IMECE2022 Tracks/Topics Descriptions

Tracks:

Track 1: Acoustics, Vibration, and Phononics

Description: Acoustics, Vibration, and Phononics- is organized by the Noise Control and Acoustics Division (NCAD) of the ASME. The Track contains a collection of Topics in the broad areas of acoustics, mechanical vibrations, and phononic metamaterials which are individually organized by leading researchers in the field. The Topics give a comprehensive coverage of experimental, computational, and analytical approaches employed to study problems of contemporary interest and importance in engineering acoustics, vibrations, and wave propagation. Contributions in the form of technical papers as well as oral presentation are sought in the individual Topics.

This track will bring together researchers from all over the world to share ideas and findings and expand international cooperation on all aspects of Acoustics, Vibration, and Phononics. Dissemination of knowledge by presenting research results, new developments, and novel concepts in Acoustics, Vibration, and Phononics will serve as the foundation upon which the conference program of this area will be developed.

Topics:

1-1: Phononic Crystals and Metamaterials

This symposium, which will be in its 18th year in 2022, 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 bandgap formation, waveguides, negative refraction, effects of nonlinearity/damping, band-structure computation, 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 General Committee Meeting at the IMECE Conference (Time 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 Guoliang Huang (huangg@missouri.edu) with the following information no later than August 31st, 2022: (1) Student Name and Affiliation, (2) IMECE2022 Paper #, and (3) Advisor Name. Note that an advisor is allowed to nominate no more than one paper for the competition.

1-2: General

This General topic area invites papers and presentations on any analytical, numerical, and experimental research and development in the general field of vibration, sound, and wave phenomenon that are not covered by other topic areas within the Acoustics, Vibration, and Phononics track. Topics include, but are not limited to, ocean acoustics, linear and nonlinear acoustics and vibration, thermoacoustics, stochastic methods in vibration and

acoustics, fluid-structural interaction, vibration and noise control, experimental methods in vibration and acoustics, and sensors and actuators. This topic area will give authors a great opportunity to reach a broad and international community at the IMECE conference and gain new perspectives on their research.

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1-3: Passive, Semi-Active, and Active Noise and Vibration Control

The Structural-Acoustics Committee of the Noise Control and Acoustics Division (NCAD) is sponsoring a Symposium on Passive, Semi-Active, and Active Noise and Vibration Control. This symposium seeks research and application of airborne, fluid-borne, and structure-borne noise and vibration 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.

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1-4: Analytical and Computational Acoustics and Vibrations

The Structural-Acoustics Committee of the Noise Control and Acoustics Division (NCAD) is sponsoring a Symposium on Analytical and Computational Acoustics and Vibrations. 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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1-5: Structural-Acoustic System Identification

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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1-6: Noise, Vibration and Harshness in Automotive Systems

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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1-7: Human Perception of Acoustics

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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1-8: Vibration and Acoustic Measurements, Signal Processing, and Test Facilities

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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1-9: Aero-acoustics and Sound Propagation

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. In-

dustrial experiences related to these areas are also of interest.

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1-10: Flow-Induced Noise and Vibration

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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1-11: Turbomachinery Noise

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

The Noise Control and Acoustics Division (NCAD) and Nondestructive Diagnostics and Prognostics Division (NDPD) are co-sponsoring a congress-wide symposium on NDE & SHM. This specific topic of the symposium will focus on

ultrasonic waves for material characterization and damage assessment. The Congress-Wide Symposium on NDE &SHM 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

The Noise Control and Acoustics Division (NCAD) and Nondestructive Diagnostics and Prognostics Division (NDPD) are co-sponsoring a congress-wide symposium on NDE & SHM. This particular topic of the symposium is dedicated to computational nondestructive evaluation and structural health monitoring. Contributions on any aspect of computational NDE and SHM are welcomed, which includes analytical and numerical modeling, digital twins, correlation of models to experimental data, development of new computational methodologies, stability of models and many others. This topic in the Congress-wide Symposium on NDE & SHM, will provide a venue for communication, discussion, and dissemination of ideas, advancements, and opinions on subjects related to computational NDE, SHM and prognosis.

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1-14: Wave Propagation in Heterogenous and Architectured Media

The study of stress wave propagation is very significant in aerospace, automotive, biomedical and electrical engineering. The understanding of the interaction between an elastic wave and a heterogenous or architectured medium is an important problem in various applications, such as wave control, energy harvesting or biomedical ultrasound. This session has the aim of gathering experts and share knowledge in the fields of theoretical modelling, numerical simulation and experiments, application of developed methods to study stress wave propagation, novel designs of materials and structures are welcome. The session will focus on research dealing with (1) composites with microstructures; (2) complex metamaterials; (3) biological tissues; (4) soil and rocks; (5) soft materials. Contributions on the following topics are welcome : (i) mathematical models and architecture continua; (ii) local and non-local modelling of multiphase and mulitphysics media; (iii) numerical techniques applied to scattering problems; (iv) multiscale modelling and experimental validation of generalised continua; (v) inverse microstructure problems.

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1-15: Dynamics of Adaptive Engineering Structures and Materials

In order to meet the requirements of tomorrow's world, engineers and architects must design extremely efficient structures. Making engineering structures and materials adaptive is a promising approach to reach that target. The load carrying efficiency of structures and materials can be increased noticeably by the employment of sensors, actuators and control units through multiphysics approach. Hence, the active manipulation of the static and dynamic structural response (i.e. forces, deformations and vibrations) enables to reduce the mass of engineering structures dramatically and to increase their performance. Additionally the adjustment to changing requirements occurring during lifetime of aerospace structures and building, like deployable and retractable structures, with significant changes between the configurations is another application of adaptive structures. This mini-symposium focuses on the adaptivity of structures in aerospace and civil engineering and on load carrying structures in general. It is devoted to new approaches in the computational design, analysis and optimization of such structures including (but not limited to):
• modelling and simulation
• form finding and optimization
• optimal strategies for sensor and actuator placement
• active and passive control strategies
• criteria for the evaluation of adaptive engineering structures.

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Track 2:   Advanced Manufacturing

Description: Advanced Manufacturing - is sponsored by the Manufacturing Engineering Division of the ASME. The Track contains a collection of Topics in the manufacturing ranging from nanomanufacturing, to fastening and joining, to material removal and forming, as well as additive manufacturing. The topics are organized by leading researchers in the field. The Topics give a comprehensive coverage of experimental, computational, and analytical approaches employed in order to implement new products and processes as well as improving current products and processes using based upon new approaches to implementing technologies. Solutions to manufacturing problems may incorporate either single or multidiscipline approaches including mechanics, thermos-fluids, systems analysis, and many others. However, the focus should be the production of either new products or manufacturing processes for products. Academic and government researchers are encouraged to submit abstracts leading to conference presentations and papers that will be published in the conference proceedings and ASME Digital Collection. Industry researchers are welcome to submit abstracts for presentation only or for publication in the ASME Digital Collection.

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 Advanced Manufacturing. Dissemination of knowledge by presenting research results, new developments, and novel concepts in Advanced Manufacturing will serve as the foundation upon which the conference program of this area will be developed.

2-1: 7th Annual Conference-Wide Symposium on Additive Manufacturing

Researchers from industry, academia, and government are encouraged to submit abstracts for the 2022 ASME IMECE's 7th Annual 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) of metals, ceramics, plastics, biomaterials, composites, and nanocomposites. Topics of interest include, but are not limited to:
• New and hybrid AM processes
• AM quality control (monitoring, machine learning, etc.)
• Experimental measurements of AM
• AM process modeling (numerical or analytical)
• Design for AM (DfAM)
• Fatigue, fracture, or mechanical analysis of AM parts
• Microstructure-property relationships of AM materials
• Ceramics, composites and multi-functional structures
• AM qualification and certification
• Powder/feedstock
• Post-processing methods for AM
• Industry 4.0, Internet of Things (IoT), digital twin, big data, data security
• Applications of AM
• Examples: Heat exchangers; implants; aerospace, automotive, and energy components

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

Measurement science, sensors, non-destructive evaluation (NDE) and process monitoring, and 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
• Manufacturing process monitoring and control
• Digital Manufacturing Threads integrating sensors, measurement instrument, NDE and control system

2-3: Nanomanufacturing: Novel Processes, Applications, and Process-Property Relationships

Nanoscale materials and constituents have superlative and emergent engineering properties compared to their bulk counterparts. The manufacture of nanoscale materials and their integration into functional and hierarchical

systems are significant challenges and are at the heart of nanomanufacturing efforts. Large-scale and repeatable production of nanoscale materials, nanoscale assemblies, and nanostructures demand complex fabrication, control, simulation, and characterization/metrology processes. This Nanomanufacturing symposium will encompass experimental, numerical, and theoretical work leading to novel, improved, and/or efficient processing and manufacturing methods with ångström to sub-micron precision across many length scales. Contributions are sought from industry, research enterprises, and academia in areas including, but not limited to:

Top-down control of bottom-up processing methods for nanoscale coatings, films, layered materials, and composites, etc.
Self-assembly methods to create 3D devices or mesoscale/bulk structures from nanoscale constituent materials
Synthesis and assembly of 0D/1D/2D materials and systems
Additive and subtractive manufacturing with/of nanoscale materials
Heuristic and machine learning based modeling of nanoscale processes
Data-enabled design of nanostructures
Scalable fabrication and large-area/volume integration of nanomaterials

2-4: Advanced Machining and Finishing Processes

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

2-5: 7th Symposium on Fastening and Joining Research and Advanced Technology

Recently fastening and joining technologies have been developed remarkably. In our topic, advanced technology and recent researches will be discussed in the above fields, in special, stress analysis, numerical analyses, experimental researches, improvement in technology and design on bolting, adhesive, welding and the technologies related to joining and fastening are welcome.

2-6: Advanced Material Forming - Mechanics, Characterization, Novel Processes, and Control

In these sessions, novel work will be presented, leading to new and improved metal and material forming processes involving mechanics, material modelling, microstructural characterization, process advancement, and control. 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/simulations
• Materials Testing and characterization
• Rolling and pre-forming processes
• Sheet metal forming and challenges
• Tube forming
• Bulk metal forming including forging, wire drawing, and extrusion
• Novel processes including hybrid forming processes
• Warm and Hot forming processes

• Dynamic testing and crash analysis
• Constitutive modeling
• Process monitoring, optimization, and control
• Tooling and equipment design
• Tool and die wear and fatigue
• Data-Driven Forming 4.0

2-7: Innovative Product and Process Design

The world is changing at a rapid pace. Innovations that were worth decades earlier are now being accomplished in weeks. Ever-evolving culture, improvements in the standard of living, demographic changes, and ecological factors among others are fuelling demand for greater diversity and increased development speed in industrial activities. In this intensely dynamic environment, relying only on traditional knowledge and not tapping into new real-world feedback can be a dangerous approach. It may lead to inefficient design, ineffective execution, and thus can result in lost revenue, wasted time, and extra effort for redesigning, and/or remanufacturing. Therefore, the inclusion of data-driven decision-making in design and manufacturing practices along with IoT enabled hybrid manufacturing systems with Digital Twin technology is of late gaining prominence in modern industry. This topic seeks to bring together novel contributions from researchers and practitioners who are exploring theoretical and application problems related to data-driven design, smart manufacturing, internet-of-things (IoT) in manufacturing and digital twin technology. Global perspectives for innovative product design and manufacturing are sought, which puts focus on novel strategies, methods and tools from research, engineering, and technological standpoints. Conceptual, theoretical, empirical and technological contributions, illustrated by manufacturing examples demonstrating noteworthy novelty in comparison with previously reported results would be the expected outcomes. The scope is set on (but not limited to) the following areas: • User-centric design from consumer data • AI/ML-assisted decision making • Internet-of-things in manufacturing • Data-driven approaches for digital twins • Data handling and data formats • Generative design/topology optimization Authors and presenters are invited to participate in this event to expand international cooperation, understanding and promotion of efforts and disciplines in the areas of data-driven and IoT enabled Innovative Product Design and Manufacturing. Dissemination of knowledge by presenting research results, new developments, and novel concepts in IoT enabled and data-driven Innovative Product Design and Manufacturing will serve as the foundation upon which the conference program of this area will be developed.

2-8: Computational Modeling and Simulation for Advanced Manufacturing

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 as well as multi-scale, multi-physics approaches to model advanced manufacturing techniques. Members of academia, government labs, and industry are encouraged to submit their research in areas such as:
Additive manufacturing
Machining
Laser processing
Multiscale forming
Material 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
New methods for improving existing processes
Warm and Hot forming
Dynamic testing and crash analysis

Constitutive modeling
Post Processing
Tool and die wear

2-9: Variation Simulation and Design for Assembly

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, inspection and 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.

2-10: Robotics and Automation in Advanced Manufacturing

Papers and presentations to promote cooperation, understanding, and efforts of disciplines in the area of Robotics and Automation in Advanced Manufacturing are featured in the topic. Cutting-edge work is welcomed across the spectrum of methods and applications. Dissemination of knowledge by presenting research results, new developments, and novel concepts in Robotics and Automation in Advanced Manufacturing are included.

2-11: Laser-Based Advanced Manufacturing and Materials Processing

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
Laser-based additive manufacturing: selective laser melting/sintering, laser engineered net shaping, laser additive manufacturing of composite materials, laminated object manufacturing, etc.

2-12: Digital Manufacturing Process Simulation and Validation

Digital manufacturing is an important 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:
Digital Twins
Internet of Things
Cloud Manufacturing
Virtual Reality in Manufacturing
Collaborative Robots
Machine Learning

2-13: Tribological Issues in Materials, Manufacturing, and Medicine - A Symposium in Honor of Professor Said Jahanmir

There are practically no simple methods or concepts having high predictive power for tribological problem-solv-

ing. This situation is due to the extremely inter-disciplinary and multi- scale character of tribological processes. Fortunately, however, recent methodical and didactical developments in the field of tribology offer hope that the situation may soon change.

