

The 35th International Conference on
**Adaptive Structures
and Technologies**

———— ICAST 2026 ————

Hong Kong, China | 1-3 June 2026



Conference Handbook

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icast2026@ust.hk

WELCOME TO ICAST2026

The International Conference on Adaptive Structures and Technologies (ICAST) is a series of esteemed conferences that began in 1990 as a collaborative USA-Japan event held in Maui. Over the past three decades, ICAST has taken place at various venues across North America, Asia, and Europe. ICAST 2026 marks the 35th iteration of this successful series, aiming to unite researchers delving into a wide array of topics related to smart and adaptive structures.

ICAST 2026 aims to provide an international platform for researchers from all over the world to exchange ideas to advance the development of the related technologies. The conference covers a wide range of topics in smart materials, structures, tools and applications, which relates to mechanical, civil, biomedical, electrical, and aerospace engineering, materials and computer science and engineering.

Hong Kong is a world-renowned international metropolis, seamlessly blending rich traditions with cutting-edge innovation. As a global financial hub, the city is also making strides in sustainability and smart-city initiatives. Nestled among stunning natural landscapes, from its iconic Victoria Harbour to its verdant mountains and coastlines, Hong Kong offers a unique juxtaposition of urban dynamism and natural beauty. Known for its vibrant multicultural atmosphere and world-class infrastructure, Hong Kong serves as a gateway to the Asia-Pacific region and beyond. Attending ICAST 2026 in Hong Kong will not only give you the opportunity to engage with leading scholars but also to explore the city's advanced research facilities and innovation ecosystem. Participants will experience Hong Kong's unparalleled hospitality, enjoy its diverse culinary scene, and witness firsthand the city's dedication to sustainable growth and technological advancement.

Organized by the Smart Transducer and Vibration Lab, ICAST 2026 will be hosted at the Hong Kong University of Science and Technology (HKUST).

We invite you to join us at ICAST 2026, and we look forward to meeting you in Hong Kong!



Prof. Zhengbao Yang
General Chair of the ICAST2026 Conference
Hong Kong University of Science and Technology
Email: icast26@ust.hk

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Prof. Wei-Hsin Liao, Chinese University of Hong Kong
Prof. Wen-Jong Wu, National Taiwan University

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As a major branch of Mechanical Engineering and other engineering disciplines, Aerospace Engineering deals with the design, development, construction, and testing of aircraft and spacecraft and their related systems and technology. Aerospace Engineering covers the operation of these vehicles both within the earth's atmosphere and outside it.

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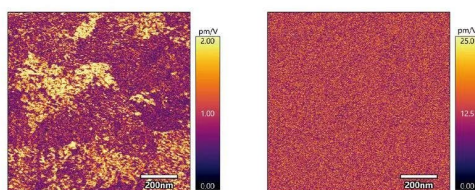
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Conference Host

The Hongkong University of Science and Technology (HKUST)



The Hong Kong University of Science and Technology (HKUST) is a public university in Sai Kung District, New Territories, Hong Kong. Founded in 1991, it was the territory's third institution to be granted university status, and the first university without any precursory existence upon its formation. It occupies a 60-hectare (150-acre) seaside site in Tai Po Tsai, Clear Water Bay Peninsula.

The university is organised into five academic schools: School of Engineering, School of Business and Management, School of Science, School of Humanities and Social Science, and the Academy of Interdisciplinary Studies. In the 2023–24 academic year, it enrolled around 10,000 undergraduates and 6,800 postgraduates, and employed 903 academic staff.

Conference Venue

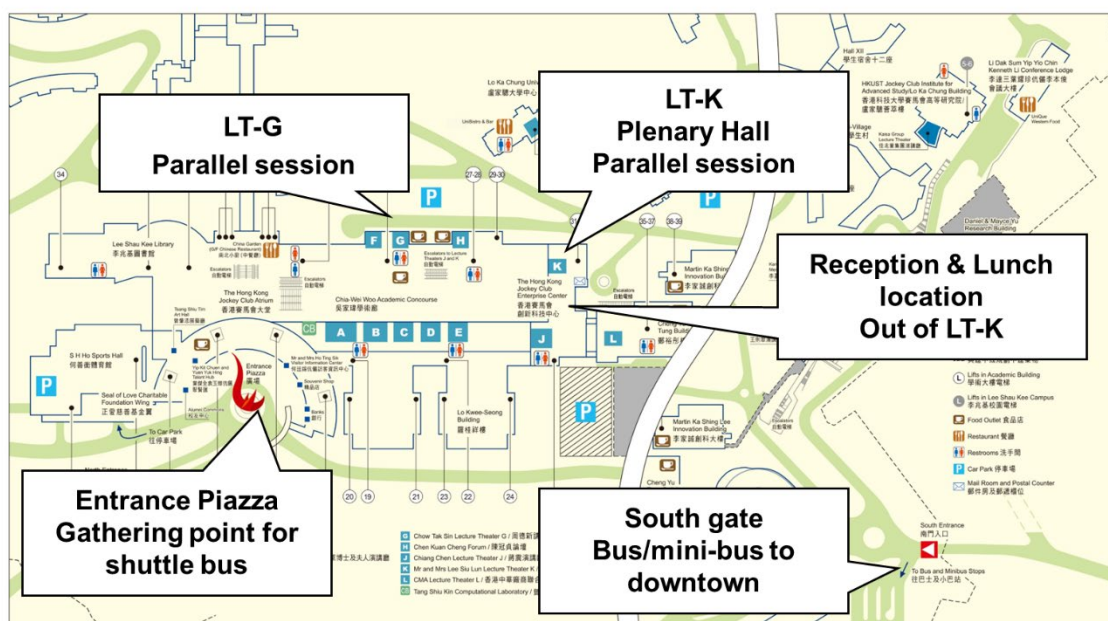
The conference will be held at the campus of Hong Kong University of Science and Technology (HKUST).

