Applied to Machine Learning Modeling and Simulation, {VVS2022-88397}
Technical Presentation Only
Joshua Kaizer - U.S. Nuclear Regulatory Commission
Gregory Banyay - APPLIED RESEARCH LABORATORY
Scott Sidener - Westinghouse Electric Company

Training Verification and Machine Learning Models, {VVS2022-88400}
Technical Presentation Only
Joshua Kaizer - U.S. Nuclear Regulatory Commission
Adam Rau - U.S. Nuclear Regulatory Commission

Data Credibility in Scientific Machine Learning, {VVS2022-87503}
Technical Presentation Only
Kyle Neal - Sandia National Laboratories
Erin Acquesta - Sandia National Laboratories
Blake Lance - Sandia National Laboratories
William J. Rider - Sandia National Laboratories
Matt Barone - Sandia National Laboratories

02-01 Development and Application of Verification, Validation, Uncertainty Quantification Standards
3:00 PM – 4:00 PM - Century lV, 1st Fl.

Chair: ***Michelle Pagano - ASME***

Overview of Key Updates from the ASME VVUQ Standards Development Subcommittees:
VVUQ 10 - Computational Solid Mechanics
VVUQ 20 - Computational Fluid Dynamics and Heat Transfer
VVUQ 30 - Nuclear System Thermal Fluids Behavior
VVUQ 40 - Computational Modeling of Medical Devices
VVUQ 50 - Computational Modeling for Advanced Manufacturing
VVUQ 60 - Computational Modeling in Energy Systems
VVUQ 70 - Machine Learning

Open Discussion of Specific Standards Projects

01-02 Student Poster Presentations
4:00 PM to 4:45 PM - Century IV, 1st Fl.

Chair: ***Michelle Pagano - ASME***
Chair: ***Daniel Papert - ASME***

Solution Verification and Analysis of Xrage Modeling of the Rayleigh-Taylor Instability, {VVS2022-88221}
Student Poster Presentation
Allyson Leffler - Los Alamos National Laboratory
Jasper Thrussell - Los Alamos National Laboratory
Brandon Wilson - Los Alamos National Laboratory
Steven Anderson - Los Alamos National Laboratory

First Principles Analysis on the Strain-Induced Variation of Adsorption Behavior of Gas Molecules on Graphene, {VVS2022-88370}
Student Poster Presentation
Hideo Miura - Tohoku University
Meng Yin - Tohoku University
Ken Suzuki - Tohoku University

Molecular Dynamics Analysis on the Creep-Fatigue Damage Around a Grain Boundary in Ni-Base Alloy at Elevated Temperature, {VVS2022-88375}
Student Poster Presentation
Hideo Miura - Tohoku University
Shogo Tezuka - Tohoku University
Ken Suzuki - Tohoku University

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