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 Dr. Said Jahanmir Symposium: Advances in Tribology, Advanced Manufacturing Systems & Tribology of Novel Materials. Dissemination of knowledge by presenting research results, new developments, and novel concepts related to the work of Dr. Said Jahanmir 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 for the authors. All sessions are quality driven.

Grand Challenges on Manufacturing Systems in regards to Tribology

Tribology of Novel Materials

Green Tribology

Biomedical (Biotribology)

Nanotribology

Emerging technologies and industrial tribology

2-14: 3D/4D BioManufacturing & BioMaterials

This topic focuses on: (i) BioManufacturing and 3D BioFabrication Process Modeling, Optimization, and Control; (ii) Tissue Engineering: Design, 3D BioFabrication, and Characterization of Scaffolds, Tissues, and Organs; (iii) Regenerative Medicine and Rehabilitation as well as Stem Cell Tissue Engineering; (iv) Bioreactor Systems for Tissue Engineering Applications; (v) Synthesis and Characterization of Bioinks as well as BioMedical Materials; (vi) Artificial Intelligence-Based and Smart BioManufacturing; (vii) Transport Phenomena in Micro/Nano-BioFabrication Processes; and (viii) Multidimensional Characterization of Cell-Material Dynamics and Interactions.

2-15: Sustainable Manufacturing Systems

In these sessions, new and innovative work in the field of manufacturing processes with an emphasis on "Sustainable Methodologies", will be presented. Sustainable methodologies improve the manufacturing processes to conserve the energy, reduce wastage, and reduce the adverse environmental impacts. The research presented here will utilize theoretical, numerical, and experimental methods to advance the current state of knowledge in sustainable manufacturing processes. Members of academia, government labs, and industry are encouraged to submit their research in areas such as:

• Susatinable methodologies for manufacturing process such as machining, forming, casting, joining, finishing operations, etc.

• Cutting tool design for sustainable machining processes

• Cutting tool material and coating for sustainable machining processes

• Sustainable additive manufacturing processes

• Life Cycle Analysis (LCA)

• 6 Rs: Reduce, Recycling, Reuse, Recover, Redesign, and Remanufacture.

• Sustainable Manufacturing for Industry 4.0

• Sustainable manufacturing processes for semiconductor devices, electronic, etc.

• Post processing additively manufactured parts using sustainable methodologies

• Sustainable manufacturing systems

2-16: Manufacturing: General

This symposium will cover topics on other manufacturing areas that were not covered in other topics.

Track 3:   Advanced Materials

Description: Sponsored by the Materials Division, Track 3 focuses on design, processing, characterization and modeling of modern materials used in a wide range of engineering applications.

3-1: Mechanics of Penetration, Shockwaves, and High-Strain-Rate Events: Modeling and Experiments

This topic aims to exchange and discuss on the fundamental mechanics of materials and structures subjected to high-rate deformation. The mechanics of high-strain-rate events span multiple length scales, ranging from molecular to structural scales, and can exhibit complex structure-property-performance relationships. Through computational and experimental analysis, the behaviors of materials and structures subjected to highly dynamic environments can be better understood. The topics of particular interest include but are not limited to:

• Fundamental material behavior under extreme strain rates
• Dynamic material characterization
• Computational and constitutive model development
• Blast and ballistic performance of materials
• Dynamic energy dissipation mechanisms
• Design of penetration resistant materials

3-2: Modeling and Experimentation of Geomaterials

Geomaterials (concrete, soils, sand, rocks, etc.) exhibit well known pressure-dependent material behaviors. 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 such as infrastructures. Understanding the static and dynamic behaviors of these geomaterials becomes more and more important in both civilian and military applications under the threat of climate change.

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. Modeling and experimentation of geomaterials such as soils, sand and rocks under quasi-static and dynamic loading. Geomaterials characterization techniques at different length scales.

3-3: Integrated Computational Materials Engineering (ICME)

The key goals of the Integrated Computational Materials Engineering (ICME) Mini-symposium are to integrate all areas of modeling and simulation (Molecular dynamics, Discrete dislocation dynamics, Crystal Plasticity, and Continuum Mechanics), experimental specialization, and design to investigate ICME tools and techniques and their integration, as well as to examine their application in engineering.

The ICME-related topics are as follows:
• The wide range of materials programs where an ICME approach validated by experimental efforts is applicable, including computational and experimental-based aspects.
• ICME Approaches to develop advanced biomaterials.
• Impact of individual computational methods utilized in an ICME approach, including both advantages and limitations.
• Roles of ICME in continuing education in industry.
• ICME Approaches to design advanced structural materials.
• Incorporation of big data, data fusion, and machine learning for materials and product development with ICME methodologies.
• ICME implementation strategies.
• Verification, validation, and uncertainty quantification issues

3-4: Modeling and Experiments in Nanomechanics and Nanomaterials

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

3-5: Design, Material Processing, and Applications of Composites

This symposium will cover experimental, computational modeling, and design-related efforts toward manufacturing or fabricating composites and heterogeneous materials for applications in diverse fields including aerospace, biomedical devices, robotics, and many others.

Sessions might include but not limited to materials research, processing techniques, or applications related to the following areas:

• Design and processing of conventional and hard composites
• Fabrication and application of nanocomposites
• Design, fabrication and application of emerging composites and heterogeneous materials including soft functional composites
• Processing-structure-property relationships for composites
• Interphases and interfaces in composites and heterogeneous materials
• Novel experimental characterization techniques for composites
• Computational modeling and optimization for composites and heterogeneous materials
• Artificial intelligence and machine learning in the design, fabrication, and analysis of composites

3-6: Mechanics and Materials of Soft/Flexible/Stretchable Electronics

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

3-7: Material Processing of Flexible/Emerging Electronics, Sensors, and Devices

This topic/symposium will cover experimental, design-related, and mechanics-based efforts toward manufacturing or fabricating flexible/emerging 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
• Artificial intelligence in electronics and sensors

3-8: Design of engineered materials and components for additive manufacturing

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.

This topic is accepting oral technical presentations ONLY.

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

3-9: Design of Engineering Materials

This symposium focuses broadly on design approaches and algorithms for engineered materials with capabilities exceeding those possible in monolithic materials. Computational methods to analyze and understand large data sets are increasingly being used to advance design. This symposium is soliciting submissions pertaining to the use of forward and inverse design, topology, gradient-based, and stochastic optimization algorithms, artificial intelligence, and machine learning techniques for materials design. Applications include, but are not limited to, acoustic, elastic, mechanical, phononic/photonic, thermal metamaterials, metasurfaces, metagratings, and metadevices with advanced functionalities.

This topic is accepting oral technical presentations ONLY.

3-10: Intelligent Designs of Soft-Hard Integration for Functional Materials

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 de-

sign 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
• Data-driven design of soft-hard material integration
• 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

3-11: Manufacturing, Integration and Characterization of Multifunctional Structure and Devices

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. The symposium aims to provide an interdisciplinary forum for discussing modeling, simulation and characterization in manufacturing of advanced materials, structures and devices. Abstracts or technical presentation are solicited in the areas including but not limited to:
• Manufacturing and integration of functional materials, structures and devices (e.g. self-assembly, microtransfer printing, folding, crack/buckling/delamination-driven templating techniques)
• 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 characterization 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

3-12: Architected Composites and Structures: Design for Multifunctionality

Lightweight engineering materials generally feature different microstructures. Lots of design motifs could be employed to tailor mechanical properties through their microstructures, either by learning from nature or from development philosophy of materials themselves. This symposium aims to bring scholars and engineers from various backgrounds related to architected composites and structures together, to discuss the recent progress of the discovery and development for engineered structural materials towards strength, toughness, energy absorption, impact resistance etc .
Topics of interests include but are not limited to
• Mechanical performance of architected materials
• Design and fabrication of architected materials
• Programmable architected metamaterials for energy absorption
• Wave propagation and manipulation for architected materials
• Additive manufacturing of architected materials

3-13: Printed Hybrid Multifunctional Electronics and Energy Devices

The goal of this symposium is to bring together researchers in the emerging area of printed multifunctional electronics and energy devices, including but not limited to printed electronics, printed sensors, printed batteries, printed supercapacitors, printed biomedical devices, 3D printing of soft robots, and the related. The objective is to enhance interactions among researchers from both academia and industry working on printing materials, devices, and technologies, as well as their related aspects in physics, mechanics, materials science, experimental methods,

manufacturing process, and novel applications. Both fundamental research and applied research are welcome. A number of sessions will be organized for the following topics:

- Printed electronics: mechanics, materials, and manufacturing
- Printed batteries & supercapacitors
- Printed sensors/RFIDs
- Printed solar cells
- Micro/nano transfer printing technologies
- Wearable devices
- Internet of Things (IoTs) and applications
- Bio-integrated electronics & implantable electronics and energy devices
- Bio-electronics interfaces
- Soft robots and soft machines
- 3D/4D printing of multifunctional materials

3-14: Mechanics of adhesion and friction

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., 1D and 2D materials.)

3-15: Mechanics of Low Dimensional Materials

In recent years, low-dimensional materials, such as nanowire, nanotubes and 2D materials have attracted significant attentions in mechanics community. The dimensional constraints of these materials result in a large surface-area-to-volume ratio that allows free surface and nanoscale features to dominate their physical response to mechanical deformation. In addition, low-dimensional materials can be physically or chemically integrated with other materials to form unconventional nanocomposite that holds unprecedented mechanical properties. Furthermore, the coupling between mechanical strain and other physical fields enables tailoring the physical/chemical properties beyond mechanics as well as engineering new functionalities into the low-dimensional materials by the mechanical design of the strain states. This symposium aims to bring together experts from mechanics and material science communities to exchange ideas on the fundamental understanding of the mechanical and mechanically coupled behaviors of low-dimensional materials as well as the challenges and strategies on integration of these basic building blocks to macroscopic level. Presentations are invited covering experimental characterization and testing, and theoretical and computational modeling of mechanical behaviors of low-dimensional materials.

3-16: Multifunctional Intelligent Materials and Systems

Responsive multifunctional materials and structures include those with either controllable properties and performance corresponding to applied stimuli or the self-adjustment capability against extreme ambient conditions, which have attracted ever-growing interest owing to their broad applications in robotics, tissue engineering, bio-

sensing, smart equipment, and aerospace industry. The material design strategies usually involve a comprehensive understanding of multiphysics responsive mechanisms based on theoretical modeling, as well as the advances in manufacturing and experimental techniques. This symposium aims to provide an interdisciplinary forum for discussing recent discoveries in designing, modeling, fabricating, and testing responsive multifunctional materials and structures that facilitate the development of next-generation intelligent devices. Papers, extended abstracts, or technical presentation are solicited in the areas including but not limited to:

• Intelligent design and optimization of programmable, responsive, or adaptive multifunctional materials and structures to external stimuli and environments, such as bioinspired/biomimetic design, soft-hard material integration design, interface mismatch, instability, self-assembly, etc.

• Multifunctional intelligent systems enabled by advanced algorithms such as artificial intelligence, machine learning, neural networks, etc.

• Computational modeling and theoretical prediction for designing responsive multifunctional materials and structures.

• Experimental characterization of the responsive properties of multifunctional materials and systems.

• Smart sensing and actuator systems enabled by multifunctional intelligent materials such as optical/temperature/gas/strain sensors, biosensors, and image sensors, and mechanical/thermal/optical/magnetic/liquid driven actuators, etc.

3-18: Bioinspired Materials, Structures and Applications

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:

• Bioinspired Materials: Conception, Design, Fabrication, and Testing
• Biomimicked materials and composites: Synthesis, Characterization and Modeling
• Biomimetics, Biomimicry and applications in healthcare, aerospace and automotive industry.
• Self-Oscillating mechanical models for biological response of human tissues
• Phono-mimetic stimulation, characterization and modeling
• Synthesis and characterization of hybrid biomimicked 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

3-19: Multifunctional Energy Storage Materials and Systems

With the increasing demand for intelligent and lightweight for current energy storage systems, multifunctionality is regarded as one of the promising ways to provide a perfect sweet solution to achieve both lightweight, tough and high-energy-density for the energy storage systems. Abstracts or technical presentation are solicited in the areas including but not limited to:

• Structural batteries and electrodes
• Multifunctional nanomaterials for energy storage
• Soft and flexible batteries
• Advanced characterization technology of multiphysics behaviors for energy storage systems
• Fabrication of the multifunctional energy storage materials and systems
• Multiphysics/multiscale modeling of energy storage materials.

3-20: Multifunctional Composite/Safety Materials

Composites and multifunctional materials are game changers of protective devices for bio-tissues and infrastructures, due to their superior mechanical performance, light weight and ability to tailor multiple functional proper-

ties. This symposium provides an open platform to facilitate the discussion of leading-edge and multidisciplinary topics related to multifunctional composite/safety materials. Session topics include but not limited to:
• Mechanics of multifunctional composite/safety materials (synthesized and additively manufactured)
• Structural response of multifunctional composite/safety materials under various loading conditions from low-speed impacts to blasts
• Advanced experimental and computational methods for multifunctional composite/safety materials
• Fracture and Failure of multifunctional composite/safety materials
• Stress wave tuning in granular system

3-21: Soft Robotics, Machine, and Intelligence

Soft robotics is becoming an emerging research area due to its great potential of safe, adaptive human-machine and environmental interactions. It has recently attracted growing research interest from the broad communities of materials, mechanics, sensors, robotics, dynamics, control, and computer science. Recent rapid advances include but are not limited to bioinspired soft-bodied systems for multitasks and functionalities, as well as embodying artificial intelligence, physical intelligence, and materials intelligence in soft robotics for achieving autonomy and intelligence.