Plenary hall: LT-K

Parallel Session: LT-K & LT-G

Poster location: outside LT-K

Lecture Theaters and Lift Location
The Hong Kong University of Science and Technology



Special Issue Opportunities

To further promote the dissemination of high-quality research presented at ICAST 2026, selected authors and conference participants will be invited to submit extended versions of their work to special issues in the following journals:

Smart Materials and Structures

<https://iopscience.iop.org/journal/0964-1726>

A special issue will be organized in Smart Materials and Structures for contributions related to the themes of ICAST 2026, including smart materials, adaptive structures, sensing and actuation, structural dynamics, vibration control, energy harvesting, robotics, and related interdisciplinary advances.

Journal of Intelligent Material Systems and Structures

<https://journals.sagepub.com/home/JIM>

A special issue will also be organized in the Journal of Intelligent Material Systems and Structures for contributions in intelligent materials, multifunctional structures, adaptive systems, structural control and monitoring, modeling and simulation, and advanced engineering applications associated with the conference themes.

Note: Submission to ICAST 2026 does not guarantee journal acceptance. All manuscripts will be handled according to the standard editorial and peer-review procedures of the respective journals.

Program at a glance

Date	Time	Schedule		
31 May 2026	15:00 - 18:00	Registration/ Poster Setup & Mounting		
	18:00 – 19:00	Welcome reception Location: Out of LT-K		
1 June 2026	08:00 – 08:30	Opening ceremony & Group photo Location: LT-K	Poster Chair: Prof. W.-J. Wu	
	08:30 - 09:05	Plenary: <i>Embodying programmability and Mechano-Intelligence in Adaptive Meta-structures</i> Prof. Kon-Well Wang, University of Michigan, USA Location: LT-K	Venue: LT-K Chair: Prof. Jinsong Leng	
	09:10 - 09:45	Plenary: <i>Shape Memory Polymer Composites: Programmability, 4D Printing and Applications</i> Prof. Jinsong Leng, Harbin Institute of Technology, China Location: LT-K	Venue: LT-K Chair: Prof. Kon-Well Wang	
	09:45 - 10:10 Coffee Break & Lion Dance Performance			
	10:10 – 12:30	Technical Session 1 LT-K		
	12:30 – 13:30 Lunch (Buffet, out of LT-K)			
	13:30 – 15:30	Technical Session 2 LT-K	Technical Session 3 LT-G	
	15:30 – 16:10	Editors' Roundtable Discussion. Moderator: Prof W.H. Liao LT-K		
	16:00- 16:30	Coffee Break & Poster Viewing (Location: Out of LT-K)		
	16:30 – 18:10	Technical Session 4 LT-K	Technical Session 5 LT-G	
	18:30 – 21:00	Conference Excursion: Victoria Harbour Night Cruise Gathering point: Entrance Piazza (only for the registered)		

2 June 2026	08:20 – 09:00	ICAST Steering Committee Meeting	Venue: LT-K Chair: Prof. Zhengbao Yang
	08:20 – 09:20 Coffee Break & Poster viewing (Out of LT-K)		
	09:20 – 12:30	Technical Session 6; LT-K	Technical Session 7 LT-G
	12:30 – 13:30 Lunch (Buffet, out of LT-K)		
	13:30 – 16:30	Technical Session 8 LT-K	
		16:30 – 16:50 Coffee Break & Poster Viewing (Location: Out of LT-K)	
	16:50 – 17:20	Award Ceremony (Location: LT-K)	
3 June 2026	8:00- 16:00	Independent Exploration	
	16:00 – 17:00	Lab Tour	
	17:00 – 20:00	Conference Excursion: Horse racing at the Jockey Club Gathering point: Entrance Piazza (only for the registered)	

Date: June 1 Morning

Technical Session 1. Venue: LT-K

Chairs: Prof. Jinglei Yang, Hong Kong University of Science and Technology

Prof. Hanxing Zhao, Harbin Institute of Technology

Prof. Tore Butlin, University of Cambridge

Time	Activity	Speaker	Title
10:10 – 10:35	Keynote Speaker	Prof. Shujun Zhang City University of Hong Kong	Piezoelectric Materials for Electromechanical Applications
10:35 – 11:00	Keynote Speaker	Prof. Mary Frecker Penn State University	Inverse Design of Compliant Adaptive Structures Together
11:00 – 11:25	Keynote speaker	Prof. Yanju Liu Harbin Institute of Technology	Shape Memory Polymer Composites and Their Biological Applications
11:25 – 11:40	Invited speaker	Prof. Wen-Jong Wu National Taiwan University	Development of Airborne Piezoelectric Micromachined Ultrasound Transducer Phased Array with Process Optimization for Three-Dimensional Spatial Range Detection System
11:40 – 11:55	Invited speaker	Prof. Hanxing Zhao Harbin Institute of Technology	Numerical Prediction and Experimental Analysis of the Buckling Loads of SMPC Cylindrical Shells
11:55 – 12:10	Invited speaker	Prof. Tore Butlin University of Cambridge	Generalised energy harvesting bounds for combined translational and rotational base excitation
12:10 – 12:25	Invited speaker	Prof. Jinglei Yang Hong Kong University of Science and Technology	Ionic Liquid-based Shear Thickening Fluid: A Versatile Energy Absorption Medium for Space Exploration

