CONTENT

WELCOME TO ICMAMS 2019

On behalf of the conference committee, we warmly welcome you to the 2nd International Conference on Mechanics of Advanced Materials and Structures (ICMAMS 2019). After the successful 1st ICMAMS conference in Turin, Italy, we now hold the 2nd ICMAMS on the quiet and beautiful campus of Nanjing University of Aeronautics and Astronautics (NUAA), China. The conference has attracted over 280 scientists and engineers, with passion and reputation, from domestic and abroad to participate, and aimed to promote the dissemination of significant developments dealing with the mechanics of advanced materials and structures.

In the next few days, ICMAMS 2019 will serve as a platform for exchanging ideas, fostering friendships and strengthening or extending collaborations for scientists and engineers from academia, research laboratories, and industry from all over the world by bringing them to one place where they can present their achievements and conduct discussions on various topics.

We are highly grateful to all the organizers for their efforts and the participants for sharing their ideas and insights. We also acknowledge greatly the support from State Key Laboratory of Mechanics and Control of Mechanical Structures and College of Aerospace Engineering, NUAA.

We sincerely hope for a successful conference!

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Weiqiu Chen, Zhejiang University, China

Erasmo Carrera, Politecnico di Torino, Italy

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Technical Program

Plenary Lectures (in Alphabetical Order by Last Name)

1. **Erasmo Carrera, Department of Mechanical and Aerospace Engineering, Politecnico di Torino, Italy**
   The Node Dependent Kinematics to Mix Finite Element and Theory of Structure Approximations
2. **Bruno Castanié, Institut Clément Ader (ICA), Université de Toulouse, CNRS UMR 5312 - INSA – ISAE Supaero - IMT Mines d'Albi - UPS, France**
   Virtual Twins of Aeronautic Composite Structures: Innovative Design Methodology, Virtual Manufacturing and Virtual Testing
3. **Maeng Hyo Cho, School of Mechanical & Aerospace Engineering, Seoul National University, Korea**
   Multiscale Simulations of Thermo-Mechanical Behavior of Polymer Nanocomposites: MD, CG MD and FE Homogenization Integrated
4. **Wanlin Guo, College of Aerospace Engineering, Nanjing University of Aeronautics and Astronautics, China**
   Mechanics of Intelligent Nano Materials and Devices
5. **Yonggang Huang, Departments of Civil and Environmental Engineering, Mechanical Engineering, and Materials Science and Engineering, Northwestern University, USA**
   Mechanics-guided Deterministic 3D Assembly
6. **Jiangyu Li, Shenzhen Institutes of Advanced Technology, Chinese Academy of Science, China.**
   Dynamic Strain based Piezoresponse Force Microscopy for Advanced Functional Materials: When Mechanics Meets "Big" Data
7. **C. W. Lim, Department of Architecture and Civil Engineering, City University of Hong Kong, China**
   Seismic Metamaterials with Low Frequency Wide Bandgaps Using Steel Barriers
8. **J. N. Reddy, Department of Mechanical Engineering, Texas A&M University, USA**
   On Nonlocal Stress and Strain Gradient Theories with Material and Structural Length Scales
9. **Arun R. Srinivasa, Department of Mechanical Engineering, Texas A&M University, USA**
   GraFEA-a Discrete, Nonlocal Approach to Simulate Damage and Fracture
10. **Yueguang Wei, College of Engineering, Peking University, China**
    Trans-scale Mechanics of Advanced Materials
11. **Tong-Yi Zhang, Materials Genome Institute, Shanghai University, China**
    Mechnoinformatics and Machine Learning of Small Data

The Node Dependent Kinematics to Mix Finite Element and Theory of Structure Approximations

Prof. Erasmo Carrera
Politecnico di Torino, Italy

Abstract

Theory of structures ToS introduces approximations over the beam sections (two-directions) and along the thickness (one-direction) in case of plates/shells. Finite element FE introduces approximations along the beam axes (one-direction) and over the plate/shell reference surfaces (two-directions). Node Depended Kinematics NDK is a manner to mix FE and ToS approximations. These elements have the capabilities to assume a different kinematic at each node of a beam/plate/shell elements, that is, the kinematic assumptions can be continuously modified at the element nodes. Based on Carrera Unified Formulation (CUF), the approximation of displacement functions of finite elements can be improved by refining the through-the-thickness assumptions and enriching the shape functions. Node-Dependent Kinematics (NDK) is also utilized to implement local kinematic refinements on the selected FE nodes within the domain of interest. The competence of the proposed approach is investigated through numerical studies on laminated structures, multifield problems and rotors. NDK vs Artificial Intelligence is discussed and some plug-in with commercial software are presented as well. Some guidelines on the choice of the best-generalized variables for high-fidelity, and low cost with a particular focus on multifield and perspectives on machine learning assisted structural analyses.

Biography

Erasmo Carrera is Professor of Aerospace Structures and Aeroelasticity at Politecnico di Torino, Italy, where he graduated in Aeronautics, 1986, and Space Engineering, 1988. He earned a Ph.D. in Aerospace Engineering in 1991. Carrera has introduced the Reissner Mixed Variational Theorem, RMVT, as a natural extension of the Principle of Virtual Displacement (PVD) for layered structure analysis. He introduced the Unified Formulation, or CUF (Carrera Unified Formulation), as a new framework to develop linear and nonlinear theories of beams, plates, and shells for metallic and composite multilayered structures under mechanical, thermal electrical and magnetic loadings. Carrera is author and coauthor of about 800 papers and a few recent books. He is founder and leader of the MUL2 group at Politecnico di Torino. The MUL2 group has six staff members and some 15 grad students or Post-Docs with a project portfolio of some ten active projects funded by the European Commission, the Italian government, Politecnico di Torino and industrial partners such as Embraer.

Main awards and roles: Highly Cited Researchers (Top 100 Scientist) by Thompson Reuters in two sections - Engineering and Materials (2013) and Engineering (2015); Editor-in-Chief of Mechanics of Advanced Materials and Structures; Founder and Editor-in-Chief of Advanced in Aircraft and Spacecraft Sciences; Member of Accademia delle Scienze di Torino, founded by Lagrange et alii; President of A.I.D.A.A. (Associazione Italiana di Aeronautica ed Astronautica).

Virtual Twins of Aeronautic Composite Structures: Innovative Design Methodology, Virtual Manufacturing and Virtual Testing

Prof. Bruno Castanié
Université de Toulouse, France

Abstract

This plenary will present the issues and recent development made at Institut Clément Ader in design, manufacturing and damage modeling vs testing of aeronautic composite structures.

Concerning the design, the large choice of material compositions (i.e. matrix and fibres combinations), architectures and manufacturing processes makes the design process complex and difficult, as the designers face a hyper-choice of materials and technologies that can be overwhelming. Most of the time, designing composite is understood as, and limited to, the choice of stacking and sizing using the TSAI method or derivative, with or without an optimization scheme. So the GAP composite design methodology (acronym of Geometry, Architecture, Process) which will be presented aims to be a starting point in a composite design process and, in this methodology, we would like to emphasize the importance of creating concepts in sufficient number and variety to tackle the issue of hyper-choice raised above.

Once a design have been selected, to reduce the cost, virtual manufacturing of the complete cycle of an autoclave curing must be develop. A calculation loop including thermo-kinetics, thermo-chemical and thermomechanical implementations has been developped. Refined experimental analysis of the different materials characterics during the cure must be conducted. CFRP stiffened panels are considered with a special focus on the effect on bonding of stiffeners in the distorsion of the cured part.

Aeronautic composite part are certified according to a damage tolerance policy and one main issue is the modeling and the efficiency of testing damaged composite structures. The Discrete Ply Modelling (DPM) is based on a mesh following the orientation of the plies. This complex mesh allows taking into account naturally the coupling between intra and inter laminar damages but also splitting. Moreover, it is based only on 13 “true” parameters. This approach was applied successfully for impact and crash on laminates, CAI, residual dent computation, pull-through, edge impact and impact on tapered laminate. This approach was extended successfully to in-plane issues like open hole tension, scaling effects and recently large notches. So the confidence in this modeling strategy is high and the next step is to move from the scale of coupon under uniaxial loading to the scale of technological specimens under complex loadings. This investigation was made through the VERTEX research program. A significant step to Predictive Virtual Testing was achieved and a new pyramid of tests for the certification of aeronautic composite structures can be proposed.

Biography

Professor Bruno Castanié is the head of Composite Group (27 Permanent researchers, about 45 PhD on-going) of Institut Clément Ader located in Toulouse, southwestern of France and location of the main plant of Airbus. His research topics emphasis all the issues of aeronautic composite structures from design to manufacturing and damage modelling. He was the leader of ANR VERTEX on multiaxal testing and validation of such structures. His researches were made mainly in collaboration with the French aeronautic industry from startup like Elixir Aircraft to large manufacturers like Airbus or Dassault Aviation through direct funding or by collaborative projects. He has published about 180 scientific communications including 50 papers in Q1 or Q2 journals and one book with ONR and supervised more than 20 PhD.

Multiscale Simulations of Thermo-Mechanical Behavior of Polymer Nanocomposites: MD, CG MD, and FE Homogenization Integrated

Prof. Maenghyo Cho
Seoul National University, Korea

Abstract

Photo-deformable polymers have drawn a significant amount of attentions due to their distinct advantages such as direct responsiveness, local and wireless control, and environmentally-friendly actuations. Photo-responsive polymers (PRPs) can convert the light energy into the mechanical work. Accordingly, these functional soft materials have been utilized as the bio-mimetic devices and light-responsive soft robots. Among them, the liquid crystalline polymer (LCP) doped with the azobenzene molecules shows large and reversible mechanical deformation under the UV/visible light irradiations. When the 365 nm-light ray is illuminated, the rod-like *trans*-moieties are excited and then, isomerized into bent *cis*-molecules. The photo-chemical reaction induces the collapse of the initial symmetry of the LCP network, which results in the macroscopic deformation. In order to design and analyze the deformation of the PRPs, the multiscale simulation framework, which integrates the mesoscopic light-triggered response and macroscopic mechanical behavior, is systematically developed. In particular, we considered the effects of the various design parameters such as the initial LC phase, morphology of the polymer network, and geometry of the specimen to carry out the multiscale simulation-based design of the photo-mechanical deformations. First, the coarse-grained molecular dynamics (CG MD) simulation is performed to investigate the changes in properties of the macromolecular network in response to the photo-isomerization reaction. The mesoscale photo-switching potential is firstly developed by using the iterative Boltzmann inversion (IBI) technique to reflect the light-induced molecular shape change and LC phase transition. As a result, we successfully reproduced the light-activated transition between 3 phases (Smectic A (Sm A) – Nematic (N) – Isotropic (I)) and corresponding mesoscale deformations. The light-induced polymeric shape change and softening effect on elastic properties are parameterized by the photo-isomerization ratio, which represents the extent of the photo-chemical reaction. Then, the mesoscale parameters are upscaled to the continuum scale stress-strain relationship, which is derived from the neo-classical elastic free energy of the LCPs. In order to efficiently reflect the light-induced rotation of the LC mesogens and geometric nonlinearity, the corotational formulation is implemented to the finite element (FE) computation. The presented multiscale analysis efficiently realizes the exotic 3D deformations as well as the simple bending behavior. Also, the instability of the snap-through deformations are systematically investigated in terms of the material parameters. We expect out scale-bridging computational study can help to practically design the deformed topographies of the photo-responsive mechanical actuators.

Biography

Professor, School of Mechanical and Aerospace Engineering, Seoul National University. **Education:** BS (1984) Seoul National University, KOREA; MS (1986) Seoul National University, KOREA; Ph. D (1993) University of Washington, Seattle, USA. **Research Areas:** Multiscale Mechanics (emphasis on Multiscale Mechanics of Photo-Responsive Polymer by Optical Stimuli), Mechanics of Nanocomposites. **Academic Activities:** President, Computational Structural Engineering of Institute of Korea (2016); Director, Division of CAE and Applied Mechanics, KSME; Vice President, (KSCM); Editor-in-Chief, (JMST), Springer; Editor-in-Chief, JMST Advances, Springer; Editor-in-Chief, (MSAE), Springer; Board of Editors, (IJSS); Editor, (JOMMS); Associate Editor, (MAMS); Associate Editor, (MBDSM); Editorial Board, Scientific Reports, Nature; Editorial Board, (IJAM); General Council, IACM; General Council, APACM; Associate Fellow, AIAA; Technical Committee, Structures, AIAA.