This symposium invites both fundamental and applied researches on modeling, design, fabrication, actuation, sensing, and control of soft robotics and soft machines composed of soft active/non-active materials from microscale to human 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 and their integration in soft robots and soft machines at all scales (e.g., artificial muscles, manipulators etc.,)
• Environment-adaptive soft mobile robots in different unstructured environments and terrains
• Autonomous and intelligent soft robots with embodied physical or materials intelligence for better human-robots and robot-environment interactions
• Robotic matter or structures: emerging soft active materials in soft robots, e.g., hydrogels, liquid crystal polymers, shape memory polymers, magnetic elastomers, and dielectric elastomers, or other emerging active materials; novel structures for robots, e.g., architected materials, origami/kirigami, tensegrity, shape-shifting structures, and composites etc.,
• Soft robots for better healthcare and medical applications, e.g., wearable soft robots, surgical soft robots, and rehabilitation robots etc.,
• Open or closed-loop control of soft robotics through integrating dynamics modeling, control, machine learning, and smart sensors or e-skin etc.

3-22: Modeling, Simulation, and Design of Multifunctional Materials

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

3-23: Dynamics of Advanced Functional Materials and Structures

Owing to their exceptional performances and multifunctional behaviors, advanced functional materials and structures are extensively explored in various fields, including material sciences, bio-inspired materials, granular

crystals, nanotechnology, acoustic metamaterials, energy materials, and magnetic materials. More recently, the dynamics of advanced functional materials and structures have attracted a growing interest, which may further shape our understanding of the underlying mechanisms and give rise to broader applications. This symposium can foster an open discussion of interdisciplinary topics and innovative discoveries in designing, manufacturing, testing, modeling, and simulating advanced functional materials and structures, and thus offering insights for potential engineering applications. Papers, abstracts, or technical presentations are solicited in the areas including but not limited to:

• Dynamic responses of bio-inspired materials/structures (inspiration, design, fabrication, experiment, modeling, and simulations)
• Advanced computational methods and experimental characterization of dynamic behaviors of functional materials and structures
• Fracture behaviors/failure mechanisms of advanced functional materials and structures
• Stress wave propagation in advanced functional materials and structures, such as granular crystals, acoustic metamaterials, layered structures, composites, and architected materials
• Theoretical models for tailoring the performances of functional materials and structures

3-24: Nanoengineered, Nano Modified, Hierarchical, Multi-Scale Materials and Structures

This symposium aims to provide a forum for exchanging current practices, research and developments, future trends and directions in the areas related to processing, and new manufacturing methods, including additive manufacturing, characterization, mechanics, modeling, analysis, design, and applications. Of particular interest are nanoengineered, nanomodified, hierarchical, multi-scale material systems and structures, tailored material configurations, and different length scales from nano to engineering scale. Material systems are highly multi-scale in nature, with properties and mechanical behavior dictated by their multi-scale morphology, materials and features, variations, including their fundamental molecular structure and associated material genome, and interaction and influence of material components at the 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 to 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
• Design and Analysis
• Engineering Applications
• High-Performance Materials
• Tailored Material Configurations
• Multi-Scale Mechanics

3-25: Processing of Ceramics and Composites for Additive and Advanced Manufacturing

This symposium will cover the processing and manufacturing aspects of ceramics and composites for advanced and additive manufacturing (AM). New processes are emerging for AM of ceramics and composites. These processes have often marked differences with metal- and polymer-based AM processes. The goal of this symposium is to be a forum for unconventional processes that aim at AM of ceramic and composites. The symposium covers both process development and characterization of materials produced using these processes. Applications for electroceramics, energy, Space and electronics are of particular interest

3-26: Fracture and Damage: Nano- to Macro-Scale

New materials are increasingly gaining importance in several engineering fields because of the property advan-

tages they offer. This session's scope 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 the laboratory.
• Damage prognostics and health monitoring methods.

3-27: Materials Processing and Characterization

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 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.

The range of materials includes the following:

1.   Metals and alloys – Tension, compression, shear, fatigue, fracture, creep, wear, corrosion responses, and their 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.

3-28: Recent Developments in Tribology

No human activity could be conducted without the expenditure of energy. The machines and devices that we use need the 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 significant influence on a country's economy. 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

3-29: Applications of AI/ML for Materials Processing

Artificial intelligence (AI) and Machine Learning (ML) based techniques guide decision-making in many fields. Research on the development of novel learning algorithms and applications of AI/ML-based methods to the synthesis, configuration, and optimization of manufacturing processes are of interest for the sessions under this topic. Papers with novel methodologies, data sets that help train classifiers and predictors, and real-time use of trained models in processing machinery are of particular interest. The application of the methods can span traditional materials processing to composites and additive manufacturing processes. Other topics can include, but not limited to, capturing the fundamental manufacturing science in a data-driven model and its applications to design or manufacturing; methods to collect model training and verification data from production machinery; and research into high-fidelity, high-accuracy neural network surrogates to predict manufacturing and materials processing behaviors. Papers and presentations describing research on predicting process-structure or process-structure-property relationships and process-induced defect predictions are of particular interest.

3-30: Fluid Dynamics Effects in Materials Processing and Advanced Manufacturing

The purpose of the symposium is to present the development of computational techniques for the inclusion of fluid dynamics phenomena in materials processing and advanced manufacturing processes such as additive manufacturing. The submitted papers should address the new application of conventional techniques or new, more efficient, numerical methods for the solution of problems that involve multiple-scale phenomena. Typical topics may include solution algorithms for coupling of models that describe microscale and macroscale phenomena, deterministic and stochastic models, phase field simulations, direct numerical simulations of microstructure, mass transport, stress evolution during solidification, and fluid dynamics effects. In addition to theoretical studies, experimental efforts that generate data to validate the models are encouraged; as are applications of these techniques to solve actual complex problems faced by industry in developing new materials and new processes.

3-31: Materials for biomedical devices and medications in healthcare

Nanomaterials enabled wearable biomedical electronics create important capabilities for long-term measurements of both physiological and psychological signals associated with human healthcare and activities. Meanwhile, the emergence of various new medications has been largely accelerated by active employment of nanomaterials. The symposium aims to provide an interdisciplinary forum for discussing the leading role of nanomaterials in design, characterization, development, and processing of wearable biomedical electronics and clinical medications for healthcare applications. Abstracts or technical presentations are solicited in the areas including but not limited to:
• Nanomaterials enabled biomedical devices
• Nanomaterials enabled biomanufacturing technologies
• Nanomaterials enabled tissue engineering
• Nanomaterials enabled clinical medications
• Nanomaterials enabled personalized medicine

3-32: Artificial Intelligence and Machine Learning in Biomedical Material Design

The prosperity and widespread of biomedical materials have made revolutionary impacts in healthcare monitoring and disease diagnostics/treatments over the past decades. Advances in biomedical materials, coupled with novel methods of creating advanced materials at the nanoscale, have opened new perspectives for the development of healthcare and medical products, especially nanomaterial-based products. Artificial intelligence (AI) and machine learning (ML) empower the computational tool for enhancing and improving the simulation and modeling process for nanomaterials-based medicine design and therapeutics. The symposium aims to provide an interdisciplinary forum for discussing the leading role of AI and ML in biomedical materials design, characterization, development, and process as well as healthcare applications. Abstracts or technical presentations are solicited in the areas including but not limited to:
• Data science-driven design and exploration of biomedical materials

- Computational nano-bio interface
- Modeling and simulations of nanomaterials-human tissue interactions
- Nanotoxicology modeling with AI and ML
- Nanomedicine optimization
- Drug development pipeline with AI and ML

3-33: Multi-scale and multi-physics mechanics of soft and biological materials

Mechanics of soft materials is a rapidly advancing field with wide-ranging and transformative applications – both technological and fundamental – that range from the creation of novel multifunctional materials to furthering our understanding of the way biological systems work, and everything in between. Many of these soft materials showcase multi-scale and multi-physics mechanics — from self-assembly at the microstructure level to instabilities at the macro-scale, thus providing many different ways to harness their power. This symposium aims to bring together a multi-disciplinary group of researchers to discuss recent experimental, computational, and theoretical advances in the broad area of mechanics of soft materials and their applications in engineering and biology.
Possible topics include but are not limited to experimental, theoretical, and/or computational studies on:
- Mechanics of self-assembly in multifunctional soft materials
- Molecular-level self-assembly of soft materials
- Mechanics of biological systems, such as growth and self-organization
- Multiphysics phenomena in soft materials
- 3D printing/self-assembly of architected soft materials
- Coupled instabilities in soft materials, such as electroactive and magnetoactive polymers

3-34: Nanomaterials for Energy

Nanomaterials are anticipated to continue 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.
Sessions will be organized around the following thematic areas:
- Next-generation energy nanomaterials: structure-property relationships of high-performance, low-dimensional (0-D, 1-D, and 2-D) materials for applications in lithium and beyond-lithium-based energy conversion and storage, fuel cells, supercapacitors, and photovoltaics, and water splitting
- Mechanics of energy nanomaterials: nanomechanics-enabled performance enhancement and structure-property relationships in energy materials
- Computational methods and simulation for energy nanomaterials: current advances in computational tools (machine learning, artificial intelligence, DFT, molecular dynamics, etc.) and modeling for energy nanomaterials
- Advanced characterization techniques for energy nanomaterials: advances in structure-property characterization techniques (incl. in-situ/in-operando methods) for energy nanomaterials

Track 4: Advances in Aerospace Technology

Description: Advances in Aerospace Science and Technology- is organized by the ASME Aerospace Division Structures and Materials Technical Committee. The Track contains a wide range of topics in the broad area of aerospace engineering, which are individually organized by leading researchers in the corresponding field. The track provides a stage for people from all over the world to exchange their experimental, computational, and analytical studies in variable subareas of aerospace engineering. Contributions in the form of abstracts for oral presentation are sought in the individual Topics.

4-1: General Aerospace

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

4-2: Advances in Aerodynamics

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.

4-3: Novel Aerospace Propulsion Systems

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.

4-4: Advances in Aerospace Structures and Materials

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.

4-5: Beam, Plate, and Shell Structures

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.

4-6: Lightweight Sandwich Composites and Layered Structures

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

4-7: Dynamic Behavior of Composites

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.

4-8: Dynamics and Control of Aerospace Structures

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.

4-9: Materials and Structures for Extreme Environments

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.

4-10: Impact, Damage and Fracture of Composite Structures

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.

4-11: Advances in Mechanics, Multiscale Models and Experimental Techniques for Composites

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.

4-12: Peridynamics Modeling

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.

4-13: Computational Aerospace Structural Dynamics and Aeroelasticity

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 aircraft type includes fixed-wing, rotorcraft, full-scale, model-scale, and UAVs. The session focuses on all aspects of structural dynamics, aeroelasticity, multibody dynamics, and new numerical and experimental techniques. Papers are especially solicited on the topics of applying SD to aircraft simulations, which includes but not limited to flow separation- and shock-induced aeroelasticity, hypersonics, high-fidelity and reduced order modeling and machine learning for SD and aeroelasticity.

4-14: Nonlinear Problems in Aerospace Structures

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 and coilable booms. On the other hand, the effects of physical nonlinearities are accounted for in the modern analysis of failure mechanics, progressive failure of composites and smart soft materials. 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, analysis of large displacements and rotations, and applications of smart soft materials in aerospace, such as silicone rubber materials, shape memory polymers and dielectric elastomer materials.

4-15: Congress-Wide Symposium on NDE & SHM – NDE and Prognostics in Structural Applications

Nondestructive evaluation (NDE) and Structural Health Monitoring (SHM) plays a significant role in enabling safety and reliability of various mechanical and structural systems. Congress-wide Symposium on NDE & SHM, 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.

The topic of the symposium seeks papers that demonstrates research and application of SHM, periodic NDE, condition-based-maintenance and prognostics of composite materials, components, structures and systems. Investigations may be theoretical, numerical and experimental in nature which addresses the integration of NDE/SHM techniques in various structural systems. Topics of interest include but not limited to damage detection, damage growth modeling, data-driven approaches (machine learning, artificial intelligence), physics-of-failure modeling (peri-dynamic, surrogate models), hybrid modeling, intelligent structures, Bayes filtering, autonomous decision making and mission risk assessment based on NDE diagnostic and prognostic information.

4-16: Advanced Manufacturing in Aerospace Engineering

Advanced manufacturing has been critical to address the most recent technical challenges in aerospace engineering. This topic promotes broad manufacturing technologies, with strong interests in custom manufacturing, controlling composition and internal structure of materials for multi-material additive manufacturing, multi-scale modeling and data analytics, and sensor-based manufacturing design. The developed technologies can be related to any structural and non-structural materials that applied to aerospace engineering, including metallic alloys, polymers, composite materials, etc.

4-17: Applications of Artificial Intelligence/Machine Learning in Aerospace Engineering

Data science including artificial intelligence and machine learning has started making significant impact in academia and industry. Aerospace engineering field has unique opportunities and challenges to incorporate data intensive analysis techniques. This topic covers a wide range of applications of artificial intelligence and machine learning in aerospace engineering such as inspection, design, manufacturing and performance of aerospace structures, anomaly detection, autonomous exploration, power or fuel consumption prediction, satellite image analysis, etc.

4-18: Congress-Wide Symposium on Advanced Research in Marine and Aerospace Lifting Surfaces

Lifting surface design and performance affect the safety, economy, and controllability of myriad systems designed for operation in air and water – including wings, hydrofoils, propellers, turbines, control surfaces, and more. This mini-symposium will cover advanced topics in the design, analysis, and control of lifting surfaces in marine and aerospace fields. The topics are multi-disciplinary, inviting participation by researchers in fluid dynamics, structural dynamics, design, control, and other disciplines. The objective is a comprehensive overview of how simulation, experiment, and new analysis techniques are being applied to the design and operation of hydrofoils, aircraft structures, and control surfaces in diverse and complex flow conditions. Topics include but not limited to 1) Aero- and hydro-acoustics of flow around lifting surface, 2) Fluid-Structure Interactions (Aeroelasticity, Hydroelasticity), 3) Multi-phase flows, 4) Advances in experimental methodologies, 5) Advances in simulation (FSI, multi-phase flows, transonic flow), 6) Multi-disciplinary optimization of lifting surfaces, and 7) Innovative airfoil and hydrofoil design.