12:25 – 12:30	Transition / Discussion
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Date: June 1 Afternoon

Technical Session 2. Venue: LT-K

Chairs: Prof. Jovana Jovanova, TU Delft

Prof. Yang Lu, University of Hong Kong

Time	Activity	Speaker	Title
13:30 - 13:55	Keynote Speaker	Prof. Ramin Sedaghati Concordia University	Magnetoactive Soft Continuum Robots Under Nonuniform Magnetic Fields: Three-Dimensional Magneto-Viscoelastic Model and Experimental Validation
13:55 – 14:20	Keynote Speaker	Prof. Jae-Hung Han KAIST	Structural Issues of Small Satellites and Some Solutions: Experiences from KAIST Satellite Programs
14:20 – 14:45	Keynote Speaker	Prof. Yang Lu University of Hong Kong	Multifunctional Microlattice Mechanical Metamaterials
14:45 – 15:10	Keynote Speaker	Prof. Jinjun Shan York University	Dynamics and Control of Smart Structures for Space Applications
15:10 – 15:25	Invited speaker	Prof. Jovana Jovanova TU Delft	Embodied Magnetic Actuation and Local Stiffness Modulation for Origami Robotics
15:25 – 15:30	Transition / Discussion		

Date: June 1 Afternoon

Technical Session 3. Venue: LT-G

Chairs: Prof. Yingxiang Liu, Harbin Institute of Technology

Prof. Guangdong Sui, Harbin Institute of Technology

Prof. Chengjun Zeng, Harbin Institute of Technology

Time	Activity	Speaker	Title
13:30 – 13:55	Keynote speaker	Prof. Yingxiang Liu Harbin Institute of Technology	Recent Progress of Piezoelectric Actuators and Piezoelectric Robots
13:55 – 14:10	Invited speaker	Prof. Guangdong Sui Harbin Institute of Technology	Dual-function of Isolation and Energy Harvesting via a Spatial Cam-Induced Multi-Stable Structure
14:10- 14:25	Invited speaker	Prof. Chengjun Zeng Harbin Institute of Technology	4D Printed Reconfigurable Metamaterial Sensors
14:25- 14:40	Invited speaker	Dr. Bin Dong Hong Kong University of Science and Technology	Optimization, Slicing, and Additive Manufacturing of Periodic-Surface-based Lattice Structure under Manufacturing Constraints
14:40– 14:55	Invited speaker	Dr. Hao Wang Xi'an Jiaotong University	Circular Halbach Flexible Electromagnetic Energy Harvesting from Rotating Machinery
14:55– 15:10	Invited speaker	Dr. Liangfen Du Hong Kong Polytechnic University	Directional Control of Noise Transmission via Ultracompact Acoustic Metagrating Barriers
15:10 – 15:25	Invited speaker	Dr. Bo Yun Xi'an University of Science and Technology	Numerical Study on WIV Energy Harvesting of a Trailing Cylinder in Triangular Multi-Cylinder Arrangement
15:25 – 15:40	Invited speaker	Dr. Zhenyu You Hong Kong University of Science and Technology	A Spinning Metamaterial for Integrated Kinetic Energy Harvesting and Sustained Heterogeneous Motion

Date: June 1 Afternoon

Technical Session 4. Venue: LT-K

Chairs: Prof. Junrui Liang, Shanghai Tech University

Prof. Wenbin Kang, City University of Hong Kong

Time	Activity	Speaker	Title
16:30 – 16:55	Keynote speaker	Prof. Yong (Eric) Chen National Research Council Canada	Demonstration of An Active Seat Mount System for Aircrew Whole-Body Vibration Mitigation on Three Representative Helicopter Platforms
16:55 – 17:20	Keynote speaker	Prof. Jiong Tang University of Connecticut	Temporal Modulation of Piezoelectric Shunt-Supported Metasurfaces – The Fifth Dimension Exploration
17:20 – 17:45	Keynote speaker	Prof. Li Zhang The Chinese University of Hong Kong	Bioinspired and Biohybrid Designs of Small-Scale Robotics
17:45– 18:00	Invited speaker	Prof. Junrui Liang Shanghai Tech University	Mechanical Energy Harvesting from Quasi-static Motions for Battery-Free IoT Applications
18:00 – 18:15	Invited speaker	Prof. Wenbin Kang City University of Hong Kong	Mechanical Energy Harvesting: From Piezoelectric Effect to Ferroelectric Switching
18:15 – 18:30	Transition		

Date: June 1 Afternoon

Technical Session 5. Venue: LT-G

Chairs: Prof. Hong Hu, Harbin Institute of Technology

Prof. Ying Zhang, Xi'an Jiaotong University

Prof. Yaohua Feng, ShanghaiTech University

Time	Activity	Speaker	Title
16:30 – 16:55	Keynote speaker	Prof. Xuanlai Fang Hongkong University	Metamaterials for Soft Actuators And Physical Intelligence
16:55 – 17:10	Invited speaker	Prof. Hong Hu Harbin Institute of Technology	Reader-Side Simulation and Enhanced Echo Frequency Estimation for Passive Wireless Resonant SAW Interrogation
17:10 – 17:25	Invited speaker	Prof. Ying Zhang Xi'an Jiaotong University	Nonlinear Magnetically Coupled Vibration Utilization and Control
17:25 – 17:40	Invited speaker	Prof. Yaohua Feng ShanghaiTech University	Mechanical Energy Harvesting from Quasi-static Motions for Battery-Free IoT Applications: A Review
17:40 – 17:55	Invited speaker	Dr. Jian Wang The Hong Kong University of Science and Technology	Physics-Informed Data-Model Interaction for 3D High-Resolution Melt Pool Temperature Reconstruction and Layer-Wise Optimization in LPBF
17:55 – 18:10	Invited speaker	Dr. Baiyang Song Shanghai Jiao Tong university	Flow-structure interaction of a flexible plate attached to a circular cylinder
18:10 – 18:30	Transition		