Mechanics of Intelligent Nano Materials and Devices

Prof. Wanlin Guo
Nanjing University of Aeronautics and Astronautics, China

Abstract

Our understanding of the nature and universal and our ability of creation and production depend on how small we can see (spatial scale), how fast we can capture (temporal scale) and how weak signal we can distinguish (energy scale). When the spatial scale goes down from macroscale to nano- and pico-scale, temporal scale reduces to femto- to atto-second, and more importantly, the related energy scale of an externally applied field drops for eighteen orders from joule to atto-joule (1 nN times 1 nm = 6.42 eV), falling into the energy scale of the local fields of matter which consist of electronic structures, charge, molecular orbital and spin states, or well enter the regime of quantum mechanics. Therefore, at nanoscale, matters show distinctly different performances from their bulk materials mainly due to the strong coupling between the local fields of matter and external applied fields, turning common materials such as carbon, even insulators, into intelligent materials with exceptional properties we expected for nanoelectronics, spintronics as well as energy conversion devices. Physical mechanics, a combination of classical mechanics with quantum mechanics to understand the structure-function correlation of matters, has witnessed its golden age in recent decades. Now with nanotechnology entering its fourth decade and nanoscience transforming into picoscience, our ability in spatial, temporal and energy resolutions has experienced revolutionized advance. This revolution is bringing us radical change in understanding not only low-dimensional nano materials, but also liquid-solid interfaces and hydro-ion-electron systems, harvesting electricity from water by hydrovoltaic effects, creating new generation artificial intelligence, leading to intelligent hydrovoltaics for understanding our brain. The challenges and chances will be outlined for discussing.

Biography

Dr. Wanlin GUO, Academician of Chinese Academy of Sciences, Chair Professor in mechanics and nanoscience, founder and director of the Key Laboratory of Intelligent Nano Materials and Devices of Ministry of Education and the Institute of Nanoscience of Nanjing University of Aeronautics and Astronautics. His current research focuses on intelligent nano materials and devices, novel conception and technology for efficient energy conversion, molecular physical mechanics for neuronal signaling and molecular biomimics, as well as strength and safety of aircraft and engine. He has published more than 400 peer-reviewed journal papers on *Nature* series, *Phys. Rev. Lett.*, *J. Am. Chem. Soc*., *Adv. Mater.*, *J. Mech. Phys. Solids*, *Nano Lett.*, etc. He received the National Science Foundation of China for Distinguished Young Scholars in 1996 and the position of Cheung Kong Scholars in 1999. He obtained the National Nature Science Prize of China in 2012 for his contribution to physics mechanics, and the ICCES Eric Reissner Award in 2019 for his sustained contributions to the integrity and durability of aerospace structures, and to nano-mechanics.

Mechanics-guided Deterministic 3D Assembly

Prof. Yonggang Huang
Northwestern University, USA

Abstract

Complex three-dimensional (3D) structures in biology (e.g., cytoskeletal webs, neural circuits, and vasculature networks) form naturally to provide essential functions in even the most basic forms of life. Compelling opportunities exist for analogous 3D architectures in human-made devices, but design options are constrained by existing capabilities in materials growth and assembly. We report routes to previously inaccessible classes of 3D constructs in advanced materials, including device-grade silicon. The schemes involve geometric transformation of 2D micro/nanostructures into extended 3D layouts by compressive buckling. Designs inspired by kirigami/origami, releasable multilayers and engineered substrates enable the formation of mesostructures with a broad variety of 3D geometries, either with hollow or dense distributions. Demonstrations include experimental and theoretical studies of more than 100 representative geometries, from single and multiple helices, toroids, and conical spirals to structures that resemble spherical baskets, cars, houses, cuboid cages, starbursts, flowers, scaffolds, each with single- and/or multiple-level configurations. Morphable 3D mesostructures whoese geometries can be elastically altered can be further achieved via nonlinear mechanical buckling, by deforming the elastomer platforms in different time sequences. We further introduce concepts in physical transfer, patterned photopolymerization, non-linear plasticity and shape memory effect to enable integration of 3D mesostructures onto nearly any class of substrate, with additional capabilities in access to fully or partially free-standing forms, all via mechanisms quantitatively described by theoretical modeling. Compatibility with the well-established technologies available in semiconductor industries suggests a broad range of application opportunities. Illustrations of these ideas include their use in building 3D structures as radio frequency devices for adaptive electromagnetic properties, as open-architecture electronic scaffolds for formation of dorsal root ganglion (DRG) neural networks, as ultrastretchable interconnects for soft electronics, as highly efficient energy harvesters for collecting low-frequency vibrations and as flexible thermoelectric devices.

Biography

Yonggang Huang is the Walter P. Murphy Professor of Mechanical Engineering, Civil and Environmental Engineering, and Materials Science and Engineering at Northwestern University. He is interested in mechanics of stretchable and flexible electronics, and mechanically guided deterministic 3D assembly. He has published 2 books and more than 500 journal papers, including multi-disciplinary journals Science (2006, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2019) and Nature (2008, 2013, 2016, 2019). He is a member of the US National Academy of Engineering, a member of European Academy of Sciences and Arts, a foreign member of Academia Europaea, and a foreign member of Chinese Academy of Sciences. He is the Editor of Journal of Applied Mechanics (Transactions of ASME), Chairman of the Executive Committee of the ASME Applied Mechanics Division (2019-2020), and was the President of the Society of Engineering Science in 2014.

Dynamic Strain based Piezoresponse Force Microscopy for Advanced Functional Materials: When Mechanics Meets "Big" Data

Prof. Jiangyu Li

Shenzhen Institutes of Advanced Technology, Chinese Academy of Science, China

Abstract

Strain and electromechanical coupling are ubiquitous in nature, and exist in many processes involved in information technology, energy conversion, and biological phenomena. Strain-based scanning probe microscopy (s-SPM) techniques, especially piezoresponse force microscopy (PFM) and electrochemical strain microscopy (ESM), have emerged as powerful tools to probe and manipulate materials, structures, and systems at the nanoscale. In this talk, we will present the fundamentals of s-SPM and a variety of its operational modes, introduce its applications in scientifically and technologically important functional materials and electrochemical systems, and discuss some of its challenges and potential opportunities, for example flexoelectricity. By detecting dynamic strains associated with underlying microscopic processes excited by a scanning probe, high sensitivity and unprecedented spatial resolution can be obtained, especially when supported by statistic tools for advanced data analysis, though caution must be exercised to distinguish different microscopic mechanisms, wherein machine learning and artificial intelligence can play important role. We expect that s-SPM will continue to provide great insight into functional materials and structures, and will play a valuable role in the emerging field of materiomics.

Biography

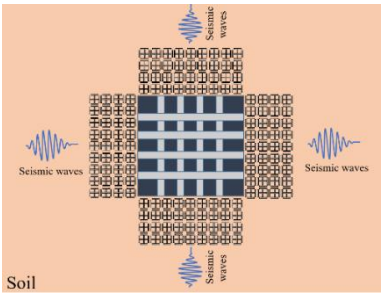
Jiangyu Li recently joins Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, where he directs Shenzhen Key Laboratory of Nanobiomechanics. Prior that, he was Professor in the Department of Mechanical Engineering, University of Washington. He obtained his B.E. degree in 1994 from the Department of Materials Science and Engineering, Tsinghua University, and Ph.D. degree in 1998 from the Department of Mechanical Engineering, University of Colorado-Boulder. Li works in the general field of mechanics of materials, focusing on advanced scanning probe microscopy and its applications in functional materials. He has published over 200 journal articles, and has been recognized by Sia Nemat-Nasser Medal from ASEM, Young Investigator Award from ICCES, and Microscopy Today Innovation Award from Microscopy Society of America. He currently serves as Associate Editor for Journal of Applied Physics and Science Bulletin, and serves on the Editorial Board of npj Computational Materials and Theoretical and Applied Mechanics Letters.

Seismic Metamaterials with Low Frequency Wide Bandgaps Using Steel Barriers

Prof. C.W. Lim
City University of Hong Kong, China

Abstract

The feasibility of built-up steel section as barriers of seismic metamaterials is proposed in this study. We consider two types of built-up steel sections (as resonators) and the surface waves propagation in a single layer homogenous medium and a six-layered soil medium (substrate) is investigated by analytical and computational techniques. The presence of resonator on the surface of a semi-infinite substrate results in the generation of local resonance that induces low frequency wide bandgaps. The generation of local resonance bandgaps are mainly governed by the impedance mismatch between resonator and substrate and the coupling of surface waves propagating on the surface of a semi-infinite substrate with a longitudinal mode of resonator. We further consider the surface waves propagation in both types of media and compared the bandgap frequencies. For layered soil media, a bandgap with relative bandwidth greater than 1.5 is reported that indicates the surface wave bandgap is relatively wide and it is located at a low frequency. The result also shows the effect of impedance mismatch on the bandgap width. Furthermore, with a change in geometric parameter of the resonator and material properties of substrate, the position and width of bandgap do vary. The infinite unit cell model study is further validated by a finite unit cell based frequency response and time transient analyses. An excellent agreement is observed. The time transient analysis results indicate more than 50% reduction in vibration amplitude of the surface waves. The study provides an insight for having steel piles to protect critical infrastructures from earthquake hazards.



Biography

Currently a fellow of ASME, ASCE, EMI and HKIE, Ir Professor Lim received a BEng from Univ of Tech. of Malaysia, MEng and PhD from National Univ of Singapore and Nanyang Tech. Univ., respectively. Prior to joining CityU, he was a post-doctoral research fellow at Dept of Civil Eng, The Univ of Queensland and Dept of Mech Eng, The Univ of HK. Professor Lim has expertise in vibration of plate and shell structures, dynamics of smart piezoelectric structures, nanomechanics and symplectic elasticity. He is one of the editors for JoMMS, Assoc Editor (Asia-Pacific Region) for JVET, Assoc Editor for IJBC, subject editor for AMM, etc. and also on the editorial board of some other top-ranked international journals. He has published more than 280 international journal papers, accumulated more than 6000 independent citations and has an ISI H-index 42. One of his papers co-authored with G. Zhang and J.N. Reddy, is a highly cited paper in JMPS and the most cited paper since 2009 in the journal, while another co-authored with L.H. He and B.S. Wu was granted the IJSS 2004-2008 most cited article award. He was also awarded Top Referees in 2009, Proc. A, The Royal Society. Professor Lim is also a registered professional engineer in HK.

On Nonlocal Stress and Strain Gradient Theories with Material and Structural Length Scales

Prof. J.N. Reddy
Texas A&M University, USA

Abstract

Engineers are “problem solving” people, who develop mathematical models of physical processes and then physically and numerically simulate the process to gain understanding that can be used to build systems for societal needs. The mathematical models are never complete because one does not know what it means to be “complete.” Thus mathematical models continuously evolve to include the latest observations and developments in science. In the context of explaining certain observed phenomena which cannot be explained by classical continuum mechanics models, new theories are being postulated (in an attempt to improve existing models). The present lecture is dedicated to an overview of non-local theories/models the author has been working for the last decade. The specific topics to be discussed are Eringen’s stress-gradient elasticity and Mindlin’s couple stress theories. These two theories are discussed in the context of reformulating the governing equations of functionally graded material beams and plates and developing associated finite element models.

Biography

Dr. Reddy is a Distinguished Professor, Regents’ Professor, and inaugural holder of the *Oscar S. Wyatt Endowed Chair* in Mechanical Engineering at Texas A&M University, College Station, Texas. Dr. Reddy earned a Ph.D. in Engineering Mechanics in 1974 from University of Alabama in Huntsville. He worked as a Post-Doctoral Fellow in Texas Institute for Computational Mechanics (now ICES) at the University of Texas at Austin, Research Scientist for Lockheed Missiles and Space Company, Huntsville, during l974-75, and taught at the University of Oklahoma from 1975 to 1980, Virginia Polytechnic Institute & State University from 1980 to 1992, and at Texas A&M University from 1992.