4-19: Greening Aviation

Commercial Aviation emissions have today a carbon contribution around 2.4% of global CO_2 emissions and are expected doubling over the next decade (source IATA, which do not consider national internal flight). A warming effect 3 times larger than that of the carbon component alone, by considering the altitude and the delicate atmospheric layer in which they are emitted. Therefore greening aeronautics is a major goal toward reaching 2050 goals about reducing the atmospheric Green House Gasses emissions. In addition, the major airport hubs are often heavily congested forcing to increase aircraft permanence in flight before landing or to long stays on the ground with engines running before take-off, with a consequent increase of the environmental footprint.

This Topic welcome contributions about energy balance and optimization of flight aircraft and aircraft operations, new aircraft architectures and design methods, optimization of aircraft architectures according to both the first and the second law of thermodynamics, strategies for regenerating today aircraft models and reducing their environmental impacts, more efficient aircraft architectures that may lead to radical steps forward toward greening aviation, adoption of new fuels including natural gas and hydrogen, and solar aircraft, innovative boxed and blended wing aircraft, innovations toward more electric, hybrid, all electric aircraft, innovative aircraft architectures to for diffused electrical or hybrid propulsion, innovative aircraft design for lift augmentation and drag reduction, skin friction reduction, measures to reduce of takeoff and landing spaces with the potential of reducing congestion on mayor airports and increasing the utilizations of smaller ones, mission management and optimization strategies, aerodynamic and structural sensing systems, breakthrough innovation which can reduce the environmental impacts of aviationand the emission of greenhouse gasses, etc. In addition, contributions about instruments, methods and models for an effective estimation, prediction or reduction of the impacts of aviation on the transitional atmospheric layer between troposphere and stratosphere on which the emissions of commercial aviation insist are invited. Multidisciplinary and interdisciplinary contributions are welcome.

4-20: Unmanned Aircraft Systems (UAS): Propulsion, Energy and Applications

Technical papers are sought on propulsion and power of unmanned aerial systems. Topics of interest include (a) energy harvesting and management; (b) conventional and alternative power systems: combustion engines, fuel cell, solar panel, and battery; (c) dynamics and control, including multi-agents/multi-modal systems; (d) applications of unmanned aerial systems; (e) advanced UAV data management, for example, edge computing and implementation of zero trust; (f) applications in agriculture, environmental sensing, wetland mapping, extreme conditions, etc. Papers of exploratory investigations, modeling and simulation, payload implementation, and sensor integration are also welcome.

Track 5: Biomedical and Biotechnology

Description: This track focuses on the implementation of various engineering principles in the conception, design, development, analysis and operation of biomedical and biotechnological systems and applications. Authors and

presenters are invited to participate in this track to expand international cooperation, to develop understanding of bioengineering principles and methodology and to promote efforts in implementing engineering principles to biomedical and biotechnological systems. Dissemination of knowledge by presenting research results, new developments and novel concepts in developing these systems will serve as the foundation for this track program.

ATTENTION: Biomedical Graduate Student Competition.
We will be holding a best-paper competition for the track. This is open to PhD and Masters students (must be the first author). If you would like to get into the competition, then please contact Jason Hua; yih61@pitt.edu, X. Gary Tan, gary.tan@nrl.navy.mil, Asheesh Lanba, Asheesh.lanba@maine.edu with your IMECE paper number.

Topics:

5-1: Injury and Damage Biomechanics

This topic is focused primarily on (i) techniques, either experimental or computational, to understand how blunt impact, ballistic impact, and blast effects forces are translated to biological damage, for both civilian and military environments; (ii) novel approaches to understanding the onset and progression of damage in biological systems; and (iii) injury detection, characterization and interpretation. Additional topics of interest include (iv) materials characterization and constitutive equations (for biological as well as protective materials) at strains and strain rates commensurate with blunt impacts, sports incidents and other threats and injury mechanisms; (v) computational modeling and experimental studies aimed at elucidating the effects of cavitation in the brain due to external loading for causing tissue and/or cellular level damage; and (vi) application of artificial intelligence (AI) and machine learning in clinical assessment of injury and damage to tissues and organs, and for developing prediction tools through big data integration. This topic also solicits papers from graduate and undergraduate students in bioengineering and biotechnology area for BioEngineering Student Papers Competition. The student must be in a Masters or PhD program, be the first author, receive an acceptable rating on the paper, and present the paper. Please designate it as a submission for the Student Design Competition for the Track.

5-2: Vibration and Acoustics in Biomedical Applications

This topic focuses on the implementations of vibration and acoustic principles in biomedical applications. This includes, but is not limited to, using these principles in: biomedical devices, tissue and organ characterization, and rehabilitation and therapy devices and methods.
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5-3: Biomedical Imaging, Therapy and Tissue Characterization

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

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 and on simplified systems that enable the biophysical characterization of living cells. These include but are not limited to, 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, and multiscale modelling of tissue constructs, buckling in grain stems, simulation of bioreactors, cell-laden hydrogels, bone mechanical properties, tumor mechanical rigidity, self-folding microgels.

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5-5: Biomedical Devices

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.

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5-6: Dynamics and Control of Biomechanical Systems

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

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5-7: Symposium on Clinical Applications of Bioengineering

This symposium provides 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 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.

ATTENTION: Biomedical Graduate Student Competition

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5-8: Biotransport (Fluid. Heat and Mass)

This topic focuses on the implementation of various heat and mass transport principles in biomechanical applications.

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5-9: Computational Modeling in Biomedical Applications

This topic focuses on solving biomedical problems using computational models.

ATTENTION: Biomedical Graduate Student Competition

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5-10: Musculoskeletal and Sports Biomechanics

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.

ATTENTION: Biomedical Graduate Student Competition

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5-11: Sensors and Actuators

This topic covers a wide range of sensor and actuator development with focus on biomedical applications. ATTENTION: Biomedical Graduate Student Competition

We will be holding a best-paper competition for the track. This is open to PhD and Masters students (must be the first author). If you would like to get into the competition, then please contact Jason Hua; yih61@pitt.edu, X. Gary Tan, gary.tan@nrl.navy.mil, Asheesh Lanba, Asheesh.lanba@maine.edu with your IMECE paper number.

5-12: Robotics, Rehabilitation

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.

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5-13: Bio Artificial Intelligence

This topic welcomes projects that utilize artificial intelligence to process bioengineering data. This includes and is not limited to methods that incorporate artificial intelligence algorithms, machine learning, neural networks, and fuzzy learning logic. This can include the use of evolutionary programming or topological optimization in the design of prosthetic devices. Topics such as the use of expert systems in the analysis of motion images or the use of neural nets and fuzzy logic in the development of control algorithms for the operation of exoskeletons would also be of interest. In addition, work employing Bayesian analysis or data mining to identify the mechanics associated with disease characteristics will also be considered.

ATTENTION: Biomedical Graduate Student Competition

We will be holding a best-paper competition for the track. This is open to PhD and Masters students (must be the first author). If you would like to get into the competition, then please contact Jason Hua; yih61@pitt.edu, X. Gary Tan, gary.tan@nrl.navy.mil, Asheesh Lanba, Asheesh.lanba@maine.edu with your IMECE paper number.

5-14: Biotechnology and General Applications

This topic includes papers in biotechnology and any general papers which do not fit in the above topics. ATTENTION: Biomedical Graduate Student Competition

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Track 6: Design, Systems and Complexity

Description: The track is intended to share knowledge, experience, and the latest scientific information in the area of designing complex systems. Methodologies, tools, and applications will be discussed in order to understand how emerging technologies can be applied to
critical engineering activities such as product design, manufacturing, management, and integrated development of information throughout the product's life cycle

Topics:

6-1: Product and Process Design

In addition to the deepening and expanding researches of product and process design today, we strongly encourage you to submit researches, which explore the new horizon in an age of the interconnected IoT society, where products and processes work as a team.
We welcome not only technical paper presentations, but also technical presentation (oral presentation) only to share your research outcomes and your ideas for the future.

6-2: CAD, CAE and CAM

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 CAD, CAM and CAE Design. Dissemination of knowledge by presenting research results, new developments, and novel concepts in CAD, CAM and CAE Design will serve as the foundation upon which the conference program of this area will be developed.
We welcome not only technical paper presentations, but also technical presentation (oral presentation) only to share your research outcomes and your ideas for the future.

6-3: Optimization

Optimization is focused on the conceptual and constructive processes for improvement and effectiveness. The main theory and practice are composed of following disciplines: numerical optimization, stochastic optimization, and combinatorial optimization. This session pursues contributions on, but not limited to: development of novel optimization methods for challenging engineering problems, applications of optimization in engineering disciplines; computational optimization techniques for data-driven engineering applications; optimization in use of Decision Support Systems and optimization methods relevant to engineering.
The aim of the session is to provide a platform for scientists, researchers and industry leaders in the field of optimization to disseminate recent findings and progress. It is an opportunity for delegates to present recent research approaches with results and introduce the latest trends in optimization techniques with their application. We welcome not only technical paper presentations, but also technical presentation (oral presentation) only to share your research outcomes and your ideas for the future.

6-4: Design for Additive Manufacturing

Design for Additive Manufacturing (DfAM) allows designer to take full advantages of unique capabilities from AM processes in term of shape, hierarchical and functional complexity.
The aim of the topic is to provide a platform for scientists, researchers and industry leaders to share their findings about major opportunities, constraints, trends and economic considerations related to DfAM. Potential topics include, but are not limited to, the following: design rules for AM, DfAM methodologies, optimization methods oriented to AM, simulation of the AM processes, CAx tool to support design for additive manufacturing, part consolidation, design methods for porous structures, periodic structures and lattices.
We welcome not only technical paper presentations, but also technical presentation (oral presentation) only to share your research outcomes and your ideas for the future.

6-5: Human Modelling for Product Design and Manufacturing

Computer-aided modelling and simulation tools enables assessment of products and manufacturing processes in their conceptual design stage. Embedding human factors and ergonomics in the first steps of the design process is mandatory to avoid failures that may affect the entire system and imply a costly design revision. Thus, there is a need for ergonomics to be a natural part of the product and production development process, also at conceptual virtual stages. Different Digital Human Modelling (DHM) software solutions are available on the market with different characteristics, performances and costs but they still have not been broadly accepted by industry as a standard part of the design toolbox. New models are emerging and industrial applications across different sectors could foster the performances, usability and diffusion of digital ergonomic analyses based on DHM.

Concerning human modelling for product design and manufacturing systems, potential topics include, but are not limited to the following: human factors in product/process design, virtual factory based on human modelling and task simulation, human-centered design, human simulation-based product validation, and DHM applications in ergonomics and posturography.

6-6: Smart Cyber-Physical Systems Design

Recent advances in mechatronic and microelectronic systems as well as telecommunication technologies help establish the concept of Cyber-Physical Systems (CPS). With the aids of Internet of Things and Web of Things, CPS is bringing the impact of digital technologies to a new level. Researchers are invited to discuss the recent advancement in systems design for hardware, software, and computational algorithms, and the applications of CPS in Internet of Things (IoT), smart systems, collective robotics, smart grids, smart cities, autonomous transportation, etc.

The research topics include but not limited to: Modeling and design of CPS with hierarchical hardware-software architecture and complexity; Mathematical and statistical models of interactions between connected systems; Integration, analysis, and usage of the data acquired by systems of CPS; Machine learning and machine intelligence in the implementation of CPS; Design of novel sensing and actuation mechanisms; Design of new capabilities of evolution and adaptability for future-generation CPS with growing complexity; Monitoring, composition, and management of CPS; Humans in the loop with considerations of security, privacy, trust, and risk; Social-technical impacts of CPS on both human and machine behaviors and public policies; Applications in Internet of Things, Web of Things, smart systems, embedded multi-agent systems, collaborative robotics, intelligent agent.

Human and Robot Collaboration extends the traditional concept of automation systems toward barrier-free environments where humans and robots work side-by-side to symbiotically improve those production processes characterized by small sized lots of tailored products. This topic is related to novel design methods that integrate and combine the key aspects for an effective development of human and robot collaborative applications, such as task planning and allocation, safety countermeasures, ergonomics and intuitive interfaces, just to cite the main of them.

6-7: Sustainability and Context Aware Design

In the last past years, research have shifted from the de-pollution of systems towards the reduction of the root cause of pollution at source. Without a doubt, design plays a crucial role in this vision.

These extensive changes in our environments and situations call for social context aware design.

The aim of the topic is to provide a forum for scientists, researchers and industry leaders to share their findings about this emerging discipline of sustainability and context aware design. Topics of interest include, but are not limited to, circular economy, remanufacturing, sustainable product design, life-cycle sustainable design and eco-design.

We welcome not only technical paper presentations, but also technical presentation (oral presentation)

Track 7:   Dynamics, Vibration, and Control

Description: Welcome to Track 7 Dynamics, Vibration and Control (DVC) of 2022 ASME International Mechanical Engineering Congress and Exposition (IMECE). This track brings together researchers from all over the world to share ideas and findings on all aspects of Dynamics, Vibration and Control. We invite you to participate. Manu-

scripts are solicited in all areas of theoretical, symbolic, computational and experimental Dynamics, Vibrations and Control. Specific topics of interest include, but not limited to, the following areas: Linear and Nonlinear Dynamics, Vibration and Control; Flow/Thermal-Induced Vibrations; Stability, Bifurcation, Chaos, Solitons and Fractals in Mechanical Systems; Discontinuous Dynamics; Applied Nonlinear Control; Acoustics and Wave Propagation in Continuous Media; Computational Dynamics in Mechanical Systems; System Identification; Noise and Noise Control. Of interest are research activities associated with aerospace, heavy machinery, manufacturing systems, and nanotechnology, etc. Please do not hesitate to contact us with your questions. We look forward to seeing you at IMECE 2022.