Date: June 2 Morning

Technical Session 6. Venue: LT-K

Chairs: Prof. Xiaotian Zhang, Hong Kong University of Science and Technology

Prof. Zhengxian Liu, Harbin Institute of Technology

Prof. Jian Sun, Harbin Insititue of Technology

Time	Activity	Speaker	Title
09:20 – 09:45	Keynote speaker	Prof. Wei-Hsin Liao The Chinese University of Hong Kong	Journey from Vibration, Energy Harvesting, to Human Motion
09:45 – 10:10	Keynote speaker	Prof. NAM SEO GOO Konkuk University	Modal Identification of a Thermally Vibrated Plate Using 3D-DIC and Physics-Informed Neural Networks
10:10 – 10:35	Keynote speaker	Prof. Alper Erturk Georgia Institute of Technology	Vibration and Wave Engineering from Hz to MHz Range via Next-Generation Smart/Meta-material Concepts
10:35 – 11:00	Keynote speaker	Prof. Antonio Concilio The Italian Aerospace Research Centre (CIRA)	Advances in the Design of a Robotic Bird
11:00 – 11:15	Invited speaker	Prof. Jian Sun Harbin Institute of Technology	KinetiX-Inspired 3D Metamaterial: Mechanism and Design of In-Plane to Out-of-Plane Deformation Coupling for Folding Wings
11:15 – 11:30	Invited speaker	Prof. Xiaotian Zhang Hong Kong University of Science and Technology	Learning, locomotion, and navigation of soft synthetic snakes in three-dimensional, heterogeneous environments
11:30 – 11:45	Invited speaker	Prof. Zhengxian Liu Harbin Institute of Technology	Behavior and Structural Design of Shape Memory Polymer Composites
11:45 – 12:00	Invited speaker	Prof. Qiye Zheng Hong Kong University of Science and Technology	Tailoring Thermal Transport in (Sc,Yb)AlN Thin Films to the Glassy Limit

12:00 – 12:15	Invited speaker	Prof. Pingan Zhu City University of HongKong	Adaptive Droplet Transport via Dynamically Reconfigurable Microfiber Rails
12:15 – 12:30	Transition / Discussion		

Date: June 2 Morning

Technical Session 7. Venue: LT-G

Chairs: Prof. Dou Zhang, Harbin Institute of Technology

Prof. Shiyuan Liu, Hong Kong University of Science and Technology (Guangzhou)

Prof. Mingjie Guan, Xiamen University

Time	Activity	Speaker	Title
09:20 – 09:45	Keynote speaker	Prof. Chuanfei Guo Southern University of Science and Technology	Iontronic sensing: materials, structures, devices, and future challenge
09:45 – 10:00	Invited speaker	Prof. Dou Zhang Harbin Institute of Technology	Preliminary design and validation of a hybrid triangular rollable and collapsible boom based on high strain and shape memory polymer composites
10:00 – 10:15	Invited speaker	Prof. Shiyuan Liu Hong Kong University of Science and Technology (Guangzhou)	Design and Advanced Manufacturing of Flexible Wearable Bioelectronics
10:15 – 10:30	Invited speaker	Prof. Mingjie Guan Xiamen University of Technology	A Study on a Flow Energy Harvester Based on Spherical Structure and Electromagnetic Conversion
10:30 – 10:45	Invited speaker	Dr. Yuanming Yang Xi'an University of Science and Technology	Fifth-Order Dynamics of Subcritical Galloping in Slotted Bluff Bodies
10:45 – 11:00	Invited speaker	Dr. Chit Ho Cheng Delft University of Technology	Multifunctional Gripper Design for Pick–Process–Place Robotic System
11:00 – 11:15	Invited speaker	Dr. Xiongjie Che Konkuk University	Thermal Deformation Measurement of a Ring Structure at High Temperatures Using Digital Image Correlation
11:15 – 11:30	Invited speaker	Dr. Wenqi Hu Hong Kong University of Science and Technology	Artificial Cilia: Fabrication, Biomechanics and Applications

11:30 – 11:45	Invited speaker	Dr. Rongrui Gu Beihang University	Optimization of Condensation Surface Structuring for Dew Point Detection: A Comparative Study on Condensation Behaviors and Optical Contrast
11:45 – 12:00	Invited speaker	Dr. Zhang Chenbao Xi'an University of Science and Technology	Modeling, Simulation and Experiment of a Multi-source Excited Piezoelectric-Electromagnetic Energy Harvester under Rotating Excitation
12:00 – 12:15	Invited speaker	Dr. Yuzhe Zhou The University of Hong Kong	Hydrodynamic Load Mapping and Dynamic Modeling of Bio-inspired Pulsed-Jet Propulsion for Adaptive Underwater Systems
12:15 – 12:30	Invited speaker	Dr. Jialin Zhang Xi'an University of Science and Technology	Design and Performance of a Piezoelectric Energy Harvester with Magnetically Coupled Indirect Excitation under Hybrid Excitation