Dr. Reddy, an ISI highly-cited researcher, is known for his significant contributions to the field of applied mechanics through the authorship of a large number of journal papers and 21 textbooks and the development of shear deformation plate and shell theories and their finite elements. His pioneering works on the development of shear deformation theories (that bear his name in the literature as the *Reddy third-order plate theory* and the *Reddy layerwise theory*) have had a major impact and have led to new research developments and applications. In recent years, Reddy's research has focused on the development of locking-free shell finite elements and nonlocal and non-classical continuum mechanics problems, involving couple stresses, surface stress effects, micropolar cohesive damage, and continuum plasticity of metals.

Dr. Reddy has received numerous honors and awards. Most recent ones include: 2019 Timoshenko Medal from the American Society of Mechanical Engineers, 2018 Theodore von Karman Medal from the Engineering Mechanics Institute of the American Society of Civil Engineers, the 2017 John von Neumann Medal from the U.S. Association of Computational Mechanics, the 2016 Prager Medal, Society of Engineering Science, and 2016 ASME Medal from the American Society of Mechanical Engineers. He is a member US National Academy of Engineering and foreign fellow of Indian National Academy of Engineering, the Canadian Academy of Engineering, and the Brazilian National Academy of Engineering.

GraFEA-a Discrete, Nonlocal Approach to Simulate Damage and Fracture

Prof. Arun R. Srinivasa
Texas A&M University, USA

Abstract

Simulation of crack propagation in materials has always been a vexing challenge within the framework of classical continuum mechanics. There are changes in topology (e.g. interior points become boundary points) that occur that cannot be captured by conventional methods. Over the years, many different methods have been developed for overcoming this problem, the chief among them (within the FEA community) are the cohesive zone models (CZM) and the Extended FEM (XFEM), both of which require extensive "re-engineering" of classical FEA with mixed results. A different approach is a fully discrete method that is usually referred to as the lattice or bond based methods (and more recently-peridynamics methods) which are very simple to implement and can simply use a bond failure criterion to change connectivity. However, in general, these approaches are not sufficiently general and are subject to convergence, mesh dependency and other numerical artefacts that significantly affect the results.

We demonstrate a new Graph Based Finite Element Analysis (GraFEA) method to study damage and fracture in materials. The central idea behind this approach is to leverage classical FEA to study fracture by enhancing it with a nonlocal damage and fracture criterion. We utilize the tools of discrete differential geometry and treat the mesh of a traditional FEA as a cell complex. Then it becomes possible to treat fracture propagation on the dual cell complex (instead of the original FEA mesh). This is not only consistent with the results of discrete differential geometry but also considerable simplifies crack propagation kinetics compared with either XFEM or CZM. This allows us to piggyback on already developed and tested FEA for structural response with a nonlocal criterion for the separation of the faces of the dual cell. We apply this method to (a) the fracture propagation in a quasibrittle material and (b) the dynamic fracture (or tearing, depending upon strain rate) of a nonlinear viscoelastic solid (such as an adhesive) under conditions of different strain rates. We show that the problems associated with mesh dependence of the element deletion (element fracture) method that is used in engineering practice can also be overcome with minimum effort using this technique. We implement the viscoelastic response as an extension of commercial software (ABAQUS) to demonstrate that it is possible to use this nonlocal approach to fracture as an add on to conventional FEA.

Biography

Dr. Srinivasa is the Holdredge/Paul Professor of Mechanical Engineering at Texas A&M University. His expertise is in the area of inelasticity and damage of materials as well as in chemorheology and has a wide-ranging interest in various aspects of the mechanics of persistent structural changes. He has published over a 100 Archival journal papers and two books (one on the inelasticity of materials and the other, with Prof Reddy, on the design of shape memory alloy actuators). His research interests (and publications) are in the areas of the Thermomechanics of persistent structural changes in materials, thermodynamic and energy efficiency of materials processing technologies, bio-materials modeling, Cosserat and non-local theories of mechanics, information theoretic approaches for parameter estimation and physics based diagnostics , Discrete Differential Geometry and its use in simulating the response of defective solids and technology-assisted instruction. He is the recipient of the Archie Higdon Distinguished Educator Award by the American Society of Engineering Education for outstanding contributions to engineering mechanics education and the Worchester Reed Warner Medal from the American Society of Mechanical Engineers for his contributions to the permanent literature in engineering.

Trans-scale Mechanics of Advanced Materials

Prof. Yueguang Wei
Peking University, China

Abstract

Advanced materials have been widely used in aerospace, modern industry, national defense and other high-tech fields because of their high strength, high toughness and other excellent properties. Advanced materials are mainly constructed by micro-structure design, and their macro-mechanical behavior shows strong micro-structure dependence, i.e. cross-scale characteristics, which is difficult to describe by traditional mechanical theory. How to characterize this trans-scale mechanical behavior theoretically and experimentally, so as to provide theoretical support for the design and manufacture of advanced materials, is the core scientific problem and major application needs. The progresses in trans-scale mechanics of solid materials and structures are systematically introduced, and the long-standing misunderstanding of the concept of cross-scale mechanics is analyzed. The main contents include the establishment of "Top-Down" (from macro to micro) cross-scale mechanics theory and methods and the latest research progress; the research progress of cross-scale mechanical simulation and experimental measurement based on "Bottom-Up" (from micro to macro); and the "top-down" cross-scale mechanics method. Related research with "bottom-up" cross-scale mechanics method; application of trans-scale mechanics theory and method; brief introduction of other related research on trans-scale mechanics; future development prospects, and so on.

Biography

Professor of Peking University. He graduated from Xi'an University of Science and Technology in 1982 with a bachelor's degree of Mechanics, from the China University of Mining and Technology in Beijing in 1986 with a master's degree of Engineering Mechanics, and from Tsinghua University in 1992 with a Ph.D. degree of Solid Mechanics. In 2017, he was elected as an academician of the Chinese Academy of Sciences. He mainly engaged in cross-scale mechanics, elastoplastic fracture mechanics, composite mechanics and other research. In recent years, he has successfully applied the theory of cross-scale mechanics to the characterization of the toughness and failure mechanism of advanced thermal barrier coatings for engine blades. The relevant achievements won 2 second prizes and 1 third prize of the National Natural Science Award.

Mechnoinformatics and Machine Learning of Small Data

Prof. Tong-Yi Zhang
Shanghai University, China

Abstract

The ceaseless and infinite development of nature science is an endless and continuous process during which mankind observes and summarizes the nature behaviors, and then gains knowledge. From data to knowledge is a quantum jump, during which key factors are extracted and classified into input features and output responses, and relationships between input features and output responses are analyzed and, if possible, explicitly expressed in mathematic equations. Materials data, especially the materials data of mechanical behaviors such as creep, fatigue, facture etc., is often small and high dimensional. Domain knowledge plays a crucial role in machine learning of small data. An example is given in the presentation to emphasize the role of domain knowledge in machine learning of small data. The example analyzes the data of three-point bending tests on concrete samples with various sizes and different lengths of pre-notches. A modified Weibull distribution is proposed to study the size- and pre-notch length- dependent strength. Based on the knowledge of fracture mechanics, the fracture toughness and the length of fracture process zone are determined from the experiment data.

Biography

Tong-Yi Zhang earned Master degree in 1982 and PhD in 1985, majoring in materials physics, from University of Science and Technology Beijing, China. From 1993 to 2015, he worked at Hong Kong University of Science and Technology, as Lecturer, Associate Professor, Professor, Chair Professor, and Fang Professor of Engineering. He full-time works now at Shanghai University, as the founding dean of the Materials Genome Institute, Shanghai University, and the founding dean of the Shanghai Materials Genome Institute. He is also the Founding Director of the MGI division in the Chinese Materials Research Society (CMRS), which organizes the MGI symposium in the CMRS annual meeting every year. His research interests include mechanical properties of materials, micro/nanomechanics, fracture/creep/fatigue, thermodynamics and kinetics, materials informatics, and mechanics informatics. He was a vice president of the International Congress on Fracture (ICF) 2013-2017 and now is a director of ICF executive committee. He was a vice president of The Far East and Oceanic Fracture Society 2001-2016. He was a recipient of the 2018 Prize for Scientific and Technological Progress from the HLHL Foundation, the Second Prizes of 2007 and 1987 State Natural Science Award, China, and the 1988 National Award for Young Scientists, China. He became ICF Fellow in 2013, Fellow of the Hong Kong Academy of Engineering Sciences in 2012, Member of Chinese Academy of Sciences in 2011, Senior Research Fellow of Croucher Foundation, Hong Kong, in 2003, Fellow of ASM International, USA, in 2001. He was Associate Editor-in-Chief of Science China Technological Sciences 2013 – 2017 and Editor-in-Chief since 2018. He is also Fracture and Continuum Mechanics Subject-Editor of the journal, Theoretical and Applied Fracture Mechanics (2013 – present).

Regular Sessions

S1: Composite Materials

S2: Structural Mechanics

S3: Computational Mechanics

S4: Fluid-Solid Interaction

S5: Fatigue and Fracture Mechanics

S6: Experimental Mechanics

S7: Mechanics of Soft Matter

S8: Biomechanics

S9: Constitutive Model

S10: Metamaterials: Structural Design

S11: Dynamics and Vibration

S12: Non-classical Elasticity

S13: Peridynamics

S14: Non-local Theories

S15: Couple Stress Theories

S16: Micropolar Elasticity

S17: Multifunctional Materials

S18: New Energy Materials

S19: Nanomechanics

S20: Thermal Stresses

S21: Piezoelectric Sensors and Multi-field Coupling Mechanics

S22: Atomic Force Microscopy (AFM)

Program Overview

Time		Program	Venue
October 19	12:00-22:30	Registration	Lobby of Yuyuan Hotel
	18:00-20:00	Reception	1st Floor of Yuan Hotel
October 20	07:30-18:30	Registration	1st Floor of Yifu Hall
	08:00-08:25	Opening Ceremony	Room I
	08:25-09:45	Plenary Lectures	Room I
	09:45-10:00	Coffee Break	1st Floor of Yifu Hall
	10:00-12:00	Plenary Lectures	Room I
	12:00-13:00	Lunch	Taoli Yuan Restaurant
	13:30-15:30	Parallel Sessions	Rooms I-VI
	15:30-15:45	Coffee Break	1st Floor of Yifu Hall
	15:45-17:45	Parallel Sessions	Rooms I-VI
	18:00-20:00	Dinner	Taoli Yuan Restaurant
October 21	08:30-09:50	Plenary Lectures	Room I
	09:50-10:00	Coffee Break	1st Floor of Yifu Hall
	10:00-12:00	Plenary Lectures	Room I
	12:00-13:00	Lunch	Taoli Yuan Restaurant
	13:30-15:45	Parallel Sessions	Rooms I-VI
	16:00-20:00	Travel & Banquet	Mingfa Pearl Hotel
October 22	08:30-10:00	Parallel Sessions	Rooms I-VI
	10:00-10:15	Coffee Break	1st Floor of Yifu Hall
	10:15-12:00	Parallel Sessions	Rooms I-VI
	12:00-13:00	Lunch	Taoli Yuan Restaurant
	13:30-14:30	Parallel Sessions	Rooms I-VI
	14:30-15:10	Plenary Lecture	Room I
	15:10-15:30	Closing Ceremony	Room I

Morning, October 20

Room I

08:00-08:25	**Opening Ceremony**	**Weiqiu Chen**
Plenary		
08:25-09:05	On Nonlocal Stress and Strain Gradient Theories with Material and Structural Length Scales **Speaker: J.N Reddy** (Texas A&M University, USA)	**Chien Ming Wang**
09:05-09:45	Mechanics-guided Deterministic 3D Assembly **Speaker: Yonggang Huang** (Northwestern University, USA)	**Jie Yang**
09:45-10:00	**Coffee Break**	
10:00-10:40	From Data to Knowledge by Domain Knowledge and Machine Learning **Speaker: Tong-Yi Zhang** (Shanghai University, China)	**Zheng-Ming Huang**
10:40-11:20	Mechanics of Intelligent Nano Materials and Devices **Speaker: Wanlin Guo** (Nanjing University of Aeronautics and Astronautics, China)	**Michel Destrade**
11:20-12:00	Trans-scale Mechanics of Advanced Materials **Speaker: Yueguang Wei** (Peking University, China)	**Marina V. Shitikova**
12:00-13:00	**Lunch** **Venue: Taoli Yuan Restaurant**	