Topics:

7-1: General Dynamics, Vibration, and Control

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

7-2: Nonlinear Dynamics, Control, and Stochastic Mechanics

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.

7-3: Design and Control of Robots, Mechanisms and Structures

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.

7-4: Fluid-Structure Interaction

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.

7-5: Dynamics and Control in Micro/Nano Engineering

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.

7-6: Smart Structures and Structronic Systems: Sensing, Energy Generation and Control

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.

7-7: Novel Control of Dynamic System and Design

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.

7-8: Multibody Dynamic Systems and Applications

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.

7-9: Vibrations of Continuous Systems

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.

7-10: Mobile Robots and Unmanned Ground Vehicles

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.

7-11: Control Theory and Applications

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.

7-12: Optimization, Uncertainty and Probability

This symposium aims to bring together researchers from both academy and industry to discuss the latest advances in 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 and propagation (probabilistic approaches, interval model, convex models, fuzzy sets, Bayesian model, etc.); stochastic dynamics; reliability assessment.

7-13: Multi-Physics Dynamics-Control & Diagnostics-Prognostics of Structures and Devices

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.

7-14: Renewable Energy, Structural Health Monitoring, and Distributed Structural Systems

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.

7-15: Dynamics and Control of Soft Structures

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.

7-16: Multi-Field Coupling and Control

Smart materials and structures usually exhibit multi-field electro/magneto/photo/thermo/elastic coupling behavior. For example, the flexoelectricity describes the contribution of the linear couplings between the electric polarization and strain gradient and between polarization gradient and strain to the thermos-dynamics of a solid. Based on the multi-field coupling mechanism, the smart materials can accomplish the energy exchange among electrical energy, potential energy, kinetic energy, etc. 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 of novel smart materials; 2) Electric modeling of multi-field coupling structures; 3) Fabrication, testing and analysis of multi-field coupling systems; 4) Sensing, energy generation and active control of structures with multi-field coupling effect.

7-17: Machine Learning and Artificial Intelligence in Dynamics and Vibrations

Machine Learning and Artificial Intelligence are both emerging as invaluable tools for studying a wide variety of research problems. In the area of dynamical systems, these tools are being applied to problems in traffic dynamics, neural dynamics, fluid dynamics, molecular dynamics, multi-agent system dynamics, weather forecasting, and many others. This symposium seeks papers addressing applications of, and theoretical developments in, Machine Learning, Artificial Intelligence, and Deep Learning as applied to the fields of dynamical systems, vibrations, and control. Topics in which these tools are used could include the prediction of dynamical states in complex systems, system identification for linear and nonlinear systems, control of complex systems, and others.

7-18: Marine Electromechanical Systems and Ocean Mechatronics

Researchers are cordially invited to contribute findings and progress in the broader areas of marine and ocean engineering with emphasis on marine propulsion, power, energy and renewables as well as autonomous systems and watercraft, ocean robotics, mechatronics, electromechanics, dynamics and control. The fields of research include but are not limited to analog and digital signal processing; feedback control and dynamical system theory; process modeling and simulation; system identification; reliability, time and data series analysis.

7-19: Modelling and Design Advances of Rotating Structures

This symposium aims at disseminating the last advances in the design and modelling of rotating structures utilized in various engineering applications such as helicopter rotor-blades, wind blades and turbomachinery. The symposium will cover as many topics as possible related to theoretical, numerical, and experimental activities performed by international researchers from academia and industry on the following areas of interest: numerical and analytical models for mechanical analyses of rotors, optimization strategies, aeroelastic and multifield analyses, damage, fatigue and failure modelling techniques, use of innovative materials, healthmonitoring procedures, active and passive techniques to reduce vibrations and noise emissions.

7-20: Congress-Wide Symposium on NDE &SHM: Dynamics, Vibration, and Control for Structural Health Monitoring Applications

Structural Health Monitoring (SHM) plays a significant role in design, manufacturing, and service of dynamic and control systems. With monitored parameters from such systems and observations from external load, NDE and SHM techniques can aid in detecting faults and predicting performance degradation of the system until it loses partial or total functionality. Congress-wide Symposium on NDE & SHM, 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.

This particular topic of the symposium seeks research and application studies to detect and characterize faults in control systems using NDE and SHM methods. Topics of interest include numerical analysis (i.e. Finite element, boundary element, peri-dynamics, surrogate modelling), data-driven methods (machine learning, artificial intelligence) uncertainty quantification, physics of failure and predictive modeling, digital twin as well as hardware-in-the-loop simulations supporting NDE and SHM methodologies. Applications may include, but not limited to, smart control technology using machine learning, fault-tolerant and fault-adaptive control systems, active vibration control using NDE, Integrated SHM in guidance and control technology, etc. The topic also encourages novel technical approaches to provide control input adjustments for slowing or reversing fault progression using NDE diagnostic and prognostic information.

7-21: Congress-Wide Symposium on Advanced Research in Marine and Aerospace Lifting Surfaces

Lifting surface design and performance affect the safety, economy, and controllability of myriad systems designed for operation in air and water – including wings, hydrofoils, propellers, turbines, control surfaces, and more. This Congress-Wide Symposium will cover advanced topics in the design, analysis, and control of lifting surfaces in marine and aerospace fields. The topics are multi-disciplinary, inviting participation by researchers in fluid dynamics, structural dynamics, design, control, and other disciplines. The objective is a comprehensive overview of how simulation, experiment, and new analysis techniques are being applied to the design and operation of hydrofoils, aircraft structures, and control surfaces in diverse and complex flow conditions. Topics include but not limited to 1) Aero- and hydro-acoustics of flow around lifting surface, 2) Fluid-Structure Interactions (Aeroelasticity, Hydroelasticity), 3) Multi-phase flows, 4) Advances in experimental methodologies, 5) Advances in simulation (FSI, multi-phase flows, transonic flow), 6) Multi-disciplinary optimization of lifting surfaces, and 7) Innovative airfoil and hydrofoil design.

7-22: Industrial Applications in Dynamics, Vibrations and Control

This Symposium is intended to provide an opportunity for communicating recent advancements in the area of dynamic, vibrations, flow-induced vibrations and fluid-structure interaction, and control focusing on industrial applications and applied R&D. Papers and Presentations Only addressing these type of problems from the energy, aerospace, marine, automotive or other industries are of interest and are encouraged to contribute to the symposium.

Track 8: Energy

Description: Papers of high technical quality related to the field of Energy are sought for the ASME International Mechanical Engineering Congress & Exposition (IMECE) Conference to be held in November, 2022. In addition to high value technical presentations spanning 20+ tracks and more than 240 topics in Mechanical Engineering, the IMECE program features:

• An opening keynote from one of the leading innovators in the field
• Daily conference-wide plenary sessions featuring technological pioneers
• Daily invited industry presentations
• Access to today's leading engineers, educators, entrepreneurs and innovators highlighted during the awards programs

All submissions relating to the Energy field are accepted for review by experts in the field, and papers are to be submitted into one of the following technical topics listed below. Selected papers will be invited for potential co-publication in special editions of the Journal of Energy Resources and Technology; or the Journal of Electrochemical Energy Conversion and Storage. Many of the topics are co-sponsored by multiple divisions and tracks. The Renewable Energy topic will be co-sponsored by the Heat Transfer Division, and the 2 topics with CMS at the start of the title are part of the Combustion Mini-Symposium.

8-1: Electrochemical Energy Storage and Conversion System

Electrochemical systems are increasingly important in current mobile society. Researchers are encouraged to contribute papers addressing the science, design, performance and application of various energy storage systems such as lithium-ion batteries, fuel cells, capacitors, flow batteries, Na/Zinc batteries and solid-state batteries. Contributions are encouraged in areas including, but not limited to:

• Li-ion and Beyond Li-ion Batteries
• Li-air and Metal Air Batteries
• Advanced Characterization Technology for Electrochemical Systems

8-2: Advanced Modeling of Electrochemical Materials

Advanced modeling methods, including multiscale modeling, multiphysics modeling, AI-assisted modeling, etc., are essential tools for the mechanism exploring and parametric studies, especially when applied to the electrochemical materials containing many physics fields and complex multi-component structures. This symposium provides a forum for discussing the novel developing and application of advanced modeling works about electrochemical materials. Abstracts or technical presentation are solicited in the areas including but not limited to:

• Modeling method developing in modeling of electrochemical materials.
• DFT/MD modeling of fundamental mechanism in electrochemical materials
• FEM modeling of structural design/behavior prediction of electrochemical materials
• Multiscale modeling of electrochemical materials
• Multiphysics modeling of electrochemical materials
• Machine learning assisted modeling of electrochemical materials

8-3: Energy-Related Multidisciplinary

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 the track Energy. The topic welcomes also works dealing with subjects such as the mitigation of the climate change, the energy demand management and other subjects, which typically require interdisciplinary and cross-sectorial approaches.

8-4: Fundamentals and Applications of Thermodynamics

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
• Carbon capture and storage

8-5: 4E Analysis and Optimization of Energy Systems

The purpose of this topic is to provide a forum for information on innovation, research, development and demonstration on thermodynamic energy systems. Papers, extended abstracts and technical presentations are solicited in areas including but not limited to:
• Thermoeconomic/exergoeconomic analysis: theory and application
• Energy, Exergy, Economic and Environmental analysis
• Thermoeconomic diagnosis
• LCCA in Thermodynamic systems
• Single/Multi objective Optimization of Thermodynamic Systems
• Thermoeconomic/exergoeconomic approach to the environmental analysis
• Exploitation of thermal energy from industrial processes for heating/cooling and power production

8-6: Design and Analysis of Energy Conversion Systems

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

8-7: Energy Systems Components

The purpose of this topic is to provide a forum for information on innovation, research, development and analysis on the realization and feasibility of all energy components to improve the efficiency of the correlated energy systems. Papers, extended abstracts and technical presentations are solicited in areas including but not limited to:

• volumetric and turbomachinery thermodynamics
• components structural and mechanical analysis
• components fluid-dynamic analysis
• components design procedure and performance/evaluation test
• components diagnosis & prognosis
• environmental impact analysis
• exploitation of fields of applications

8-8: Design and Analysis of Energy Recovery Systems

The purpose of this topic is to provide a forum for information about innovation, research, development and demonstration on low-medium temperature energy recovery 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 the environment.

Papers, extended abstracts and technical presentations are solicited in areas including but not limited to:
• Low-medium temperature waste heat recovery

• Refrigeration applications
• Electricity generation from low temperature heat

8-9: Thermal Energy Storage

This topic aims 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, both experimental and computational, are solicited in the following areas:

• Novel concepts for thermal energy storage
• New and advanced thermal energy storage materials (sensible, latent and thermochemical materials)
• Thermal energy storage devices (modules, components, units)
• Thermo-mechanical energy storage (CAES, liquid air energy storage, pumped thermal energy storage, etc.)
• Cold thermal energy storage for low-temperature applications
• Whole system integration, optimisation and techno-economic analysis of thermal energy storage
• Thermal energy storage for concentrated solar power plants

8-10: Nuclear Energy: Plants, Design, Analysis and Safety

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 energy. Papers related to Nuclear Engineering Technology and Radiation Sciences are sought. Topical sessions 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, Portable & Micro Reactors
• Research & Test Reactors: Research Reactor Fuel Cycles, LEU Fuels, Fuel Development and Qualification, Fuel Fabrication Technology, Fuel Testing and Characterization, Reactor Conversions, HEU Removal and Operations, International Conversion Programs

Interested authors are invited to submit their abstracts via the web tool at the IMECE2022 website.

8-11: CMS-General Combustion and Fire

Authors are invited to submit papers in the general areas of combustion, fire, and reacting flow, both applied and fundamental. Topics of interest include, but are not limited to: burner design, emission control, simulation and modeling, diagnostics and experiments, power generation, ignition and extinction, biomass and waste gasifica-

tion, biofuels production and conversion, flame stabilization, flame dynamics and structures, MILD combustion, oxy-fuel combustion, chemical looping and Fire Behavior and Sensing.

8-12: CMS-Novel Combustion Technologies

Authors are invited to submit papers in novel areas of combustion and reacting flow, both applied and fundamental. Topics of interest include, but are not limited to: micro-combustion, plasma-assisted combustion, hypersonic combustion, carbon-free fuel combustion. Experimental, computational, and theoretical work is welcome, and work on systems from lab, to pilot, to full scale is of great interest.

8-13: Outstanding Early-Career Investigators in Energy Conversion and Storage Systems

This topic will feature invited talks from outstanding early-career investigators in the broad area of energy conversion and storage systems. The invited speakers will have demonstrated their excellent research accomplishments and capabilities and potential for high impact in the field during their independent research career (typically within 12 years of their Ph.D. degrees).

8-14: Solar Energy

The solar energy topic aims to provides insights into innovation, research, development and demonstrating of solar energy technologies, including photovoltaics and concentrating solar power. This track welcomes technical papers and technical presentations related to solar energy in areas including but not limited to:
- Solar photovoltaics, Including different kinds of solar cells (such as thin film solar cell, perovskite solar cell, heterojunction solar cell, solar modules), their performance, stability and standards.
- Concentrating solar power
- Thermal energy storage for solar thermal systems
- Solar process heat
- Solar fuels and chemicals
- Solar hybrid systems
- Integration of solar energy systems into the electrical grid

8-15: Wind and Water power

The wind and water power technologies topic area aims to provide insights into innovation, research, development, and demonstration of these renewable energy systems. The main focus of this topic will be on recent advances in the design, modeling, and control for wind and water power technologies. This track welcomes technical papers and technical presentations related to wind and water power technologies in areas including but not limited to:
• Land based wind,
• Offshore wind,
• Airborne wind,
• Marine wave energy converters (WECs),
• Marine tidal and current energy converters (TECs & CECs),
• Marine hybrid systems (Wind+Wave) & floating solar,
• Low-impact hydropower,
• Hydropower contributions to grid reliability and resilience.