Date: June 2 Afternoon

Technical Session 8. Venue: LT-K

Chairs: Prof. Nan Li, Harbin Institute of Technology

Prof. Xin Lan, Harbin Institute of Technology

Prof. Shijing Zhang, Harbin Institute of Technology

Time	Activity	Speaker	Title
13:30 – 13:55	Keynote speaker	Prof. Yong Chen Hong Kong University of Science and Technology	Advanced Manufacturing of Laser-Induced Graphene Electronics for Multifunctional Aerospace Materials
13:55 – 14:10	Invited speaker	Prof. Mu Fan Nanjing University of Aeronautics and Astronautics	Comparative Analysis of Flexoelectric and Piezoelectric Effects for Beam Sensing and vibration control
14:10– 14:25	Invited speaker	Prof. Nan Li Harbin Institute of Technology	Research on Inverse Design of Kirigami Metamaterial and Its Passive 3D Force-Tactile Sensing Function Integration
14:25 – 14:40	Invited speaker	Prof. Shijing Zhang Harbin Institute of Technology	A Dual-end Piezoelectric Micromanipulator Used for Gripping and Twisting Manipulations
14:40 – 14:55	Invited speaker	Prof. Xin Lan Harbin Institute of Technology	Active Vibration Control of High-Stiffness Structures Based on High-Voltage Stacked Piezoelectric Actuators
14:55 – 15:10	Invited speaker	Dr. Chunyu Zhou Harbin Institute of Technology	A spatially mechanical-decoupled three-DOF quasi-zero-stiffness isolator integrating flexible curved beams
15:10 – 15:25	Invited speaker	Dr. Jie Zhang Nanjing University of Aeronautics and Astronautics	Modeling and Flexoelectric Control of a Rotating Rigid-Flexible Coupled Plate Structure
15:25 – 15:40	Invited speaker	Dr. Jingyuan Yang	Numerical Simulation and Performance Investigation of

		Xi'an University of Science and Technology	Wake-Induced Galloping Piezoelectric Energy Harvesters
15:40 – 15:55	Invited speaker	Dr. Yiran Wu Hong Kong University of Science and Technology	A Novel Self-adaptive Energy Absorption Structure: Ionic Liquid-based Shear Thickening Fluid-integrated Buckle-beam
15: 55 – 16:10	Invited speaker	Dr. Qianyi Chen Southwest Jiaotong University	Adaptive Structural Design of Continuum Manipulators for Geometrically Constrained Environments
16:10 – 16:25	Invited speaker	Dr. Si Lu Xi'an University of Science and Technology	Structural Design of a Zigzag Unequal-Height Wind-Induced Vibration Piezoelectric Energy Harvester for Self-Powered Underground Coal Mine Applications

Plenary Speakers



Professor Kon-Well Wang

University of Michigan

Topic: *Embodying programmability and Mechano-Intelligence in Adaptive Meta-structures*

Abstract: This presentation will provide a glimpse into the speaker's research activities in the field of smart structures and material systems, which have evolved throughout the years, from responsive materials-based structures to nature-inspired modular metastructures, and to embodying mechano-intelligence in structural dynamics. For example, inspired by the plant nastic movements and the rich designs of origami folding, a class of adaptive metastructures is created building on the innovation of fluidic-origami modular elements. Overall, the modules are designed to be reconfigurable in their shape, mechanical properties, and stability features, so to produce synergistic dynamic functionalities at the system level, such as programmable phononic bandgap control, beamforming, and wave steering. More recently, with the rapid advances in autonomous systems, we are witnessing a prominent demand for the next generation of mechanical matter to be even more intelligent. An emerging direction is to pioneer and harness the metastructures' high dimensionality, nonlinearity, and multiple stability, for mechano-intelligence via physical computing. That is, we aim to concurrently embody computing power and functional intelligence, such as perception, learning, memorizing, decision-making and execution, directly in the mechanical domain, transforming from conventional systems that rely solely on add-on digital computers to achieve intelligence. Such smart metastructures would be more energy-efficient and sustainable, have more direct interaction with the surroundings, and are much more resilient against harsh environments and cyberattacks. This talk will highlight some of these advances and discuss future directions of the field.

Biography: Dr. Kon-Well Wang is the A. Galip Ulsoy Distinguished University Professor of Engineering and Stephen P. Timoshenko Professor of Mechanical Engineering (ME) at the University of Michigan (U-M). He has been the U-M ME Department Chair (2008-18), and has served as a Division Director at the U.S. National Science Foundation. Wang received his Ph.D. from the University of California, Berkeley. He started his academic career at the Pennsylvania State University in 1988, and joined the U-M in 2008. He is a recipient of many top awards in the field, such as the ASME Honorary Member, the Pi Tau Sigma-ASME Charles Russ Richards Memorial Award, the ASME J.P. Den Hartog Award, the SPIE Smart

Structures and Materials Lifetime Achievement Award, and the ASME Adaptive Structures and Materials Systems Prize. He is the current Editor-in-Chief for the Journal of Intelligent Material Systems & Structures. Wang is a Fellow of the AAAS, AIAA, ASME, IOP, and RAeS.