Afternoon, October 20

Parallel Sessions	
S1: Composite Materials	**Room I**
S3: Computational Mechanics	**Room II**
S6: Experimental Mechanics S7: Mechanics of Soft Matter	**Room III**
S10: Metamaterials: Structural Design	**Room IV**
S12: Non-classical Elasticity S13: Peridynamics	**Room V**
S17: Multifunctional Materials S18: New Energy Materials S19: Nanomechanics	**Room VI**

S1: Composite Materials (Room I)		
Time	**Titles and Speakers**	**Chairs**
13:30-13:45	Micromechanical Analysis of Composite Failures ***Zheng-Ming Huang*** **[Invited]**	**Lei Zu** **Marco Petrolo**
13:45-14:00	Nanomodification Cement Systems in the Technological Life Cycle ***O. Artamonova, Galina Slavcheva*** **[Invited]**	
14:00-14:15	In-Plane Free Vibrations of Combined Curved Beams with Rayleigh-Ritz Method ***S.D. Ding, J.H. Wu, C.L. Bian, Y.Y. Zhang, L.T. Xie, Ji Wang*** **[Invited]**	
14:15-14:30	Effect of Particle Arrangement on the Mesoscale Thermo-Mechanical Behavior in Dispersion Fuels during Post-Irradiation Annealing ***Feng Yan, Shurong Ding, Xiangzhe Kong***	
14:30-14:45	A Magneto-Active Flexible Gripper with Adaptive and Controllable Motion ***Xianghao Li, X.C. Yu, M. Sun, S.F. Jiang, Z. Zhang***	
14:45-15:00	Identification of Delamination in CFRP Laminates using Laser-Measured Modal Energy: A Multi-Resolution Analysis ***Wei Xu, Z. Su, M. Cao***	
15:00-15:15	Surface Acoustic Waves in Isotropic Infinite Plates Calculated by Rayleigh-Ritz Method ***J.H. Wu, L.T. Xie, Y.Y. Zhang, S.Y. Wang, Ji Wang***	
15:15-15:30	Locally Exact Homogenization Theory for Hygro-Thermo-Elastic Behavior of Unidirectional Composites with Inorganic Fibers ***Guannan Wang***	
15:30-15:45	**Coffee Break**	
15:45-16:00	Characterization and Control of Viscosity Behavior of Prepreg for Laying Process ***Xianzhao Xia, Lei Zu, Hui Xu*** **[Invited]**	**Wei Xu** **Guannan Wang**
16:00-16:15	A Simulation Scheme for Matrix Cracking and Interface Debonding for Fiber-Reinforced Composite Materials Based on the Phase Field and the Cohesive Zone Approaches ***X. Suo, Yongxing Shen***	
16:15-16:30	Study of Environmental Effects on the Composite-to-Metal Double Lap Shear Joints ***Qian Zhang, Xiaoquan Cheng, Hui Xu, Lei Zu***	
16:30-16:45	Torsional Properties of 3D Surface-Core Five-Directional Braided Composite Tube ***Xiaopei Wang, Deng'an Cai, Fangzhou Lu, Guangming Zhou***	
16:45-17:00	Modeling and Simulation of Carbon Fiber Shell Membrane Reflector ***Xiaotao Zhou, X.F. Ma***	
17:00-17:15	Energy Absorption Characteristics of Coconut Mesocarp/Glass Fiber Reinforced Plastic (Gfrp) Composite Based on Geometric Optimization ***B. Malomo, A.A. Akinola, W.A. Fahanmi, O.T. Ogunbodede***	
17:15-17:30	Application of the Ritz-Legendre Method to the Vibration Analysis of 3D Solid and Thin-Walled Composite Beams ***Fiorenzo Fazzolari***	
17:30-17:45	Effect of Structural Modelling Approximations on Minimum Weight Design Optimization of Composite Laminates ***Alfonso Pagani, A.R. Sanchez Majano***	

S3: Computational Mechanics (Room II)		
Time	**Titles and Speakers**	**Chairs**
13:30-13:45	Uncertainty Modelling for Dynamic Characteristics of Functionally Graded Porous Beams ***Jie Yang, K. Gao*** **[Invited]**	**José Mantari** **Yujie Guo**
13:45-14:00	Hermite Radial Basis Collocation Method for Vibration and Buckling Analysis of Functionally Graded Plates with in-Plane Material Inhomogeneity ***Lihua Wang, Fuyun Chu, Zheng Zhong, Jianzhang He*** **[Invited]**	
14:00-14:15	A Corotational Unified Formulation for Geometrically Nonlinear Beams ***J.L. Mantari, Jorge Yarasca***	
14:15-14:30	Multiscale Modeling of Nanoparticle Reinforced Polymer Nanocomposites with Modified Interphase Percolation Model ***Kyungmin Baek, H. Shin, M. Cho***	
14:30-14:45	Multiscale Approach to Local Crosslink Density Variation of Epoxy Nanocomposites with Nanoparticle ***Taewoo Yoo, B. Kim, M. Cho***	
14:45-15:00	Structural-Genome-Driven Computing for Composite Structures ***Jie Yang, R. Xu, H. Hu, Q. Huang, W. Huang***	
15:00-15:15	Dynamic Damage Analysis of Aviation Structures via Higher Order FEM with Displacements Only ***Min Dan***	
15:15-15:30	Dic Measurement and Numerical Simulation of Strain Field and Crack Propagation of Aluminium Laser Welded Joint ***Haoyun Tu, Y. Li, S. Schmauder***	
15:30-15:45	**Coffee Break**	
15:45-16:00	Isogeometric Stability Analysis of Thin-Walled Structures ***Yujie Guo, H. Wu, H. Do, M. Ruess*** **[Invited]**	**Lihua Wang** **Ke Liang**
16:00-16:15	Node-Dependent Kinematic Shell Finite Element Models Based on Reissner's Mixed Variational Theorem ***Guohong Li, E. Carrera, E. Zappino, M. Cinefra*** **[Invited]**	
16:15-16:30	A Reduced-Order Modeling Method for Nonlinear Structural Analysis ***Ke Liang*** **[Invited]**	
16:30-16:45	In Situ Laminography Investigation and Numerical Simulation of Damage Evolution of Steel S355 ***Haoyun Tu, Y. Li, S. Schmauder, T.F. Morgeneyer***	
16:45-17:00	Multiscale Analysis Using Cohesive Zone Model in the Laminated Composite Structures According to Temperature Change ***Hyunil Kim, I. Chung, J. Kim, Y. Kim, K. Won, M. Cho***	
17:00-17:15	Generic Theoretical Framework for Percolation Threshold, Tortuosity and Transport Properties of Anisotropic Porous Composites via Finite-Size Scaling Analysis ***Wenxiang Xu***	
17:15-17:30	Intelligent Geometric Modelling and Mechanical Analysis Based on 3D Point Cloud Data ***Xiangyang Xu, H. Yang, E. Carrera***	
17:30-17:45	Study on Meso Modeling and Tensile Failure Mechanism of Epoxy Polymer Concrete ***Dongpeng Ma, Z.M. Liang, Y.P. Liu, Z.Y. Jiang, Z.J. Liu, L.C. Zhou, L.Q. Tang***	

S6: Experimental Mechanics, S7: Mechanics of Soft Matter (Room III)		
Time	**Titles and Speakers**	**Chairs**
13:30-13:45	Tests on Thermal Buckling and Mode Jumping in Composite Laminated Plates ***J. GutiérrezÁlvarez, Chiara Bisagni*** **[Invited]**	**Shouhu Xuan** **Wei Qiu**
13:45-14:00	Probing the Mechanics of Two-Dimensional Materials via Raman Spectroscopy ***Z. Zhang, X. Zhan, J. Liu, Pei Zhao, H. Wang*** **[Invited]**	
14:00-14:15	Ultrasensitive Multifunctional Magnetoresistive Strain Sensor Based on Hair-like Magnetization-induced Pillar Forests ***Li Ding, S.H. Xuan, X.L. Gong*** **[Invited]**	
14:15-14:30	Rate-Dependent Decohesion Modes in Graphene Sandwiched Interfaces ***Chaochen Xu, W. Qiu, R. Huang, Q. Li, Y. Kang*** **[Invited]**	
14:30-14:45	Angle-Resolved Micro-Raman System and Measurement Method for Stress/Strain Analysis ***Y. Chang, A. Xiao, J. Chai,T. Meng, H. Bao, R. Li, Wei Qiu***	
14:45-15:00	Torsion Balance, Torsion Pendulum, and Related Devices for Characterizing the Torsional Properties of Wires, Fibres and Silks ***Dabiao Liu, Yuming He, D.J. Dunstan***	
15:00-15:15	Flexible, Self-Powered, Magnetism/Pressure Dual-Mode Sensor Based on Magnetorheological Plastomer ***Jiaqi Xu, S.H. Xuan, X.L. Gong***	
15:15-15:30	Experimental Investigation of Linear Correlation Coefficients between FRP Elastic Properties Using Full Field Measurements and the Virtual Fields Method ***Haibin Zhu, S. Zhang***	
15:30-15:45	**Coffee Break**	
15:45-16:00	Camera Array-Based Digital Image Correlation for High-Resolution Strain Measurement ***Xinxing Shao, Z.N. Chen, X.Y. He*** **[Invited]**	**Shouhu Xuan** **Wei Qiu**
16:00-16:15	Quantification of Cell Interactions with Extracellular Substrates Based on Adaptive Global Digital Image Correlation ***Xiaocen Duan, Y. Yuan, J.Y. Huang*** **[Invited]**	
16:15-16:30	In-Situ Stress Measurements in Bilayer Composite Electrodes: Key Role of Li-Related Material Modulus ***Q. Zhang, Haimei Xie, Y.L. Kang***	
16:30-16:45	Mechanobiology of Solid Tumors ***Xi-Qiao Feng, Bo Li*** **[Invited]**	**Xin Yi** **Bin Wu**
16:45-17:00	Strain Rate Effects of Mechanical Behaviors of Hydrogel ***P.D. XU, B.X. Xie, Ligun Tang***	
17:00-17:15	Instabilities of Soft Biomaterials ***Bo Li***	
17:15-17:30	Large-Deformation Analysis of Isotropic Elastomeric Structures by Carrera Unified Formulation ***Bin Wu, A. Pagani, W.Q. Chen, E. Carrera***	
17:30-17:45	Reconfigurable Mesostructures with Reverse Stiffness and Shape Memory Effects ***Chao Song, J. Ju***	

S10: Metamaterials: Structural Design (Room IV)		
Time	**Titles and Speakers**	**Chairs**
13:30-13:45	Periodic Wave Solutions in A Granular Chain of Elastic Spheres: Trigonometric Function Solutions, Periodic Hyperbolic Function Solutions (Including Breather), Rogue Wave Solutions and Their Stabilities ***Zhi-Guo Liu, Yue-Sheng Wang*** **[Invited]**	**Yue-Sheng Wang** **Kai Zhang**
13:45-14:00	Programmable Elastic Valley Hall Insulator ***Quan Zhang, Y. Chen, Kai Zhang, G.K. Hu*** **[Invited]**	
14:00-14:15	Designing Acoustic Metamaterial with Anticipated Band Structure Through a Deep Learning Based Data-Driven Method ***Zhanli Liu, Xiang Li, Shaowu Ning, Zhuo Zhuang***	
14:15-14:30	Topological Refinement of Bimode Structures for Extremal Mechanical Properties ***Zhiming Cui, J. Ju***	
14:30-14:45	Connection Effect on Kinematic and Mechanical Properties of an Imperfect Modular Origami Structure ***Kai Xiao, Jaehyung Ju***	
14:45-15:00	Fractal Metamaterial for Broadband Sound Insulation ***Yu Liu, W.S. Xu, M. Chen, H. Jiang, Y.R. Wang***	
15:00-15:15	Modular, Programmable and Inflatable Kirigami ***Lishuai Jin, A.E.Forte, B.L.Deng, A.Rafsanjani, K. Bertoldi***	
15:15-15:30	A Double-Zero-Index Elastic Metamaterial for Wave-Front Shaping ***Bing Li***	
15:30-15:45	**Coffee Break**	
15:45-16:00	Band-Gap Tuning in Metamaterials Using Two-Way Shape Memory Alloys ***Kuo-Chih Chuang, Xu-Feng Lv***	**Jaehyung Ju** **Kuo-Chih Chuang**
16:00-16:15	Bistable-Induced Tunable Phononic Bandgaps in Low Frequencies ***Yangbo Li, Yan Shen, Zhihao Xiong, Xiaoshun Zhang***	
16:15-16:30	Mechanical Analysis of Vertex-Based Hierarchical Honeycomb Sandwich under Bending Compression ***Zhendong Li, Z.G. Wang***	
16:30-16:45	Willis-Type Elastic Metamaterials and Asymmetric Wave Propagation ***Yongquan Liu, Zixian Liang, Andrea Alù, Jensen Li***	
16:45-17:00	Deflecting Incident Flexural Waves by Nonresonant Single-Phase Meta-Slab with Subunits of Graded Thicknesses ***Yanlong Xu, L.Y. Cao, Z.C. Yang***	
17:00-17:15	3D Pixel Mechanical Metamaterials ***F. Pan, Yuli Chen***	
17:15-17:30	Reverse Design of Two-Dimensional Phononic Crystal Band Gap Based on Depth Neural Network ***Xuanbo Miao, Y.S. Wang***	
17:30-17:45	Axial-Shear Coupling and Dual Poisson's Ratio of Undulated Tetra-Chiral and Tetra-Achiral Lattices ***Zhihao Yuan, Jaehyung Ju***	