8-16: Emerging Renewable Energy Technologies

The emerging renewable energy technologies topic covers geothermal, biomass, green fuel and other renewable energy.

Geothermal energy track aims to provide an interdisciplinary platform to exchange information on geothermal systems involving exploration, development and use of geothermal resources. The submission will concern all areas of geothermal energy use, from very shallow geothermal systems to deep drilling and high-temperature fields. Case studies, experimental, numerical, and computational analyses on reservoir response to production and scaling characteristics of Enhanced Geothermal Systems (EGS) and low temperature systems; field manage-

ment for exploitation and injection, exploration, drilling and wellbore flows, field infrastructure are particularly welcome.

The biomass/biofuels and green fuels track aims to provide insights into the fuel conversion, processing technologies and innovative energy systems, including biofuels/biomass and green fuels such as renewable natural gas and hydrogen, topics related to the integration of biomass/biofuels and green fuels system into sustainable energy systems are also welcome. This track welcomes contributions in all areas related to green fuel conversion and processing techniques, including but not limited to, thermochemical/biochemical conversion, biomass liquefaction and gasification, biofuel upgrading, biofuel/green fuel resources, green fuels/hydrogen production, storage, handling and distribution, and power-to-gas/gas-to-power. Experimental, thermo-economic analysis, computational modeling, numerical simulation, optimization, verification or validation, and integrated system analysis studies, are particularly welcome.

8-17: Sustainable and Grid-Interactive Buildings

The sustainable and grid-interactive efficient buildings topic aims to provide insights into innovation, research, development, and demonstration on energy systems for buildings. The main focus of this topic is energy systems, technologies, and control for sustainable and grid-interactive smart buildings. This track welcomes technical papers and technical presentations related to sustainable and grid-interactive buildings in areas including but not limited to:
• Energy system management and control for sustainable and grid-interactive buildings
• Cyber-Physical Systems (CPS) and Internet of Things (IoT)
• Heating, Venti lati on, Air Conditioning, and Refrigeration (HVAC&R) systems
• Distributed Energy Resources (DERs) for buildings
• Energy storage technology for buildings
• Renewable and alternative energy resources for buildings
• Commercial and residential buildings and their systems
• Zero energy and zero carbon buildings

Track 9: Engineering Education

Description: Authors and panelists are invited to participate in the Engineering Education Track at the 2022 ASME IMECE by submitting papers, organizing panels, and leading workshops in all aspects of mechanical engineering and mechanical engineering technology education at the undergraduate and graduate levels. Papers are sought in the following thematic topics:

Topics:

9-1: Curriculum Innovations, Pedagogy and Learning Methodologies

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, teachers and students preparation for a project approaches, service-learning approaches, hands-on projects and educational games and other learning methodologies

9-2: Globalization of Engineering and Study Abroad Education

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 and teaching Collaborations, Studying abroad, 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.

9-3: Engineering Accreditation, Curricular Reforms and Revisions, Assessment and ABET

This topic deals with assessment of student learning, accreditation process and related self-study aspects. Also, the topic focuses on curricular innovations and modifications to better prepare students for future careers, and where the future lies with continuous improvement in both undergraduate and graduate programs.

9-4: Sustainable, Ethical dimensions and Safety issues in Engineering Education

This topic covers, but is not limited to, the advances and engineering educational endeavors for the Sustainable Development Goals (SDG). Papers on integrative undergraduate and graduate education as well as women in engineering and minority groups are welcomed. 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, safety issues, 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.

9-5: Applied Mechanics, Dynamic Systems and Control Engineering

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.

9-6: Fluid Mechanics, Heat Transfer, and Energy Systems

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
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

9-7: Problem Solving in Engineering Education, Research and Practice

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

9-8: Distance/Online Engineering Education, Models and Enabling Technologies

This topic accepts papers and presentations in novel ways of online course developments. Papers dealing with new software for course and labs and teamwork for distance learning are welcomed. Impact on student attendance due to COVID-19 pandemic, difficulties/challenges and solutions/opportunities created could also be interesting topics of the papers

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

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.

9-10: Teaching Laboratories, Hands-on Experiences, Embedding Novel Manufacturing Concepts in ME Programs, and Technology-Aided Lecturing

This topic focuses on teaching laboratories, hands-on experiences, innovative teaching-aids and tools used in lecturing. It also includes topics such as machine shop experiences, and the use of additive manufacturing in research, laboratories, and capstone projects. Authors are welcomed to submit papers in the above examples and similar hands-on teaching methods.

9-11: Engineering Research Innovation and Research Experiences for Undergraduates

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

9-12: Competencies for Industry 4.0 and Learning Factories

This topic covers competencies for Industry 4.0 and the concept of learning factories as one of the instructional methods suitable to provide such aptitudes and skills. Authors are expected to share their learning factories experiences and field implementations. Learning factories have been used for research, education and training in a close partnership with companies and industrial practices. Authors are invited to submit papers related to the innovative experiences in designing, planning and/or using learning factories to their main purposes. Advantages/disadvantages, difficulties in their design, plan and/or use, technologies and/or methodologies used/studied, competences promoted and/or assessed, among others, could be the topics discussed in the papers.

9-13: Approaches and Methodologies for Applying for Public and Private Grants in Engineering Education

This topic focuses on the strategies and skills to apply for successful grants in engineering education. Submissions are sought on developing and acquiring expertise in finding and seeking grant funding from public and non-public sources targeting the engineering education of future engineers and scientists in the STEM fields. Developing the skills and methodologies to apply for undergraduate and graduate STEM research grants. This includes but not limited to grant budgeting, key elements of successful grant applications, interdisciplinary and multidisciplinary grants in the STEM fields and crafting concept or white papers.

9-14: Aeronautics and Space Applications in Engineering Education

This topic focuses on the education strategies of aerospace engineers and scientist in the fields of aeronautical and astronautical engineering. Submissions are sought on the education of future engineers and scientists on the design and manufacturing of aircraft, spacecraft, propulsion systems, satellites, and missiles, as well as the design and testing of atmospheric and space aircraft and related systems and equipment. The topic includes the teaching strategies for the future generation of aerospace engineers to gain skills in, and in-depth understanding of, materials and structures, aerodynamics, heat transfer, vehicle dynamics and control, propulsion technologies, and flight mechanics software. Moreover, it includes topics such as students gaining hands-on experiences with projects in aeronautical engineering and rocketry and opportunities to participate in various competitions.

9-15: Materials, Mechanics of Materials, and Structures, Experimental and Numerical Methods, and Advanced Materials in Engineering Education

This topic focuses on the education strategies of engineers and scientist in the fields: (i) Materials, subjects include atomic structure, metals, polymers, ceramics, composite materials, and semiconductors. (ii) Mechanics of materials, such as elasticity, plasticity, fracture, fatigue, and materials damage. (iii) Mechanics of structures such as structural dynamics, system vibration, fluid-structure interaction, shock and impacts, structural stability, and buckling. (iv) Experimental testing of materials and structure and numerical modelling, such as numerical methods, material behavior simulation, computational and multi-scale modelling, and experimental testing. (iv) Advanced materials such as nanostructures, adaptive and smart structures, advanced composite structures, bio-inspired structures, thick and thin shell structures, and lightweight structures.

9-16: Energy Efficiency, Renewable Energies, Sustainability and Climate Changes

This topic focuses on the education of future engineers and scientists about present-day primary energy sources, availability, sustainability and efficiency. It deals primarily with the future of traditional fossil fuel and the special

case of nuclear energy, the increasing use of renewable energies and related manufacturing industry and utilities, the techniques of energy conservation and transportation, and the effects of climate change in reshaping the energy production industry and policies.

Track 10:   Fluids Engineering

Description: Fluids Engineering Track is sponsored by the Fluids Engineering Division of the ASME. The Track focuses on topics related to fluids mechanics encompassing both fundamental and applied aspects. Areas of interest include but not limited to, fundamental perspectives in fluid mechanics, fluid applications and systems, computational fluid mechanics, fluid measurements and instrumentation, multiphase flows, flows in micro and nano systems, fluid mechanics in biological systems, etc. Papers are sought from researchers in academia, industry and government sectors.

Topics:

10-1: Electric, Magnetic and Thermal Phenomena in Micro and Nano-Scale Systems

This topic is to bring together researchers from academia, industry, and government to promote further development in this broad field. It 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

10-2: Fluid Mechanics and Rheology of Nonlinear Materials and Complex Fluids

This topic 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.

10-3: Fundamental Issues and Perspectives in Fluid Mechanics

This topic 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.

10-4: CFD Applications for Optimization and Controls

This topic is focused 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. It seeks recent contributions of both basic and applied research in these areas. Industrial applications related to these areas are also of particular interest.

10-5: Fluid Engineering in Micro- and Nanosystems

This topic provides a means of reporting the latest developments in the uses of fluids 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

10-6: Flow and Thermal Processes in Internal Multiphase Flows

To address the complex multiphase fluid flow and heat transfer problems posed by the process industry, engineers are increasingly utilizing CFD modeling, in addition to the widely used approach of applying empirical correlations. With the growing demand of numerical modeling inside heat exchangers, pipelines as well as for other internal flows, there is an increasing need for validating experiments, beyond single-point measurements. Fortunately, a number of experimental approaches such as particle image velocimetry (PIV), laser Doppler velocimetry (LDV), laser-induced fluorescence (LIF), flow visualization, tomography, and transient thermo reflectance (TTR) have evolved to produce reliable validation data that can provide holistic information about the flow and heat transfer phenomena. The goal of this forum is to bring together researchers and engineers involved in performing CFD simulations and/or experiments inside industrially relevant geometries. The forum will focus on • Experimental and/or numerical studies in heat exchangers, including process and micro heat exchangers • Experimental and/or numerical modeling of multi-phase flow inside process piping • Experiments and/or numerical modeling inside other process equipment, or internal flows in geometries relevant to the process industry.

10-7: Recent Developments in Multiphase Flow

This topic 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.

10-8: Multiphase Flow with Bio-applications

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 topic aims to create a multi-disciplinary platform to exchange new ideas and review recent progresses among researchers and engi-

neers 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.

10-9: Industrial Flows

This topic 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.

10-10: Wind Turbines Aerodynamics and Control

This topic is focused on 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.

10-11: Measurement and Modeling of Environmental Flows

Measurement and Modeling of Environmental Flows topic 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.

10-12: Fluid Measurements and Instrumentation

Fluid Measurements and Instrumentation topic 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.

10-13: Advanced Research in Marine and Aerospace Lifting Surfaces

Lifting surface design and performance affect the safety, economy, and controllability of myriad systems designed for operation in air and water – including wings, hydrofoils, propellers, turbines, control surfaces, and more. This Congress-Wide Symposium will cover advanced topics in the design, analysis, and control of lifting surfaces in marine and aerospace fields. The topics are multi-disciplinary, inviting participation by researchers in fluid dynamics, structural dynamics, design, control, and other disciplines. The objective is a comprehensive overview of how simulation, experiment, and new analysis techniques are being applied to the design and operation of hydrofoils, aircraft structures, and control surfaces in diverse and complex flow conditions. Topics include but not limited to 1) Aero- and hydro-acoustics of flow around lifting surface, 2) Fluid-Structure Interactions (Aeroelasticity, Hydroelasticity), 3)

Multi-phase flows, 4) Advances in experimental methodologies, 5) Advances in simulation (FSI, multi-phase flows, transonic flow), 6) Multi-disciplinary optimization of lifting surfaces, and 7) Innovative airfoil and hydrofoil design.

10-14: Young Engineers Paper (YEP) Contest

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 2022), and beginning graduate students (i.e. start of graduate studies after April 2022). 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 2022 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. Travel expenses up to $750 will be provided to the presenting author to help defray costs of attending IMECE 2022, if personal attendance is allowed at the conference for purposes of conducting in-person presentations. Otherwise, finalist presentations will be conducted in a virtual manner. All finalist papers will receive certificates acknowledging the First Place, Second Place, Third Place, and Honorable Mention award winners.

Track 11:   Heat Transfer and Thermal Engineering

Description: The Track contains a collection of Topics in the broad area of heat transfer, which are individually organized by leading researchers in the field. The Topics give a comprehensive coverage of the theory and application of heat transfer in equipment and thermodynamic processes in all fields of mechanical engineering and related technologies. Contributions in the form of abstracts for oral presentation are sought in the individual Topics. This track will bring together researchers from all over the world to share ideas and findings on all aspects of Heat Transfer. 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 Heat Transfer. Dissemination of knowledge by presenting research results, new developments, and novel concepts in Heat Transfer will serve as the foundation upon which the conference program of this area will be developed.