Professor Jinsong Leng

Harbin Institute of Technology

Topic: *Shape Memory Polymer Composites: Programmability, 4D Printing and Applications*

Abstract: Shape memory polymers and their composites are a type of smart material that can respond to external stimuli. They can maintain a temporary shape and return to their original shape in response to specific external stimuli. They have demonstrated significant potential for practical applications in fields such as aerospace, biomedicine, the textile industry, and electronic devices. This work covers the fabrication of shape memory polymers and their composites, the design of smart structures, 4D printing and its applications. We have designed a series of space-deployable structures based on shape memory polymer composites, which were successfully applied in the Tianwen-1 Mars probe. A series of SMP-based skin was developed and used on morphing aircraft, its deformation behaviour was analysed and its function was verified. Furthermore, smart structures such as cardiac occlusion structures and bone tissue structures were fabricated through 4D printing technology. In addition, by combining energy harvesting technology, a variety of health monitoring devices with integrated sensing functions have been developed for achieving the monitoring of motion states. Shape memory composites and 4D printing technology exhibit great application prospects in fields such as aerospace structural technology and biomedicine.

Biography: Prof. Jinsong Leng is a Professor at Harbin Institute of Technology, China. He is a Member of Chinese Academy of Sciences, the Foreign Member of Academia Europaea, Member of the European Academy of Sciences and Arts. He is the Dean of School of Future Technology, Director of the Center for Smart Materials and Structures (CSMS), Director of International Center for Applied Mechanics at Harbin Institute of Technology, and Deputy Director of the Academic Committee of Harbin Institute of Technology. He currently serves as Vice President of the International Committee on Composite Materials (ICCM), Vice President of Chinese Society of Theoretical and Applied Mechanics (CSTAM), Vice President of Chinese Society of Aeronautics and Astronautics (CSAA), and Editor-in-Chief of the International Journal of Smart and Nano Materials (IJSNM). He was elected as Fellow of American Association for the Advancement of Science (AAAS), Fellow of the Society of Photo-Optical Instrumentation Engineers (SPIE), Fellow of American Society of Mechanical Engineers (ASME).

Keynote Speakers



Professor Antonio Concilio

The Italian Aerospace research Centre (CIRA)

Topic: Advances in the Design of a Robotic Bird

Abstract: The work tracks the evolution of a robotic bird idea, which has been maturing within a cooperation between the University La Sapienza, and CIRA. It starts with a bibliographic research study, aiming at characterizing the state of the art at the date and pointing out some critical or relevant issues with the assessment of a full replica of a natural bird's behavior, in order to better address the research investigation and its final aims. In particular, the following areas were selected as priority in the development of the activity. The need for a light aerodynamic model that could be easily integrable with a real-time control system. In fact, the complexity of the aerodynamics and the structural response, in turn influencing the aerodynamics, would have led to heavy models to be dealt with traditional methods, making hard the possibility of closing the loop. Volterra's logic was chosen, moving from a model freely available in literature, based on which some preliminary tests were conducted to better understand the problem at hand. Such a model is based on a limited amount of experimental data and is based on the demanding hypothesis that the aircraft behavior is dependent on the previous states, so that a sort of memory influences the future dynamics of the object. The need for a system enabling the flight to be interrupted at certain moments for several reasons. For instance, the necessity to stay in a determined position if long observance is required. Or, simply, to recharge the solar batteries by the light of the sun. Or, to gain autonomy in waiting for more favorable wind conditions, to maneuver like a glider. To attain this capability, it is necessary to proceed to the definition and construction of a gripper, compact and eclectic enough to be used on different perches of different diameters (branches, cables, rods, and so on). The possible architectures are herein presented, together with the most promising technological solutions. The basic attainments, till now achieved during this first period of study are presented and discussed, in view of the final construction of a first, flying demonstrator.

Biography: Antonio Concilio earned his degree in aeronautics engineering with honours at the University of Napoli Federico II (Italia) in 1989; there, he was also awarded his PhD in aerospace engineering in 1995. In 2007, he completed his ECATA master's in aerospace business administration at ISAE-Supaero, Toulouse (France). Since 1989, he has worked as a researcher at the Italian Aerospace Research Centre (Italia), where he is the head of

the Adaptive Structures Division. Since 2005, he has been a lecturer at the PhD School SCUDO at the University of Napoli Federico II (course on Introduction to Smart Structures, Theory and Applications). He is the author of more than 150 scientific papers, and has presented at conferences and been published in specialized journals. Scopus metrics (August 2021): 144 authored documents; 1215 citations from 664 documents; h-index 19.



Professor Yong Chen

Hong Kong University of Science and Technology

Topic: Advanced Manufacturing of Laser-Induced Graphene Electronics for Multifunctional Aerospace Materials

Abstract: Next-generation aerospace systems increasingly demand materials that go beyond structural support to actively sense, regulate, and adapt to their environment. This talk highlights how laser induced graphene (LIG) enables a new manufacturing paradigm in which electronic functionality is directly written into high performance polymer structures, seamlessly merging structure and function. LIG is created through a direct, maskless laser process that locally transforms polymers into conductive, graphitic networks. When combined with additive manufacturing (AM), this approach enables precise electronics to be integrated within complex, three-dimensional aerospace components. The result is a unified material platform where mechanical integrity and electronic performance are co-designed and fabricated.

This talk presents process-aware design principles that link laser fabrication conditions to the resulting electrical, thermal, and mechanical behavior of LIG. Advanced laser toolpath strategies further enable high resolution, conformal graphene electronics on curved and additively manufactured surfaces, supporting embedded strain sensing, localized heating, and thermal regulation where they are most needed. Looking forward, early results suggest that LIG can be fabricated on space-qualified polymers and under reduced-pressure conditions, opening pathways toward in-space manufacturing. Together, these advances position LIG on AM-fabricated high-performance polymers as a foundational technology for multifunctional aerospace materials, where intelligence is built directly into structures.