S12: Non-classical Elasticity, S13: Peridynamics (Room V)		
Time	**Titles and Speakers**	**Chairs**
13:30-13:45	3D Green's Functions for Quasicrystals with Multiple Coupling Effects ***Weiqiu Chen*** **[Invited]**	**Fan Xu** **Weiqiu Chen** **Marina V. Shitikova**
13:45-14:00	Wrinkling and Smoothing of a Soft Shell ***Fan Xu, Ting Wang, Yifan Yang, Chenbo Fu, Fei Liu*** **[Invited]**	
14:00-14:15	Modeling Reorientation and Instabilities of Stretched LCE Films ***Zhiyuan Zhang, Y. Zhang, Y.Z. Huo*** **[Invited]**	
14:15-14:30	Visco-Elasticity of Liquid Crystal Elastomeric Gels ***Chen Xuan, Y.Z. Huo***	
14:30-14:45	Morphology Transitions of Filled Carbon Nanotubes ***Mingda Ding, Ting Wang, Fan Xu***	
14:45-15:00	Weakly Nonlinear Analysis of Localized Bulging of an Inflated Hyperelastic Tube of Arbitrary Wall Thickness ***Yang Ye, Yibin Fu, Yang Liu***	
15:00-15:15	A Non-Classical High-Frequency Mindlin and Medick Theory for Microstructure-Dependent Functionally Graded Magneto-Electro-Elastic Beam ***Yilin Qu, P. Li, G.Y. Zhang, F. Jin***	
15:15-15:30	Electric Field Induced Bending in Gradient Nematic Elastomer Strips ***Yiqing Zhang, Y.W. Xu, Y.Z. Huo***	
15:30-15:45	**Coffee Break**	
15:45-16:00	Orientable Wrinkles in Stretched Orthotropic Films ***Fei Liu, Fan Xu***	**Fan Xu** **Weiqiu Chen** **Marina V. Shitikova**
16:00-16:15	Torsion Inducing Mechanocaloric Effect in Composite Ferroelectric Nanowires ***Shuai Yuan***	
16:15-16:30	A Hybrid Local/Nonlocal Continuum Mechanics Modeling and Simulation of Fracture in Brittle Materials ***Y. Wang, Fei Han, G. Lubineau*** **[Invited]**	**Qing Zhang** **Fei Han**
16:30-16:45	Significance of Nonlocality in Dynamic Cracking Simulation of Polycrystal: Insight from Peridynamics ***Xin Gu, Q. Zhang, E. Madenci*** **[Invited]**	
16:45-17:00	The Deduction and Application of Two-Parameter Model of Bond-Based Peridynamics under Plane Stress ***Jiabao Li, S.C. Lu, Q. Wang***	
17:00-17:15	A Peridynamic Framework for Analyzing the Mechanical Properties of Particle Reinforced Metal Matrix Composites ***Jiaming Zhan, X.H. Yao***	
17:15-17:30	The Variational Principles and Bounds of Material Parameters of Composites in Peridynamics ***X. Liang, L.J. Wang, Jianxiang Wang***	
17:30-17:45	Theory and Quasi-Analytical Solution of Nonlinear Thermoelasticity Problem of Semilinear Thermo-Hyperelastic Thin Disc ***Adegbola Akinola, O.O. Fadodun, A.S. Borokinni, O.P. Layeni***	

S17: Multifunctional Materials, S18: New Energy Materials, S19: Nanomechanics (Room VI)		
Time	**Titles and Speakers**	**Chairs**
13:30-13:45	Shear Horizontal Wave Transducers and Modulus/Internal Friction Measurement Methods Based on Piezoelectric Ceramics ***Faxin Li, Q. Huan, M.T. Chen*** **[Invited]**	**Faxin Li** **Jie Wang** **Jinjin Zhao**
13:45-14:00	Fabrication and Mechanical Properties of Carbon Fiber Reinforced 3D Auxetic Cellular Structures ***Li Ma*** **[Invited]**	
14:00-14:15	Phase Field Modeling of Topological Phase Transition in Ferromagnetic Materials ***Jie Wang, Yinuo Shi, Yu Wang, Yu Wang*** **[Invited]**	
14:15-14:30	Nanoscale Insights into Photovoltaic Hysteresis in Perovskite: Resolving the Role of Polarization and Ionic Migration ***G. Xia, B. Huang, Y. Zhang, Jinjin Zhao, W. Chen, J. Li***	
14:30-14:45	Electromagnetic-Mechanical Energy Conversion of a 1-3 Metal-Matrix Lightweight Magnetostrictive Fiber Composites ***Zhenjun Yang, Kenya Nakajima, Lixin Jiang, Hiroki Kurita, Go Murasawa, Fumio Narita***	
14:45-15:00	Novel Deformation Properties of Azo-Incorporated Liquid Crystalline Elastomer (LCEs) ***Hyunsu Kim, C. Li, M. Cho***	
15:00-15:15	A Displacement-Energy Model for Delamination Mechanism of a Multilayered Thin-Film Structure Grown from Different Fabrication Techniques ***Stephen Ogbonna Mbam, X.F Gou***	
15:15-15:30	Strain-Temperature Phase Diagram of Bazro3 With Rotation of Oxygen Octahedral ***Jingtong Zhang, Jie Wang***	
15:30-15:45	**Coffee Break**	
15:45-16:00	Effect of Grain Size on the Electrocaloric Properties of Polycrystalline Ferroelectrics ***Xu Hou, X.K. Li, Jie Wang***	**Faxin Li** **Jie Wang** **Jinjin Zhao**
16:00-16:15	Interfacial Mechanical Behavior of Nanocomposites Reinforced with Surface Hydrogen Functionalized Grapheme ***Rui Sun, L. Li, Jie Yang***	
16:15-16:30	High Strength Yet Flexible Strain Sensors Based on Piezoresistive Composites ***Y.F. Fu, Yuan-Qing Li, N. Hu, S.Y. Fu***	
16:30-16:45	Theoretical Study on the Stress Fields within Anisotropic Hollow Sphere under Compression ***Xuexia Wei, L.T. Yan***	**Qiang Chen** **Chao Shi**
16:45-17:00	Analysis on Mechanical Interaction between Flexible Nanofibers and Vesicles ***Chao Shi, X. Yi***	
17:00-17:15	Limit for Applying Continuum Thin-Shell Model to Investigating the Mechanical Behavior of Two-Dimensional Materials ***Guoxin Cao***	
17:15-17:30	Effective and Localized Responses of Nanoporous Aluminum with Surface Effects ***Guannan Wang, Q. Chen***	
17:30-17:45	Dynamic Response of Functionally Graded Carbon-Nanotube Reinforced Piezoelectric Composites with Active Control ***Fiorenzo Fazzolari, Violi Lorenzo***	

Morning, October 21

Room I

Plenary		
08:30-09:10	The Node Dependent Kinematics to Mix Finite Element and Theory of Structure Approximations **Speaker: Erasmo Carrera** (Politecnico di Torino, Italy)	**Gennady Kulikov**
09:10-09:50	Virtual Twins of Aeronautic Composite Structures: Innovative Design Methodology, Virtual Manufacturing and Virtual Testing **Speaker: Bruno Castanié** (Université de Toulouse, France)	**Heng Hu**
09:50-10:00	**Coffee Break**	
10:00-10:40	Multiscale Simulations of Thermo-Mechanical Behavior of Polymer Nanocomposites: MD, CG MD, and FE Homogenization Integrated **Speaker: Maeng Hyo Cho** (Seoul National University, Korea)	**Liao-Liang Ke**
10:40-11:20	Seismic Metamaterials with Low Frequency Wide Bandgaps Using Steel Barriers **Speaker: C.W. Lim** (City University of Hong Kong, China)	**Chaofeng Lü**
11:20-12:00	GraFEA-A Discrete, Nonlocal Approach to Simulate Damage and Fracture **Speaker: Arun R. Srinivasa** (Texas A&M University, USA)	**Ji Wang**
12:00-13:00	**Lunch** **Venue: Taoli Yuan Restaurant**	

Afternoon, October 21

Parallel Sessions	
S1: Composite Materials S2: Structural Mechanics	**Room I**
S3: Computational Mechanics S4: Fluid-Solid Interaction	**Room II**
S7: Mechanics of Soft Matter S8: Biomechanics	**Room III**
S10: Metamaterials: Structural Design	**Room IV**
S13: Peridynamics S14: Non-local Theories	**Room V**
S19: Nanomechanics S20: Thermal Stresses	**Room VI**

S1: Composite Materials, S2: Structural Mechanics (Room I)		
Time	**Titles and Speakers**	**Chairs**
13:30-13:45	Integration of CUF Micromechanics Framework into NASMAT for Multiscale Analysis of Fiber-Reinforced Composites ***I. Kaleel, Marco Petrolo, E. Carrera, E.J. Pineda, T.M. Ricks, B.A. Bednarcyk, S.M. Arnold*** **[Invited]**	**Li Ma** **Jincheng Wang**
13:45-14:00	Geometrical Nonlinear Analysis of Shells by Carrera Unified Formulation ***Bin Wu, A. Pagani, W.Q. Chen, E. Carrera*** **[Invited]**	
14:00-14:15	Micromechanical Modeling and Experimental Characterization for the Elastoplastic Behavior of a Functionally Graded Material ***Liangliang Zhang, Qiliang Lin, Yang Gao, Huiming Yin***	
14:15-14:30	Stress Concentrations within Layered Hollow Spheres under Compression ***Lintong Yan, X.X. Wei***	
14:30-14:45	Low Velocity Impact Damage in AP-PLY Composite Laminates ***Weiling Zheng, C. Kassapoglou***	
14:45-15:00	Stochastic Multiscale Analysis of Wavy Cnt-Reinforced Ductile Damage Polymer Matrix Composites ***FeiYan Zhu, G.J. Yun***	
15:00-15:15	Preparation of Novel Damping Layered Silicates and its Application in Chlorinated Butyl Rubber (CIIR) Composites ***Ye Pan, Jincheng Wang, Siyuang Yang***	
15:15-15:30	Hiearchical Multiscale Modeling Approach for Environmentally Aged Polymer Nanocomposites ***Seunghwa Yang, S. Kwon, J. Moon, H. Shin, M. Cho***	
15:30-15:45	Steady-State Thermomechanical Analysis of Composite Laminated Plate with Damage Based on Extended Layerwise Method ***Dinghe Li, W. Shan, F. Zhang***	