Topics:

11-1: Heat and Mass Transfer in Heating, Cooling, and Power Systems

Investigation of heat and mass transfer in heating, cooling, and power systems

11-2: Heat Transfer Engineering Leveraging Additive Manufacturing and Topology Optimization

Investigationof heat transfer in systems leveraging additive manufacturing and topology optimization

11-3: Heat Transfer in Batteries and Energy Storage Technologies

Investigation of heat transfer in batteries and energy storage systems

11-4: Nanoscale Measurements of Thermophysical Properties

Measurement of thermophysical properties of materials at the nanoscale

11-5: Techniques Development for Thermophysical Characterization

Exploration of techniques for characterization of thermophysical properties of materials

11-6: Thermophysical Properties of Micro/nanoscale Materials

Fundamental studies involving modeling and prediction of thermophysical properties of micro/nanoscale materials

11-7: Thermophysical Properties Modeling and Prediction

Fundamental studies involving modeling and prediction of thermophysical properties

11-8: Fundamentals of Phase-Change Including Micro/Nanoscale Effects-Boiling, Evaporation, Freezing and Condensation

Exploration of the fundamental aspects of phase-change including micro/nanoscale effects in boiling, evaporation, freezing and condensation

11-9: Fundamentals of Single Phase Convection

Investigation of fundamental aspects of single-phase convection

11-10: Fundamentals of Radiative Transport and Conduction Including Micro/Nanoscale Effects

Fundamental investigation of radiative transport and conduction including micro/nanoscale effects

11-11: Machine Learning in Nanoscale Thermal Transport

Investigation of machine learning applied to thermal transport at nanoscale

11-12: Thermal Transport in Low-Dimensional Materials

Exploration of thermal transport in low-dimensional materials

11-13: First-Principles Calculations in Thermal Transport in Solids

Investigation of thermal transport in solids using first principles

11-14: Molecular Dynamics Simulation of Thermal Transport in Nanostructures or Across Interface

Investigation involving molecular dynamics simulations of thermal transport in nanostructures or across interfaces

11-15: Ultra-Low and Ultra-High Thermal Conductivity Materials

Exploration of thermal transport in ultra-low and ultra-high thermal conductivity materials

11-16: Nanoscale Phase Change Heat Transfer

Exploration of nanoscale phase change heat transfer

11-17: Radiative Properties of Nanostructures

Investigation of radiatiave properties of nanosctructures

11-18: Nanoscale Radiative Thermal Devices/Systems

Investigation of nanoscale radiative thermal devices and systems

11-19: Tunable Nanoscale Heat Transfer

Exploration of tunable heat transfer in nanoscale systems

11-20: Single-phase Enhanced Heat Transfer Equipment

Fundamental studies involving single-phase enhanced heat transfer equipment

11-21: Multi-Scale Multi-Phase Heat Transfer Equipment

Investigation of multi-scale and multi-phase heat transfer equipment

11-22: Additive Manufacturing of Heat Transfer Equipment

Explorations of additive manufacturing of heat transfer equipment

11-23: Application of Advanced Materials and Coatings for Heat Transfer Equipment

Investigations of thermal transport in systems involving advanced materials and coatings in heat transfer equipment

11-24: High-Temperature Heat Transfer Equipment

Investigations of transportin high-temperature heat transfer equipment

11-25: Heat Transfer Equipment Nemesis: Frost, Fouling, Corrosion,condensate Build-up

11-26: CMS - Emissions Reduction Technologies and Decarbonization

Combustion Mini Symposium: Topics in combustion related to emissions reduction and decarbonization in combusiton systems

11-27: CMS - Industrial and Applied Combustion Systems

Combustion Mini Symposium: Topics in combustion related to industrial and applied combustion systems.

11-28: CMS - Fundamental Processes - Lamainar and Turbulent Reacting Flows

Combustion Mini Symposium: Topics in combustion related to laminar and turbulent combustion systems

11-29: Aerospace Heat Transfer

This topic covers all aspects of thermal transport in aerospace applications

11-30: Convective Boiling and Condensation

Fundamental aspects of convective boiling and condensation

11-31: Heat Pipes

Fundamental aspects of heat pipes

11-32: Heat Transfer in Particle-Laden Flows

Fundamental aspects of thermal transport in particle-laden flows

11-33: Gas Turbine Heat Transfer

Thermal transport in gas turbine systems

11-34: Transport Phenomena in Manufacturing and Materials Processing

Fundamental investigations of transport phenomena in manufacturing and materials processing

11-35: Processing of Frontier Materials

Exploration of thermal transport using frontier materials

11-36: Transport Phenomena in Additive Manufacturing

Thermal transport in additive manufacturing systems

11-37: Processing of Battery Materials

Thermal transport in processing of battery materials

11-38: Heat Transfer in Electronic Equipment

Investigations of heat transfer in electronic equipment

11-39: Heat Transfer under Extreme Conditions

Thermal transport in scenarios involving extreme conditions

11-40: Heat and Mass Transfer in Biomass Energy Utilization Systems

Investigation of heat and mass transfer in biomass energy utilization systems

11-41: Heat and Mass Transfer for Natural Disasters/Climate Change

Investigation of heat and mass transfer in natural disasters and climate change

11-42: Heat and Mass Transfer for Natural and Built Environments

Exploration of heat and mass transfer in natural and built environments

11-43: Bio/Nature-Inspired Heat and Mass Transfer

Exploration of heat and mass transfer in bio- and nature-inspired systems

11-44: Heat and Mass Transfer for Renewable Energy Conversion Processes

Investigation of heat and mass transfer in processes involving renewable energy conversion

11-45: Applications of Computational Heat Transfer

Investigation of applications in computational heat transfer

11-46: Methods and Algorithms in Computational Heat Transfer

Exploration and development of predictive methods and algorithms for computational heat transfer

11-47: Computational Methods for Materials Development and Manufacturing

Investigation of computational methods for materials development and manufacturing processes

11-48: Application of Machine Learning/Artificial Intelligence in Heat Transfer

Fundamental studies in application of machine learning and artificial intelligence in heat transfer systems

11-49: Application of Computational Heat Transfer for Indoor Environmental Quality

Studies related to application of computational heat transfer related to indoor environmental quality

11-50: Inverse Problems in Computational Heat Transfer

Investigation of inverse problems and methods in computational heat transfer

11-51: Application of Computational Heat Transfer for Energy Systems

Exploration of ocmputational heat transfer in applications involving energy systems

11-52: Computational Thermal/Fluids

Investigations involving computational methods in thermal and fluid systems

11-53: Visualization

Methods and results for visualizing heat and mass transfer

Mechanics of Solids, Structures and Fluids

Description: The Mechanics of Solids, Structures, and Fluids is sponsored by the Applied Mechancis Division of ASME. The Track focuses on topics related to solids, structures, and fluids mechanics encompassing both fundamental and applied aspects. Areas of interest include, but are not limited to, fundamental perspectives in mechanics, applications and systems, computational mechanics, measurements and instrumentation, micro and nano systems, mechanics in biological systems, soft matter, etc. Papers are sought from researchers in academia, industry and government sectors.

Topics:

12-1: Fracture and Failure of Reinforced Polymer Matrix Composite Materials

High-performance polymer matrix composites have been attracting tremendous research interests for decades owing to their extraordinary mechanical strength, thermal stability, and corrosion resistance, which leads to broad industrial applications in aerospace engineering, wind energy management, soft robotics, and high-end sports equipment. The design and improvement of composite materials and structures rely on both the fundamental understanding as well as the theoretical prediction of the failure events under their diverse service conditions. However, uncertainties of predictions can arise from both the heterogeneous nature of materials and the various loading conditions. Further prediction complexities associated with the manufacturing process, such as irregular geometries, the spatial distribution of the reinforcement phase, and the existence of material interfaces, can also be expected. Nevertheless, research efforts in the following aspects can address these challenges: Develop advanced testing and characterizing techniques to identify different failure modes in reinforced polymer composites, and their relationship with loading conditions; Develop sophisticated computational models, informed by the experiential observation, to capture different failure and fracture modes at the microscale; Integrate the modeling tool with uncertainty quantification, advanced machine learning algorithms (e.g., Gaussian process regression, artificial neural networks, Bayesian inference, et cetera.), and sensitivity analysis, to either identify the relative importance of different uncertain parameters or identify the optimal material microstructure. This symposium aims to highlight recent advancements in characterizing and modeling of different failure/fracture phenomena in different reinforced polymer matrix composites and the usage of uncertainty quantification, machine learning, and sensitivity analysis that may guide material design. Materials of interest may include but are not limited to particle-reinforced, short-fiber-reinforced, unidirectional composites, woven composites, et cetera.

12-2: Modeling of the Fracture, Failure and Fatigue in Solids

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 etc. Other than the desired material properties, the behavior of fracture, failure and fatigue of these advanced materials is essential to be understood 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 aerospace, automobile, construction, energy, healthcare and etc. The focus of the symposium will be aligned in the following areas: Computational methodology development on fracture and fatigue modeling. Machine learning on fracture and failure behavior prediction of the materials. 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. Numerical simulation and experimental validation of the material's fracture, failure and fatigue behavior in real applications. This symposium dedicates to understand the mechanism behind fracture, failure, and fatigue in advanced solid materials.

12-3: Mechanics and Design of Cellular Materials

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): 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. Multifunctional design of cellular materials with a combination of structural strength, blast protection, ballistic protection, and thermal management. Advanced technologies to manufacture cellular materials.

12-4: Multiscale Models and Experimental Techniques for Composite Materials and Structures

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.

12-5: Data-Enabled Predictive Modeling, Scientific Machine Learning, and Uncertainty Quantification in Computational Mechanics

Recent advances in computational and computer science have resulted in the ability to perform large-scale simulations and collect massive amounts of data obtained from measurements or high-fidelity simulations of complex physical systems. Harnessing such large and heterogeneous observational data through the scientific machine learning methods has enabled the scientific community to push forward the prediction capabilities of traditional computational models. However, the development of predictive models of complex physical systems is challenging due to uncertainties in the experimental measurements, model parameters, selection of reliable models, and coping with model inadequacy. This symposium aims to bring together researchers in the emerging area of data-enabled predictive modeling of physical systems. The symposium solicits abstracts on novel methods that enables utilizing data in innovative ways to dramatically improve traditional computational and theoretical tools with applications across science, engineering, and medicine. The topics of interest include but are not limited to scientific machine learning, data science, model validation, uncertainty quantification, real-time assimilation of data, reduced-order modeling, optimal design of experiments, Bayesian inference, as well as design control, and decision making under uncertainty.

12-6: Data-Driven Modeling and Simulation for Computational Biomedicine

The rapid development of computational power has led to significant advances in statistical and machine learning techniques in the past few decades. On the other hand, the plummeting costs of sensors, computational power, and data storage technologies have equipped us with the capability of generating and collecting vast quantities of data. All these developments afford us new opportunities for data-driven discovery in broad engineering applica-

tions such as computational biomedicine. In this mini-symposium, we solicit contributions that describe advances in data-driven modeling and simulation for computational biomedicine. Novel modeling methods development across all scales are solicited. This mini-symposium would also highlight interdisciplinary efforts of basic and clinical scientists, biophysicists, engineers, and mathematicians that jointly address the most critical challenges and trends in computational biomedicine, including neuron material transport, soft tissue growth, cardiovascular systems, and implantable devices.

12-7: Mechanics of Soft Materials

This topic covers the characterization, prediction, modeling, and application of mechanics in soft materials. This topic seeks abstracts for individual sessions in:
• Active Materials
• Functional Soft Composites
• 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.

12-8: Peridynamic Modeling of Materials' Behavior

The peridynamic formulation of continuum mechanics allows for natural treatment of problems with discontinuities, such as fracture, damage, disintegration, dissolution. Nonlocality permits unrestricted evolution of discontinuities and a simplified representation of complex material microstructure and behavior that is able to predict, for example, dynamic fracture in brittle materials, fatigue failure, impact damage and penetration, failure in fiber-reinforced composites, rupture in soft materials, stress-corrosion cracking, etc. New theoretical and computational developments in these areas are continuing to develop fast, and the number of journal papers published each year is on an exponential growth trajectory. This symposium will bring together researchers from around the globe who want to share their latest advances on peridynamic modeling of materials' behavior. The focus areas will be:
1.   Analytical solutions for peridynamic models (static/dynamic, mechanical/transport, multiphysics).
2.   Peridynamic simulations for fracture and failure of materials (concrete, 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).
4.   Local-nonlocal coupling.
5.   Multiscale problems: from MD, to micromechanics, to macro-mechanics.
6.   Fast solvers for peridynamic models: meshfree, pseudo-spectral, parallelization, coupling to FEM.
7.   Multiphysics problems: disintegration/dissolution, corrosion, thermomechanical.
8.   Behavior at material interfaces: fracture, mixing, dissolution.

12-9: Multiphyics Simulations and Experiments for Solids

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, multiscale simulations, machine learning approaches) 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.

12-10: Multi-scale and Multi-physics Computations in Fluids and Solids

The symposium will address some of the emerging themes in the computational appliedmechanics. 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. Some of the key developments in this ongoing process are the multi-scale, multi-physics, and parallel computations. The contributions will include atomistic/continuum computations, peridynamics, fast multipole method (FMM), acoustic and optical metamaterials, fluid-structure interactions, multi-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. Crossdisciplinary contributions are particularly welcome.

12-11: Perspective on Fracture and Failure Mechanics

This symposium will feature a number of invited talks from Early-, Mid- and Distinguished-career level researchers and scientists related to fracture and failure of materials and structures. 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. The fracture and failure processes are guided by the spatial and temporal evolutions of defects and damage in the material and the structure. It is commonly accepted that Leonardo da Vinci provided first insight into 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. However, 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.

12-12: Mechanics of Solids, Structures and Fluids

Mechanical metamaterials are intelligently designed material systems with exotic properties rarely found in nature. The exciting features 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. This symposium aims 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 unusual mechanical properties

• Analytical, numerical, and experimental studies on the behaviors of architected structures, lattice materials, foams, granular structures, origami, kirigami, tessellations, tensegrities, and minimal surfaces

• Design and application of reconfigurability, tunability, multi-stability, symmetry breaking, and other interesting functional properties of mechanical metamaterials

• Responses to impact loads, strain energy transformation, super damping 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.

12-13: Modeling and Experiments in Nanomechanics and Nanomaterials

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.

12-14: CONCAM Distinguished Lectures on Computational Mechanics

This symposium is by invitation only. The CONCAM Distinguished Lectures on Computational Mechanics will feature three researchers (early-career, mid-career and senior) that have made novel and significant contributions to Computational Mechanics.

12-15: Dynamic Failure of Materials & Structures

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.

12-16: Drucker Medal Symposium

This is a symposium held in honor of the 2022 Drucker Medalist.