Biography: Prof. Yong Chen received the B.S. and M.S. degrees in Mechanical Engineering from Zhejiang University and Huazhong University of Science and Technology in 1993 and 1996, respectively. He received his Ph.D. degree in Mechanical Engineering from the Georgia Institute of Technology in 2001. He was a Senior Research and Development engineer at 3D Systems Inc., a pioneer in the 3D printing industry, from 2001 to 2006. Prof. Chen joined the University of Southern California in 2006 and was a tenured professor of Aerospace and Mechanical Engineering, Industrial and Systems Engineering, and Biomedical Engineering before joining the Hong Kong University of Science and Technology in December 2025. His research focuses on additive manufacturing (3D printing) and related modeling, control, material, and application. He

has published nearly 200 scientific papers in refereed journals and conferences, as well as 19 issued and pending U.S. patents. His work has been recognized by over 15 Best/Outstanding Paper Awards in major design and manufacturing conferences and research journals. Other major awards he received include the NSF CAREER Award and USC's Innovation Commercialization Awards.



Professor Yong (Eric) Chen

Aerospace Research Center, National Research Council, Canada

Topic: Demonstration of An Active Seat Mount System for Aircrew Whole-Body Vibration Mitigation on Three Representative Helicopter Platforms

Abstract: Helicopter aircrew are exposed to high levels of whole-body vibrations (WBV) during flight missions, which may adversely affect their ride comfort and performance. Long term exposure to excessive WBV has been identified as a contributing factor to several adverse health issues such as the lower back pain and neck strain in the military helicopter aircrew community. National Research Council (NRC) Canada has developed a patented active seat mount technology to reduce the whole-body vibration levels for the helicopter pilot at the seat and occupant cushion interfaces in accordance with ISO2631-1 and MIL-STD-1472 standards. The active seat mount system is designed for installation between the helicopter cabin floor and the pilot seat frame and acts as an active interface to suppress the major N/rev harmonic vibration peaks of the main rotor speed. The prototype active seat design has demonstrated significant WBV reduction to the mannequin occupant on the mechanical shaker table using helicopter floor vibration profiles. Full-scale flight demonstration of the active seat mount system on the four-bladed NRC Bell-412 helicopter using two human occupants has achieved significant and simultaneous reductions to the occupant WBV and the head vibrations, and also shown consistent performance in the tested flight conditions.

This paper presents a follow-on study to demonstrate the capability of the Active Seat Mount system for aircrew WBV mitigation on three different helicopter platforms. A Bell-412 pilot seat with a 50th percentile Hybrid III male mannequin was installed on the Active Seat Mount system for performance evaluation purposes. Helicopter floor vibration time traces measured from three different helicopter platforms were replicated as the floor vibration profiles on a large mechanical shaker table, which included a four-bladed Bell-412 helicopter with the main rotor speed of 5.4Hz, a three-bladed CH-147F helicopter with the tandem rotor speed of 3.75Hz, and a four-bladed NH90 helicopter with the main rotor speed of 4.25Hz. The active vibration controller was adjusted to accommodate corresponding main rotor speed and major harmonic peaks to be suppressed for each of the selected helicopter platforms. Test results showed that the aircrew WBV was reduced significantly for all three helicopter platforms. The mannequin ISO-weighted WBV levels were reduced by 45 to 60%, with the major N/rev peaks suppressed by 65-99%. Per

ISO2631-1997/MIL-STD 1472 metrics, the Active Seat Mount system was able to extend the helicopter aircrew daily exposure time by more than 7 times in terms of health evaluation, and also improved the ride quality of the helicopter greatly. Therefore, the study demonstrated that the Active Seat Mount system is an effective and versatile technology for helicopter aircrew WBV protection.

Biography: Prof. Yong (Eric) Chen is a Senior Research Officer at the Aerospace Research Centre of the National Research Council Canada in Ottawa. His research focuses on aerospace smart structures, structural dynamics, vibration control and mitigation, and vibroacoustic testing. He has worked extensively on active vibration isolation systems for rotorcraft applications, including helicopter seat systems for reducing aircrew whole-body vibration, as well as acoustic testing and control technologies for aerospace structures.



Professor Alper Erturk

Georgia Institute of Technology

Topic: *Vibration and Wave Engineering from Hz to MHz*

Range via *Next-Generation Smart/Meta-material Concepts*

Abstract: Conventional smart materials such as piezoceramics and shape memory alloys couple multiple physical domains and enable stimuli-responsive behavior, while metamaterials leverage engineered lattice structures to exhibit properties beyond those of ordinary materials. This talk presents an overview of our efforts on exploiting smart/meta-material concepts, as well as their synergistic integration, for applications spanning from energy harvesting and elastic/acoustic wave manipulation to ultrasonic communication and neuromorphic computing. First, we will discuss energy harvesting for low-power electricity generation from vibrations by leveraging designed nonlinearities for bandwidth enhancement. Multiphysics problems of energy harvesting from fluid-structure interaction, and multifunctional concepts such as an energy-harvesting bioinspired robotic fish will also be presented, along with deep-sea investigations to sustain high hydrostatic pressures. We will then discuss mechanical and electromechanical metamaterials and metastructures for vibration attenuation and wave manipulation, followed by piezoelectric metamaterials with digital programming enabled by synthetic impedance circuits. Through the capability of circuit impedance modulation in space and/or time, we will show resonant concepts from tunable rainbow effect and reciprocity breaking to exceptional points and topological interface modes. Nonlinear metastructures exploiting chaotic vibrations and envelope soliton generation from a nonlinear piezoelectric metamaterial for reservoir computing will be presented. Finally, we will discuss examples of higher frequency problems including gradient-index phononic crystal lens designs for elastic and acoustic waves, wireless ultrasonic power and data transfer, and leveraging vibrations and guided waves in the human skull-brain system for transcranial ultrasound, along with metamaterial opportunities therein.