S3: Computational Mechanics, S4: Fluid-Solid Interaction (Room II)		
Time	**Titles and Speakers**	**Chairs**
13:30-13:45	Assessment of Second Piola-Kirchhoff Stress Tensor in Laminated Composite Structures via Exact Geometry Sas Solid-Shell Elements ***M.G. Kulikov, S.V. Plotnikova, Gennady Kulikov*** **[Invited]**	**Chiara Bisagni** **Boyang Chen**
13:45-14:00	Design and Application of Multilayer Perceptron and Convolutional Neural Network for the Homogenization and Damage Pattern Prediction of Composite Substructures ***Boyang Chen, T.H. E. Gulikers, K. Venkatesan*** **[Invited]**	
14:00-14:15	Assessments on Stress Evaluations in Compact, Thin-Walled, FGM and Laminated Beams ***Munise Didem Demirbas, E. Carrera, M. Petrolo***	
14:15-14:30	Application of the Arc-Length Constraint to the Sparse Sampling-Based Nonlinear Model Order Reduction ***Jaehun Lee, M. Cho***	
14:30-14:45	Finite Element Analysis of Temperature and Stress Fields in Selective Laser Melting for Defects Prediction ***KangHyun Lee, G.J. Yun***	
14:45-15:00	Dynamical Analysis of Pipes Conveying Fluid Based on Ansys Workbench ***Haoran Yi, H.L. Dai***	
15:00-15:15	An Accurate Immersed Boundary Method for Fluid-Solid Interaction Simulation ***Yegao Qu, G. Meng*** **[Invited]**	**Lin Wang** **Zhen Lyu**
15:15-15:30	Theoretical Investigation on the Large-Deformation Dynamical Behaviors of Soft Pipe Conveying Fluid under Gravity ***Wei Chen, H.L. Dai, L. Wang***	
15:30-15:45	Experimental on Vortex-Induced Vibration of a Cylinder with Low Mass Ratio At High Reynolds Number ***Zhen Lyu, W.W. Zhang, X.T. Li, Q.Q. Diwu***	

S7: Mechanics of Soft Matter, S8: Biomechanics (Room III)		
Time	**Titles and Speakers**	**Chairs**
13:30-13:45	Continuum Micromechanics of Non-Affine Fiber Kinematics: Theory and Application to Arterial Tissues ***C. Morin, S. Avril, Christian Hellmich*** **[Invited]**	**Liqun Tang** **Tongqing Lu**
13:45-14:00	Effects of Osmotic Pressure in the Finite Indentation of Elastic Fluid Nanovesicles ***Xingyi Tang, Jianxiang Wang, Xin Yi*** **[Invited]**	
14:00-14:15	Elastography of Cell Nucleus: Understanding the Nonhomogeneous Biomechanical Behavior of Cell Nucleus ***Yue Mei*** **[Invited]**	
14:15-14:30	A Design Method to Customize Dental Implants for Patients with Various Bone Density ***Chang Liu, J.X. Lin, G. Zhang, Z.Y. Jiang, L.Q. Tang, K.Q. Lian***	
14:30-14:45	The Stiffness-threshold Conflict in Polymer Networks and a Resolution ***Yifan Zhou, W. Zhang, J. Hu, J. Tang, C. Jin, Z. Suo, T. Lu***	
14:45-15:00	Effect of Loading Rate on Elastic Properties of CNT-Polyethylene Nanocomposites and It's Interface Using MD Simulation ***Lanyu Liu, X.F. Gou***	
15:00-15:15	Alterations of Articular Cartilage and Subchondral Bone in Different Rat Osteoarthritis Models ***Q.Z. Tan, G.D. Niu, C.L. Song , Huijie Leng***	
15:15-15:30	Experimental and Theoretical Discussion on Soft Mechanical Metamaterials with Unusual Swelling Behavior ***Hang Zhang, X.G. Guo, J. Wu, X. Cheng, D.J. Yan, D.N. Fang, Y.H. Zhang***	
15:30-15:45	Mechanics of Growth for the Straightening of a Fern ***Xiaoyi Chen, H.H. Dai***	

S10: Metamaterials: Structural Design (Room IV)		
Time	**Titles and Speakers**	**Chairs**
13:30-13:45	Crack Identification of Functionally Graded Beam Based on Continuous Wavelet Transform and Mode Shape ***L.L. Ke, Lin-Feng Zhu*** **[Invited]**	**Seongmin Chang** **Hui Wang**
13:45-14:00	Establishing Digital Metamaterial Structural Genome Based on Machine Learning ***Jingyi Zhang, Y.W. Li, K. Zhang*** **[Invited]**	
14:00-14:15	Reanalysis Method Using Model Reduction Technique for Analysis and Design of Large-Scale Dynamic System ***Seongmin Chang, M. Cho*** **[Invited]**	
14:15-14:30	Controlling Sound Field with a Tunable Metasurface ***Tianyu Zhao, Y.W. Li, S.L. Zuo, K. Zhang***	
14:30-14:45	Novel Two- and Three-Dimensional Mechanical Metamaterial with Negative Poisson's Ratio ***Hui Wang, Yuxuan Zhang, Q.H. Qin***	
14:45-15:00	Band Gap and Nonreciprocal Transmission of Granular Nonlinear Phononic Crystals ***Lin-Shuai Wei, Yi-Ze Wang, Yue-Sheng Wang***	
15:00-15:15	Nonreciprocal Transmission of Solitary Waves in Elastic Wave Metamaterials with One-Dimensional Graded Bead Chain ***Qi Lu, Yi-Ze Wang, Yue-Sheng Wang***	
15:15-15:30	Active Metamaterials with Broadband Controllable Stiffness for Non-Reciprocal Wave Propagation ***Kaijun Yi, Morvan Ouisse, Gael Matten, Emeline Sadoulet-Reboul, Manuel Collet***	
15:30-15:45	The microstructure and performance of membrane and catalyst layer in PEMFC ***Cong Feng, Y. Li, K.N. Qu, P.F. He***	

S13: Peridynamics, S14: Non-local Theories (Room V)		
Time	**Titles and Speakers**	**Chairs**
13:30-13:45	On Softening and Hardening Behaviors of Equivalent Stiffness of Nanostructures ***Cheng Li, C.W. Lim, Muhammad*** **[Invited]**	**Qing Zhang** **Fei Han** **Cheng Li**
13:45-14:00	The Nonlinear PFEM Based on Non-Local State Theory ***Xiaozhou Xia, G. Lu, X. Gu, Q. Zhang***	
14:00-14:15	The Application of Peridynamic Method for the Evaluation of Thermal Ablation Problems ***Hui Li, L.P. Zhang, X.J. Shao, Y.X. Zhang***	
14:15-14:30	Peridynamic Modeling of Fiber-Reinforced Composite Materials ***Yile Hu, Y. Yu***	
14:30-14:45	Simulation of 2D Dynamic Fracture Using a Novel Volume-Compensated Peridynamic Lattice Model ***J.S. Guo, W.C. Gao, F.S. Li, Xiongwu Yang***	
14:45-15:00	A Class of Improved Contact Recognition Algorithms Based on Peridynamics ***Wei Peng Xiong, C. Wang, C.J. Cao, B. Yang***	
15:00-15:15	Transverse Vibration of a Class of Nanobeams with Torsional Spring Boundary Constraints ***P.Y. Wang, J.P. Shen, Cheng Li***	
15:15-15:30	Eshelby Integral in Nonlocal Elasticity ***Zaixing Huang***	
15:30-15:45	Hygro-Thermo-Mechanical Bending of Fg Porous Nanobeams Based on the Nonlocal Strain Gradient Theory ***Yansong Li***	

S19: Nanomechanics, S20: Thermal Stresses (Room VI)		
Time	**Titles and Speakers**	**Chairs**
13:30-13:45	Theoretical Characterizations on Temperature Dependent Mechanical Properties of Materials ***Weiguo Li, X. H. Zhang, J. X. Shao, H. B. Kou*** **[Invited]**	**Weiguo Li** **Kongjun Zhu**
13:45-14:00	Evolution of Hydrothermal Synthesis of NaV2O5 as a Novel Intercalation-Type Anode Material of Na-Ion Battery ***Kongjun Zhu, P. Liu*** **[Invited]**	
14:00-14:15	Multiaxial Hyperelasticity of Graphene ***Raphael Höller, V. Smejkal, F. Libisch, C. Hellmich***	
14:15-14:30	Oxygen Order in the Atomic Structure of Conductor Yba2cu3o7-X and its Correlation with Temperature and Pressure ***Xinyu Qu, X.F. Gou, J.J. Cao , T.G. Wang***	
14:30-14:45	Nanocrystallization in Single-Crystal Copper Under Laser Shock Compression ***Qilin Xiong, Takayuki Kitamurac, Zhenhuan Li***	
14:45-15:00	Modeling the Temperature Dependent Ultimate Tensile Strength for Unidirectional Ceramic-Fiber Reinforced Ceramic Composites ***Xin Zhang, W.G. Li, J.X. Shao***	
15:00-15:15	A Modelling Approach to Temperature-Dependent Yield Strength of Precipitation Strengthening Ni-Base Superalloys ***Jianzuo Ma, W.G. Li, H.B. Kou***	
15:15-15:30	Thermomechanical Fatigue of Fiber-Reinforced Ceramic-Matrix Composites ***Longbiao Li***	
15:30-15:45	Multiscale Model for the Prediction of Fatigue Crack Growth Behavior of Thermoset Polymer Nanocomposites ***Hyunseong Shin, M. Cho***	

Morning, October 22

Parallel Sessions	
S2: Structural Mechanics	**Room I**
S4: Fluid-Solid Interaction S5: Fatigue and Fracture Mechanics	**Room II**
S8: Biomechanics S9: Constitutive Model	**Room III**
S11: Dynamics and Vibration	**Room IV**
S15: Couple Stress Theories S16: Micropolar Elasticity	**Room V**
S21: Piezoelectric Sensors and Multi-field Coupling Mechanics S22: Atomic Force Microscopy (AFM)	**Room VI**

S2: Structural Mechanics (Room I)		
Time	**Titles and Speakers**	**Chairs**
8:30-8:45	Computational Semi-Analytical Method for the 3D Elasticity Solution for the Multi-field Problem Analysis of Multilayered Plates and Shells Structures ***J.C. Monge, José Mantari*** **[Invited]**	**Guohong Li** **Marco Petrolo**
8:45-9:00	Integrated Simulation of Powder-Temperature-Microstructure-Residual State Relationships in Laser Additive Manufacturing ***Zhao Zhang, X.X. Yao, P. Ge*** **[Invited]**	
9:00-9:15	Asymptotic Boundary Conditions via a Constrained Virtual Work Principle ***Jun-Sik Kim, M. Cho***	
9:15-9:30	Multiscale CUF-FE2 Nonlinear Analysis of Composite Beam Structures ***Yanchuan Hui, R. Xu, Q. Huang, J. Yang, H. Hu, G. Giunta, G. De Pietro, S. Belouettar, E. Carrera***	
9:30-9:45	Dynamic Response of the Steel Frame Structure under Explosive Load ***Wenjie Wang, W. Xu, Z.D. Xu***	
9:45-10:00	Graded Stiffness Design Strategy and Effective Crushing Distance of Grooved Tube Subjected to Axial Crushing ***Ru-Yang Yao, Z.Y. Zhao, G.S.Yin, B. Zhang***	
10:00-10:15	**Coffee Break**	
10:15-10:30	Evaluation of Shell Theory Performances via Neural Networks ***Marco Petrolo***	**Wenxiang Xu** **Deng'an Cai**
10:30-10:45	Finite Element Modeling of High Velocity Impact Behavior of Preloaded Fiber Metal Laminates ***Chao Zhang***	
10:45-11:00	Mechanical Properties of Defect-prefabricated 2.5D Twill Woven Composites ***Liming Xu, Xingyu Jin, Deng'an Cai, Guangming Zhou***	
11:00-11:15	Meso-FE Modelling of Progressive Damage in Textile Composites Using Cohesive Zones and Embedded Regions ***Fangzhou Lu, Qiang Liu, Guangming Zhou, Stepan V. Lomov***	
11:15-11:30	Investigation of Polyamide 12 and Thermoplastic Polyurethane Nanocomposites Fabricated by 3D Printing ***Shangqin Yuan, Fei Shen, Chee Kai Chua, Kun Zhou***	
11:30-11:45	The Application of Machine Learning in Osteoporosis of Ovariectomized Rats ***Y. Zhou, Z. Zhong, T.T. Guo***	
11:45-12:00	Particle-Chain Evolution and Constitutive Model of Magnetorheological Polishing Fluids with Hexagonal Close-Packed Structure ***W.L. Song, Z. Peng, S. Pang, K. Shan, N. Wang, S.B. Choi***	
12:00-13:00	**Lunch** **Venue: Taoli Yuan Restaurant**	