12-17: Computational Methods in Heterogeneous Porous Media

Mechanics of heterogeneous porous media play an essential role in many engineering and scientific disciplines including materials science, biosciences, geosciences, etc. Due to unique properties of porous materials such as low resistivity, low thermal conductivity, low density, etc. heterogeneous porous materials are found in many natural and engineering applications, where their functionality is controlled and/or affected by the movement of fluids, solutes, particles, electrical charges, and heat through their porous network. Understanding physical, chemical, thermal, and biological processes such as fluid flow, diffusion, dissolution, degradation, shrinkage, fracturing, electrical charges, etc. are essential in designing and maintaining such porous systems. This minisymposium invites scientific and engineering contributions to the field of porous media by improving or developing computational methods, including but not limited to:
• modeling thermo-hydro-mechanical-chemical processes, • poro-mechanical coupling schemes, • fluid-solid interaction in porous media, • multi-scale modeling methods, • homogenization techniques, and • data-driven modeling and machine learning methods in heterogeneous porous media.

12-18: Functional Origami and Kirigami-inspired Structures and Metamaterials

The principles of origami (folding thin sheets), and kirigami (cutting and folding) can create advanced functional systems at multiple scales. The concepts allow for 3D self-assembly, deployment-stowing capabilities, shape morphing, property tuning, and adaptation for multiple functions. This mini-symposium aims to bring together researchers working in the areas of origami/kirigami structures and metamaterials, and to emphasize how 3D folding can enable advanced functionalities. Topics of interest include: mechanics of origami/kirigami; 2D fabrication for 3D self-assembly; active materials; actuation principles; bi-stable and multi-stable systems; programmable

mechanical behaviors; tunable multi-physical properties; origami/kirigami-inspired metamaterials; robotic and functional applications; and others.

12-19: Emerging Topology and Shape Optimization Techniques in Computational Design of Materials and Structures

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

Track 13: Micro- and Nano-Systems Engineering and Packaging

Description: Microelectromechanical Systems - is organized by the Microelectromechanical Systems Division (MEMSD) of the ASME. The Track contains a collection of Topics in the broad area of micro and nano systems, which are individually organized by leading researchers in the field. The Topics give a comprehensive coverage of experimental, computational, and analytical approaches employed to study various phenomena occurring in micro and nano systems. Contributions in the form of abstracts for oral presentation are sought in the individual 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 Micro- and Nano-Systems Engineering and Packaging. Dissemination of knowledge by presenting research results, new developments, and novel concepts in Micro- and Nano-Systems Engineering and Packaging will serve as the foundation upon which the conference program of this area will be developed.

Topics:

13-1: General Topics of MEMS/NEMS

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 2022 ASME IMECE, Track 13 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.

13-2: Design and Fabrication, Analysis, Processes, and Technology for Micro and Nano Devices and Systems

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

13-3: Computational Studies on MEMS and Nanostructures

This topic 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.

13-4: Applications of Micro and Nano Systems in Medicine and Biology

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
• Lab-on-a-chip, 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

13-5: Micro and Nano Devices

Micro and Nano Devices and Systems (MEMS and NEMS) include miniature devices that combine electrical, mechanical, optical, chemical, and/or biological components, fabricated via micro- and nanofabrication 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, covering applied science, engineering, and medicine. New research, insights, and applications in this field will shape the basis for the creation of innovative devices and systems, which can significantly impact a wide spectrum of areas such as computing, information technology, data science, medicine and healthcare, energy, transportation, manufacturing, and national security.

Specific areas of interest in this topic include, but are not limited to:
- Design, fabrication, integration, and applications of micro/nano devices and systems.
- Micro- and nanofluidic devices with integrated sensing and/or actuation capabilities.
- Novel micro- and nanofabrication methods and their applications in innovative device designs.
- Micro and nano devices that are based on new materials or material systems such as polymers, composites, and nanomaterials.
- Theoretical and modeling analysis, as well as experimental characterization and validation, of micro/nano structures, sensors, and systems.
- Control and dynamics of micro/nano sensors and devices.
- Physical, chemical, biological, and biomedical micro/nano sensors and actuators.

13-6: Applied Mechanics and Materials in Micro- and Nano-Systems

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

13-7: Packaging Technology in Heterogeneous Integration Applications

Research work related to the state-of-the-art hybridization capabilities to enable prototyping of high performance electronic, optoelectronic and MEMS microsystems for national security applications. Intimate integration of dissimilar materials enables the use of optimized photonic devices, optical elements, MEMS sensors/actuators, and

electronic circuitry, while improving overall component size, weight, and performance, compared to conventional packaging approaches will be covered in this topic. The topic is multidisciplinary in nature.

13-8: PowerMEMS

This topic will cover the latest results in the general fields of miniaturized devices and systems for power generation and energy conversion in micro and nano scales. PowerMEMS will also accept wide range of topics, from basic principles, materials and fabrication ending on applications and markets in all energy domains including, but not limited to: electrical, mechanical, chemical, thermal, magnetic, electrostatic, ferroelectric, optical, nuclear, and fluidic.

13-9: Advanced Manufacturing of Microsystems, Microstructures, and Miniaturized Actuators

This session aims to explore the interdisciplinary research on novel techniques for fabrication of microstructures and microsystems that leverage the most recent advancement in manufacturing technologies. The scope includes integration of multiple fabrication technologies such as 3D printing, laser ablation, solution casting, thermoplastic forming, soft lithography, and photolithography for fabrication of micropatterns, microsystems and miniaturized actuators. Other examples include microfabrication on 3D devices for engineering their surface properties, and development of robots integrated with miniaturized actuators/sensors. Another topic of interest is exploring applications of the field of machine learning in design and fabrication of microsystems and microstructures.

13-10: Microfluidics 2022

The Micro/Nanofluidics 2022 forum provides a means of reporting the latest developments in the uses of fluid for micro-and nano-devices in mechanical, chemical, biological and other advanced 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

13-11: Inertial Navigation: MEMS/NEMS to Bio-Inspired

The topic focuses on advancements of novel inertial sensors, systems, packaging, 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, packaging 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, systems, and packaging.

The aim of this topic 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, magneto-reception, 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 and packaging
• 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 for precision guided munitions and missiles
• Innovative testing and characterization of inertial sensors/systems and packaging
• 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

Track 14:   Safety Engineering, Risk and Reliability Analysis

Description: The Track contains a collection of Topics in the broad area of safety engineering and risk analysis, which are individually organized by leaders in the field. The topics give a comprehensive coverage of experimental, computational, and analytical approaches to the safety question. Safety Engineering, Risk, and Reliability Analysis- is organized by the Safety Engineering, Risk, and Reliability Analysis Division (SERAD) of the ASME.

Topics:

14-1: General Topics on Risk, Safety, and Reliability

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. To promote cross-fertilization and facilitate the development of this field, we welcome papers mainly related, but 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; and, Reliability-based Design and Design for Resiliency.

14-2: Reliability and Risk in Energy Systems

In the current global debate on tackling climate change being able to risk-inform key energy decisions for both developed and under development countries is paramount. Probabilistic risk assessment, along with appropriate mathematical modeling, is one approach to provide a fundamental understanding of both the vulnerabilities and opportunities for better performance found in complex energy systems, such as nuclear, renewables, hydro, or natural gas. Still, developing analytical and computational techniques to assess the failure behavior of these complex energy systems and energy infrastructures has always been a challenge. The main objective of this topic is to understand the failure behavior of any such complex energy system by defining the hazards and quantifying their

reliability, risk, and resilience. By resilience, we understand the capacity of the system to recover from failures. To promote cross-fertilization and facilitate the development of this field, we welcome papers mainly related, but not limited to: Nuclear power systems; Oil and gas systems; Renewable energy systems; Early warning signal systems; System recovery modeling; Complex network modeling; Cascading failures analysis; Network design optimization; Life cycle assessments; and, Impact of energy and environmental risk on policy and economics.

14-3: Reliability and Safety in Industrial Automation Systems

Analysis of reliability and risk has become an essential but challenging task in the planning, construction, and operation of networked industrial automation 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 topic aims to cover the most recent theoretical and experimental studies for performing reliability and risk analysis in complex industrial automation systems. This topic is focused on the modeling, assessment, and management of reliability and risk in industrial automation systems. To promote cross-fertilization and facilitate the development of this field, we welcome papers mainly related, but not limited to: Safety in Industry 4.0; Safety analysis of networked industrial Cyber-physical Systems; Safety evaluation with digital tweens; Safety for smart manufacturing and industrial robotic systems; Failure Detection, Isolation, and Recovery; and, Scheduling and Planning.

14-4: Reliability and Safety in Transportation Systems

Safety is an essential requirement in transportation systems. The increasing usage of automation and connectivity shows great promise in increasing their safety. Autonomous and connected transportation systems (e.g., road and off-road vehicles, maritime surface ships, trains, space systems, aircraft, UAVs, and mobile robots, etc.) are going to play the leading role in the future of smart infrastructure by providing safer, more cost-effective, and secure transportation of people and goods. The biggest challenge is to achieve the fail-safe implementation of such systems. Application-specific precise approaches for these systems have to be developed and validated. We welcome papers mainly related, but not limited to: Reliability and safety analysis of autonomous transportation systems; Fault-tolerant design of transportation system; Standardization of automated and autonomous transportation systems; Practical reports of risk and safety evaluation of transportation systems.

14-5: Models and Methods for Probabilistic Risk Analysis

Probabilistic Risk Assessment (PRA) is a mandatory procedure for safety-critical domains. PRA exploits methods for evaluating the dependability and resilience properties of technical systems. These methods usually include classical Event trees, Fault trees, Bayesian networks, Markov chains, and their numerous extensions and combinations. The authors are invited to submit papers about new numerical methods as well as efficient extensions and combinations of the methods and mathematical models that stay behind these methods. To promote cross-fertilization and facilitate the development of this field, we welcome papers mainly related, but not limited to, reliability block diagrams, static and dynamic fault trees, event trees, binary decision diagrams, Bayesian networks, Markov chains, stochastic Petri nets, formal methods, probabilistic model checking as well as probabilistic-centric engineering analysis of complex technological systems and how factor of safety and probabilistic methods can be, or should be, reconciled in efficacy of protection, assessment of hazard intensity during protective system operations including operational risk management, and advances in/applications of stochastic process analysis of hazard intensity.

14-6: Machine Learning for Safety, Reliability, and Maintenance

Today, Machine Learning (ML) and Deep Learning (DL) enhance almost every industrial sector, including safety-critical areas. ML and DL techniques are used to detect and mitigate errors during the system operation. ML and DL are used to predict and determine when the system's maintenance will be indispensable to reduce or prevent the chance of future failures, and therefore increase its availability. ML and DL-based risk and safety analysis can help to ensure that component fault will not lead to a hazardous system failure. Also, DL-based components will soon become parts of safety-critical systems. The next generation of safety standards has to define appropriate verifica-

tion and validation techniques and propose adequate fault tolerance mechanisms. To promote cross-fertilization and facilitate the development of this field, we welcome papers mainly related, but not limited to: Application of ML and DL-base methods for anomaly and error detection and mitigation, predictive maintenance, and reliability and safety evaluation; Safety and risk analysis of DL components; Evaluation of the resilience of DL components; Research on fault-tolerant architectures of DL components; Safety standardization and practical application of DL components in safety-critical industrial domains.

14-7: Big Data and IoT Applications in Reliability, Maintenance, and Security

With the recent advent of cheap edge-computing, increased last-mile connectivity (5G), and a revolution in the use of machine learning techniques, a new horizon emerges in applications for real-time, distributed, large scale monitoring of complex systems. This topic covers basic research and applications on the use of cyber-physical systems for enhanced reliability and maintenance. To promote cross-fertilization and facilitate the development of this field, we welcome papers mainly related, but not limited to: Sensor placement and optimization; Sensor fusion; Remote health monitoring; Sensors and structural health monitoring; correlation analysis and statistical data processing; Anomaly detection; Reconfigurable/self-healing systems; Predictive maintenance; Security of networked CPS.

14-8: Crashworthiness, Occupant Protection, and Biomechanics

This topic covers research and development in the areas of vehicle crashworthiness, occupants protection, and biomechanics. Vehicle crashworthiness focuses on components, systems, and full vehicle structures design and development for crash energy management, light weighting, and vehicle systems safety i.e. high voltage battery, fuel tank, etc. Occupants protection comprises the safety of self and partner vehicles occupants in all crash modes as well as road users i.e. pedestrians. Occupants injuries and human body modeling are also covered in this topic.

14-9: Congress-Wide Symposium on Prognostic and Health Management: NDE and prognostics of structures and systems

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. To promote cross-fertilization and facilitate the development of this field, we welcome papers mainly related, but not limited to: Nondestructive evaluation technologies in PHM; Structural Health Monitoring (SHM) techniques for design, manufacturing, and service; 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; Use of sensors and devices in PHM; and New methods and technologies in PHM.

14-10: Users, Technology, and Human Reliability in Safety Engineering

All technological systems are a nexus of human, technological, and environmental actors. This topic invites research that focuses on the interaction between technology and its community of human users, as well as the natural world, relative to safe design and reliability considerations. In this context, safety engineering approaches serve to identify and understand environments and usage patterns (in the primary as well as secondary markets) that may lead to product or system failures if they are not incorporated into initial design parameters. Such failures may result in harms to human users, the environment, the technology, or all of the above. Some usage patterns may be legacies from older technologies, while others may arise from user domestication of new ones. Specific user and environmental vulnerabilities may also be examined. This topic also covers the human reliability analysis, safety engineering of the systems with human-in-the-loop, and social and ethical aspects of safety engineering.

14-11: Student Safety Innovation Challenge

Annually, SERAD hosts a challenge to undergraduate and graduate students to submit papers on Safety Engineering, Risk, and Reliability Analysis topics. The papers are peer reviewed by experts in these areas. The top two

winning papers in each the undergraduate and graduate groups will be presented in a special SERAD session and honored at a SERAD awards banquet during the conference. Recognitions also include cash honorariums for first place winning authors, and reimbursement with a limit for conference related expense (travel, registration) for all students presenting paper at the special session.

14-14: Developments in Design Theory for Component and System Safety and Reliability

This topic captures research into new methods of design analysis and verification test methods for components and systems that can be used to identify, assess, and validate critical parameters and safe performance limits. This information, when integrated with a user/environmental analysis, are the basis of safe design.