S4: Fluid-Solid Interaction, S5: Fatigue and Fracture Mechanics (Room II)		
Time	**Titles and Speakers**	**Chairs**
8:30-8:45	Influence of a Crack on the Vibration Characteristics of Cantilever Pipe Conveying Fluid ***Ziyang Hu, Lin Wang*** **[Invited]**	**Bin Wu** **Yegao Qu**
8:45-9:00	Fluid-Structure Interaction Analysis of Elastic Pipes with Gas-Liquid Two-Phase Flow ***Heng Su, Y.G. Qu, S.C. Zhou, Y. Zhou, T. Wu, Z.K. Peng***	
9:00-9:15	Study on Flutter Suppression Based on Dynamic Vibration Absorber ***Fuqing Luo, Z. Lyu, C.Q. Gao, W.W Zhang***	
9:15-9:30	Vibration and Stability Analysis of Lipid Nanotubes Conveying Protein Solution ***Zhihang Li, Yanqing Wang***	
9:30-9:45	Wave Dispersion in Viscoelastic Lipid Nanotubes Conveying Viscous Protein Solution ***Dongyu Cao, Yanqing Wang***	
9:45-10:00	Damage Localization of Smart Composite Laminates Using Deep Learning ***A. Khan, H.S. Kim, Nayeon Kim***	
10:00-10:15	**Coffee Break**	
10:15-10:30	Small Scale Effect on Wave Propagation Behaviors of Fluid Conveying Carbon Nanotube Based on Nonlocal Fluid Theory ***Q.H. Lin, W.H. Yan, Yang Yang***	**Bin Wu** **Yegao Qu**
10:30-10:45	Determination of the Interlaminar Tensile and Shear Strength of Woven Glass Fiber Reinforced Plastic Composite Laminates ***Masashi Suzuki, Kenichi Katabira, Fumio Narita***	**Yongxing Shen** **Mu Fan**
10:45-11:00	Modeling of Anisotropic and Asymmetric Plasticity Fully Coupled with Ductile Damage for HCP Metals ***Kai Zhang, H. Badreddine, K. Saanouni, J.L. Liu***	
11:00-11:15	Ferroelastic Toughening of Yttria-Stabilized Zirconia: A Phase Field Study ***Y.Z. Sun, J. Luo, Jingming Zhu***	
11:15-11:30	A Micromechanics-Based Phase Field Approach to Fracture ***Yangyuanchen Liu, Cheng Cheng, Yongxing Shen***	
11:30-11:45	The Mixed Thermohydrodynamic Analysis of A Worn Rolling Bearing ***Yao Ning, Xueqian Fang***	
11:45-12:00	Numerical Study on Dual Side-By-Side Inverted Flags in a Uniform Flow ***K. Jia, L. Fang, W.X. Huang***	
12:00-13:00	**Lunch** **Venue: Taoli Yuan Restaurant**	

S8: Biomechanics, S9: Constitutive Model (Room III)		
Time	**Titles and Speakers**	**Chairs**
8:30-8:45	Mechanics of the Brain ***Michel Destrade*** **[Invited]**	**Zhanli Liu** **Linli Zhu** **Michel Destrade**
8:45-9:00	Pattern Prescription in Growing Tubular Tis- Sues by Initial Residual Stress ***Yangkun Du, Chaofeng Lü, C. Liu, Z. Han, J. Li, W. Chen, S. Qu, M. Destrade*** **[Invited]**	
9:00-9:15	A Unified Hierarchical Structural Model for Rheology of Living Cells ***Jiu-Tao Hang, Guang-Kui Xu***	
9:15-9:30	The Effect of Microstructure on the Strain Energy Storage of Semi-Lunar Process Cuticle for Locust Jumping ***C. Wan, Xiaoyong Chen, Z.X. Hao***	
9:30-9:45	Chiral Morphologies of Biological Materials Induced by the Interplay Between Chirality and Anisotropy of Structural Elements ***Huichuan Zhao, Jianshan Wang***	
9:45-10:00	Bio-Inspired Structure to Achieve Superlubricity ***D. Yuan, Weifeng Yuan***	
10:00-10:15	**Coffee Break**	
10:15-10:30	Non-Linear Analysis of the Human Eye by Using 2D Elements with 3D Capabilities under the Unified Formulation of Carrera ***Roy Panduro, J.L. Mantari, Ahmed Elsheikh***	**Zhanli Liu** **Linli Zhu** **Michel Destrade**
10:30-10:45	Constitutive Modeling of Dynamic Failure Behavior of Segmented Copolymers under Impact Loading ***Zhanli Liu, Dongyang Chu, Kaili Yao, Zhuo Zhuang***	
10:45-11:00	Modeling the Constitutive Behaviors in Novel Nanostructured Metallic Materials ***Linli Zhu***	
11:00-11:15	Mechanics of Nanofibers Packing in Vesicles: Effects of Fiber Length, Radius, and Elasticity ***Zeming Wu, Chao Shi, Xin Yi***	
11:15-11:30	Study of Aneurysm Formation as A Bifurcation Problem in Inflated Bilayer Tubes ***Yang Liu, Yang Ye, Ali Althobaiti, Yu-Xin Xie***	
11:30-11:45	Modeling the Thermomechanical Behavior and Constrained Recovery Performance of Cold-Programmed Amorphous Shape-Memory Polymers ***Rui Xiao***	
11:45-12:00	Stress Evolution in Elastic-Plastic Electrodes during Electrochemical-Mechanical Coupling ***Jici Wen, Y. Wei, Y.T. Cheng***	
12:00-13:00	**Lunch** **Venue:** **Taoli Yuan Restaurant**	

S11: Dynamics and Vibration (Room IV)		
Time	**Titles and Speakers**	**Chairs**
8:30-8:45	Axially Functionally Graded Structures and Their Excellent Capabilities for Passive Panel Flutter and Thermal Buckling Suppression ***Zhiguang Song, Jincheng Sha, Fengming Li*** **[Invited]**	**Lifeng Wang** **Zhiguang Song**
8:45-9:00	Free Vibration Analysis of Functionally Graded Graphene-Reinforced Composite Laminated Plates with New Admissible Functions ***Miao Wang, Z.M. Li, Y.G. Xu***	
9:00-9:15	Nonlinear Free Vibration of Polymeric Rectangular Plates Reinforced with 3D Graphene Foams ***Mei-Wen Teng, Yan-Qing Wang***	
9:15-9:30	Global Analysis of A Rotor in Permanent Magnet Synchronous Motor Considering Unbalanced Magnetic Pull ***Gang Chen, F.L. Liu***	
9:30-9:45	Study on Increasing or Decreasing Resistance Characteristics of Miura Ori Patterned Metamaterials ***Ji Zhang, Chang-Guo Wang, Qiang Tao, Xiang-Qiao Yan***	
9:45-10:00	Smart Shaft Based on a Metasurface for Vibration Sources Identification ***Chong Li, Tianxi Jiang, Qingbo He***	
10:00-10:15	**Coffee Break**	
10:15-10:30	Design and Analysis of Composite L-Shaped Joints ***Qi Zhang, Deng'an Cai, Liming Xu, Guangming Zhou***	**Xingyu Zhang**
10:30-10:45	Sub-Wavelength Imaging Using Acoustic Meta-Material Lens with Discrete Concentric Rings ***Heng Lu, Han Zhang, Zi Long Dou***	
10:45-11:00	The Wave Motion and Vibration of Axially Moving Continua with Varying Supports ***L. Lu, X.D. Yang***	
11:00-11:15	Study on the Cropped Edges Cut by Cutting Machine for the Orthotropic Paper Based on Cohesive Zone Model ***Yong-Jian Wang***	
11:15-11:30	Bending Stress Concentration in a Functionally Graded Thin Plate with a Circular Hole ***Yun Li, Quanquan Yang***	
11:30-11:45	Double Hysteresis Loops in Ferroelectrics with Electrodes ***Cheng Huang***	
11:45-12:00	Electric-current Induced Thermal Stress around a Non-Circular Rigid Inclusion in a Nonlinear Thermoelectric Material ***Hai-Bing Yang***	
12:00-13:00	**Lunch** **Venue:** **Taoli Yuan Restaurant**	

S15: Couple Stress Theories, S16: Micropolar Elasticity (Room V)		
Time	**Titles and Speakers**	**Chairs**
8:30-8:45	Classification of the Transient Waves in Cosserat-Type Shell Structures ***Marina V. Shitikova*** **[Invited]**	**Liao-Liang Ke** **Gongye Zhang**
8:45-9:00	Identification of Constitutive Parameters of Materials with Coupled Stress Effect from Full-field Displacement Measurements ***Iksu Jeong, Maenghyo Cho***	
9:00-9:15	Sliding Frictional Contact of a Coated Half-Plane with Couple Stress ***Hongxia Song, L.L. Ke, Y.S. Wang, X.L. Gao***	
9:15-9:30	Elastic Wave Propagation in 2-D Periodic Three-Phase Composites with Coated Star-Shaped Inclusions and an Orthotropic Matrix ***Gongye Zhang, X.L. Gao***	
9:30-9:45	Bending and Free Vibration Analysis of Timoshenko Nanobeams Based on Nonlocal Strain Theory ***Peng Jiang, Q. Hai***	
9:45-10:00	Theoretical Analysis of Bending, Buckling and Vibration for a FGM Circular Timoshenko Beam Based on the Modified Couple Stress Theory and Surface Elasticity ***Jian-Qiang Zhang, Hai Qing***	
10:00-10:15	**Coffee Break**	
10:15-10:30	A Two-Variable Beam Model Based on Modified Couple Stress Theory and Surface Elasticity ***Pengbo Wang, H. Qing***	**Zaixing Huang** **Hai Qing**
10:30-10:45	Mises Flow Equations For Gradient Plasticity with Isotropic and Kinematic Hardening ***A.S. Borokinni, O.O. Fadodun,*** ***B.A. Olokuntoye , O.P. Layeni1, A.P. Akinola***	
10:45-11:00	Theoretical Analysis for Static Bending of Circular Nanobeams Based on Stress-Driven Nonlocal Integral Model ***Pei Zhang, H. Qing***	
11:00-11:15	Hydrogen Fossil Graphene Origami Inspired by Origami Technology ***Shuai Luo, Yun Qiu, Yang Zhang***	
11:15-11:30	Free Vibration of DWCNT Based on the Stress-Driven Nonlocal Model Using DQM ***Chang Li, Hai Qing***	
11:30-11:45	Thermo-Electro-Elastic Field in a Piezoelectric Strip ***Shi-Chao Xing*****, Chuanbin Yu**	
11:45-12:00	Indentation of an elastic soft thin layer with surface tension by a rigid cylinder ***Min Li***	
12:00-13:00	**Lunch Venue: Taoli Yuan Restaurant**	

S21: Piezoelectric Sensors and Multi-field Coupling Mechanics, S22: Atomic Force Microscopy (AFM) (Room VI)		
Time	**Titles and Speakers**	**Chairs**
8:30-8:45	Voltage-Driven Magnetization Switching in Magnetoelectric Heterostructure ***Min Yi***	**Min Yi** **Yunya Liu**
8:45-9:00	Modeling the Effect of Temperature on Mechanical Properties of Fiber Reinforced Ceramic-Matrix Composites ***Yong Deng, Weiguo Li***	
9:00-9:15	3D Thermo-Electro-Chemo-Mechanical Coupled Modeling of Solid Oxide Fuel Cell with Double-Sided Cathodes ***Congying Jiang, Y.C. Gu, W.B. Guan, J.H. Zheng, M. Ni, Z. Zhong***	
9:15-9:30	Structural Design and Thermal Analysis for Inflatable Reflector ***Jianzheng Wei, G.C. Lin, L. Yu, H.F. Tan, D. Li, J.X. Zhang***	
9:30-9:45	Characteristics of Complex Guided Waves in Functionally Graded Piezoelectric Bars with Rectangular Cross-Sections ***Xiaoming Zhang, Tao Chen, Jiangong Yu***	
9:45-10:00	Thermal Residual Solutions of Composite Laminates by 3D Printing ***Xiaoping Shu, Z. Zhang***	
10:00-10:15	**Coffee Break**	
10:15-10:30	Dynamic Analysis of Smart Composites Through Node-Dependent Kinematic Plate Models ***Guohong Li, E. Zappino, E. Carrera***	**Min Yi** **Guohong Li**
10:30-10:45	Analytical Solutions for Unidirectional Elasto-Piezoelectric Composites under Far-Field Loading ***Guannan Wang, Q. Chen, B. Yang***	
10:45-11:00	Flexoelectric Actuation and Vibration Control of Conical Shells ***Han Qiu, M. Fan, H.S. Tzou***	
11:00-11:15	Effect of Circuit Conditions on Natural Frequencies of Smart Beams: Geometrically Exact Approach ***P.M.G. Bashir Asdaque, Sitikantha Roy***	
11:15-11:30	Epitaxial Growth of Graphene Buffer Layer on 6H-SiC and Thermal Transport at Heterogeneous Interface ***Bing Yang, Jianming Yang, Ping Yang***	
11:30-11:45	Nanomechanics of Pb (Zr0.52ti0.48) O3-Cofe2o4 Multiferroic Composite Nanofibers ***Q.F. Zhu, K. Pan, Shuhong Xie, Y.Y. Liu, J.Y. Li***	
11:45-12:00	High Fidelity Direct Measurement of Local Electrocaloric Effect by Scanning Thermal Microscopy ***Yunya Liu, Dongliang Shan, Kai Pan, Jiangyu Li***	
12:00-13:00	**Lunch Venue: Taoli Yuan Restaurant**	

Afternoon, October 22

S2: Structural Mechanics	**Room I**
Plenary and Closing Ceremony	
S5: Fatigue and Fracture Mechanics	**Room II**
S11: Dynamics and Vibration	**Room IV**
S19: Nanomechanics	**Room V**
S21: Piezoelectric Sensors and Multi-field Coupling Mechanics	**Room VI**

S2: Structural Mechanics (Room I)		
Time	**Titles and Speakers**	**Chairs**
13:30-13:45	Discontinuous Galerkin Formulation for Layer-Wise Analysis of Composite Plates ***V. Gulizzi, I. Benedetti, A. Milazzo***	**Mu Fan**
13:45-14:00	Microstructure Simulation and Constitutive Modelling of Magnetorheological Fluids Based on Hexagonal Close-Packed Structure ***W.L. Song, Z. Peng, C.L. Ye, J.W. Gao, N. Wang, S.B. Choi***	
14:00-14:15	Acoustic Reflection/Transmission Coefficients at Liquid-Solid Interface of Prestressed Thin Plate ***Guorong Song, Xiaoyu Du, Yan Lyu, Yuchen Shi, Cunfu He, Binpeng Zhang***	
14:15-14:30	Experimental Study on the Axial Compression of GRP-Concrete-PVC Tube Composite Column ***Y. Yu , Z.J. Wu, H.W. Guan***	

S5: Fatigue and Fracture Mechanics (Room II)		
Time	**Titles and Speakers**	**Chairs**
13:30-13:45	Study on Fatigue Damage Constitutive Model of Shape Memory Alloy ***B.F. Liu, S.Y. Jin***	**Zhaolin Chen**
13:45-14:00	An I-Integral for a Permeable Crack in a Ferroelectric Solid ***H.J. Yu, M.H. Zhao, X.R. Wu, L.C. Guo***	
14:00-14:15	An Experimental and Computational Investigation of Length-Scale Effects on Fracture at the Nanoscale ***S. Roy, J. Bodiuzzaman, S. Nakarmi, T. Sohail***	

S11: Dynamics and Vibration (Room IV)		
Time	**Titles and Speakers**	**Chairs**
13:30-13:45	Free Vibration of Functionally Graded Sandwich Truncated Conical Shell Using Improved Shear Deformation Theory ***Meixiang Wang, Yuxin Hao, Wei Zhang***	**Yan Deng**
13:45-14:00	Study on Acoustic-Vibration Coupling Characteristics of Functionally Graded Sandwich Plates ***Y.X. Chen, F.L. Li***	
14:00-14:15	Development of Multi-Channel Guided Wave System and Its Application on the Plate Examination by Total Focus Imaging Algorithm ***Yan Lyu, Huaxing Hong, Guorong Song***	
14:15-14:30	Finite Element Modeling and Simulation of Damping Laminated Structures ***Y.S. Gao, S.Q. Zhang***	

S19: Nanomechanics (Room V)		
Time	**Titles and Speakers**	**Chairs**
13:30-13:45	Effect of Grain Boundary on Vortex Motion in Polycrystalline Superconducting Films ***Yu Liu, X. F. Gou***	**Deng'an Cai**
13:45-14:00	Finite Element Modeling and Simulation of Grain Size Measurement by Ultrasonic Transmission Method ***Guorong Song, Shuo Wang, Yan Lyu***	
14:00-14:15	Buckling and Postbuckling of Graphene Platelets Reinforced Functionally Graded Plates with Dielectric Property ***C. Feng, Y. Wang, J. Yang***	
14:15-14:30	Prediction of Interface Stiffness of Single-Walled Carbon Nanotube Reinforced Polymer Composites by Shear-Lag Model ***Yan-Gao Hu, Y.F. Li, J. Han, C.P. Hu, Zh.H. Chen, S.T. Gu***	

S21: Piezoelectric Sensors and Multi-field Coupling Mechanics (Room VI)		
Time	**Titles and Speakers**	**Chairs**
13:30-13:45	Quantitative Observation of Micromagnetic Structure Based on Magneto-Optical Method ***Jinbo Yang, Cong Liu, Jun Zhou, Xingyi Zhang***	**Kun Song**
13:45-14:00	Weibull Analysis of the Delamination Strength of YBCO Coated Conductors at Both Room and Liquid Nitrogen Temperatures ***Ce Sun, Cong Liu, Jun Zhou, Xingyi Zhang***	
14:00-14:15	Electroelastic Deformation of Semilinear Hyperelastic Circular Tube ***Odunayo Fadodun, A.S. Borokinni ,*** ***B.A. Olokuntoye, O.P. Layeni, A.P. Akinola***	
14:15-14:30	Experiment and Simulation of the Magnetic Film in Electromagnetic-Assisted Transfer Printing ***Qingmin Yu, Xudong Yu, Honglei Zhou***	

Plenary (Room I)		
14:30-15:10	Dynamic Strain based Piezoresponse Force Microscopy for Advanced Functional Materials: When Mechanics Meets "Big" Data **Speaker: Jiangyu Li** (Shenzhen Institutes of Advanced Technology, Chinese Academy of Science, China)	**Kongjun Zhu**
15:10-15:30	**Closing Ceremony**	**Arun R. Srinivasa**

General Information

◆ Conference Language

The official language of the ICMAMS2019 is English.

◆ Registration and Information Desk

- October 19, the Lobby of Yuyuan Hotel
- October 20-22, Yifu Hall

◆ Registration Fee

- Early Registration: 350 EUR/ 400 USD/ 2500 CNY
- On-site Registration: 420 EUR/ 475 USD/ 3250 CNY

◆ Hotel Information

- The Grand Metropark Hotel Nanjing

Address: No.319, East Zhongshan Road, Nanjing, Jiangsu, China

Tel: 025-84808888

Website: http://en.grandmetropark-hotel.com/

- Yuyuan Hotel

Address: No.30,Yudao Street, Nanjing, Jiangsu, China

Tel:025- 84893434

◆ Catering

- **Lunch:** October 20–22
  Taoliyuan Restaurant, 3rd Floor of the First Student Canteen.
- **Dinner:** October 19, Dining Room of Yuyuan Hotel
  October 20, Taoliyuan Restaurant, 3rd Floor of the First Student Canteen.
- **Banquet:** October 21, Mingfa Pearl Hotel

◆ Contacts

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Maps and Transportation

◆ Conference Maps

➢ In ICMAMS 2019, most constructions are located inside the Ming Palace Campus of Nanjing University of Aeronautics and Astronautics :

➢ **Main Venue of ICMAMS 2019**

◆ Conference Transportation

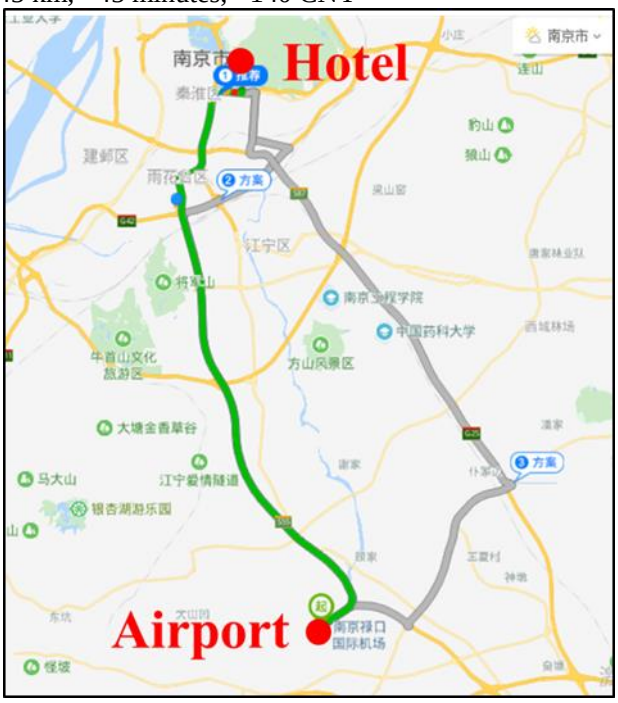
The Yuyuan Hotel and **the Grand Metropark Hotel, Nanjing** are very near to each other and located near to the metro station "**Ming Palace Station**".

- From **Nanjing Lukou International Airport** to **the Yuyuan Hotel** and **the Grand Metropark Hotel, Nanjing**:

  I. By **metro**: ~85 minutes, 7 CNY

  First, take metro line S1 from "Lukou Airport Station" to "Nanjing South Station". Then, transfer to metro line 1 and take it to "Xinjiekou Station". Transfer again to metro line 2 and take it to "Ming Palace Station". Last, walk straight to the south for about 550 m to the Yuyuan Hotel, or walk straight to the east for about 400 m to the Grand Metropark Hotel, Nanjing.

  II. By **taxi**: ~45 km, ~45 minutes, ~140 CNY



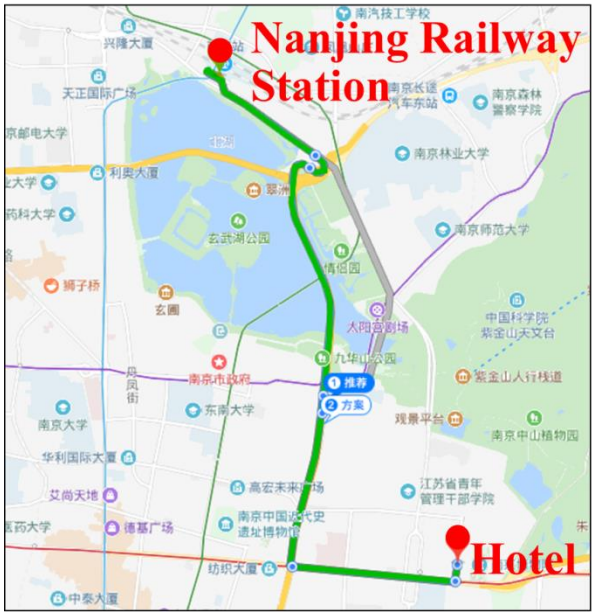
- From **Nanjing South Railway Station** to t**he Yuyuan Hotel** and t**he Grand Metropark Hotel, Nanjing**:

  I. By **metro**: ~45 minutes, 3 CNY

  First, take metro line 1 from "Nanjing South Station" to "Xinjiekou Station". Transfer to metro line 2 and take it to "Ming Palace Station". Last, walk straight to the south for about 550 m to the Yuyuan Hotel, or walk straight to the east for about 400 m to the Grand Metropark Hotel, Nanjing.

  II. By **taxi**: ~10 km, ~30 minutes, ~30 CNY

- From **Nanjing Railway Station** to **the Yuyuan Hotel** and **the Grand Metropark Hotel, Nanjing**:
  - **I.** By **metro**: ~35 minutes, 2 CNY
    First, take metro line 1 from "Nanjing Railway Station" to "Xinjiekou Station". Transfer to metro line 2 and take it to "Ming Palace Station". Last, walk straight to the south for about 550 m to the Yuyuan Hotel, or walk straight to the east for about 400 m to the Grand Metropark Hotel, Nanjing.
  - **II.** By **taxi**: ~8.5 km, ~20 minutes, ~25 CNY



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