Biography: Prof. Alper Erturk is the Carl Ring Family Chair in the Woodruff School of Mechanical Engineering at Georgia Tech, where he leads the Smart Structures & Dynamical Systems Lab. His theoretical and experimental research interests are in dynamics, vibration, and acoustics of passive and active (smart) structures for various engineering problems. He has published 120 journal papers, 130 conference proceeding papers, 5 book chapters, and 2 books (total citations > 19,000 and h-index: 60). He is a recipient of various awards including an NSF CAREER Award in Dynamical Systems, ASME C.D. Mote Jr. Early Career Award for “research excellence in the field of vibration

and acoustics”, ASME Gary Anderson Early Achievement Award for “notable contributions to the field of adaptive structures and material systems”, SEM James Dally Young Investigator Award for “research excellence in the field of experimental mechanics”, and numerous best paper awards including the Philip E. Doak Award of the Journal of Sound and Vibration, and two ASME Energy Harvesting Best Paper Awards, among others. He is an Associate Editor for various journals such as Smart Materials & Structures and ASME Journal of Vibration & Acoustics. He holds Invited/Adjunct Professor positions at Politecnico di Milano (POLIMI) and at Korea Advanced Institute of Science and Technology (KAIST). He is a Fellow of ASME and SPIE.



Professor Mary Frecker

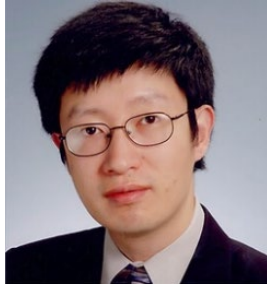
Penn State University

Topic: Inverse Design of Compliant Adaptive Structures Together

Abstract: This presentation will describe inverse design approaches for adaptive compliant structures, with applications ranging from medical devices to aerospace structures. Highlights include modeling and synthesis approaches for compliant mechanisms with both superelastic material behavior and large deformations, design of compliant mechanism-based metamaterials with highly nonlinear tailorable stiffness and enhanced energy absorption, and inverse design of flexible kerf structures for stress distribution. Additionally, the presentation will cover our method for systematic design of active compliant mechanisms that change shape on demand due to application of external stimulus such as magnetic field. Methods to model and design soft magneto active elastomer devices produced via additive manufacturing will be described. These devices are designed to be robust to geometry variation inherent in additively manufacturing processes. Finally, recent work on inverse design of buckling structures to achieve precise shape morphing will be discussed.

Biography: Dr. Mary Frecker is the Head of the Department of Mechanical Engineering, a Professor of Mechanical Engineering and Biomedical Engineering, the Leighton Riess Chair in Engineering, and the founding director of the Center for Biodevices at Pennsylvania State University. She has served as Associate Department Head for Graduate Programs in Mechanical & Nuclear Engineering, as well as Director of the Bernard Gordon Learning Factory in the College of Engineering. Dr. Frecker has a B.S. from the University of Dayton, and an M.S. and Ph.D. in Mechanical Engineering from the University of Michigan. Dr. Frecker has been awarded the Pearce Endowed Development Professorship in Mechanical Engineering at Penn State, the GM/Freudenstein Young Investigator Award by the American Society of Mechanical Engineers (ASME) Mechanisms Committee (2002), the Outstanding Advising Award by the Penn State Engineering Society (2002), the Outstanding Research Award by the Penn State Engineering Society (2005), three ASME Best Paper awards (2009 and 2015), the ASME Adaptive Structures and Material Systems Award (2021), the ASME McDonald Mentoring Award (2023), and the ASME Mechanisms & Robotics Award. She served as an Executive Leadership in Academic Technology & Engineering (ELATE) Fellow in 2018-2019, and completed the Changing the Future for Senior Women Faculty in STEM leadership program in 2019. Dr. Frecker is a Fellow of the ASME, is currently an Executive Committee member

of the ASME Design Engineering Division, past Chair of the ASME Mechanisms & Robotics Technical Committee, and has served as Associate Editor of the ASME Journal of Mechanical Design, Chair of the ASME Adaptive Structures and Material Systems Technical Committee, and Executive Committee member of the ASME Aerospace Division.



Professor Xuanlai Fang

University of Hong Kong

Topic: Metamaterials for Soft Actuators And Physical Intelligence

Abstract: The pursuit of mechanical intelligence in adaptive structures demands the seamless integration of actuation, sensing, and control challenges historically hindered by disparate manufacturing processes. This keynote talk presents a paradigm shift: leveraging advanced 3D microfabrication to co-design architected metamaterials with inherent adaptivity, enabling fully autonomous soft robotic systems. Unlike conventional planar lithography, our voxelated 3D printing approach enables graded, multi-material interfaces—permitting smooth impedance transitions between piezoelectric actuators, hydrogel metasurfaces, and compliant skeletal frameworks.

In the first part, we explore advanced 3D microfabrication techniques and design principles for architected metamaterials with multifunctional capabilities. For example, we deduced closed-form dispersion relations for soft-matter layered structures, revealing quasistatic, resonance, and slip modes via equivalent interface conditions—enabling programmable wave control for acoustic cloaking and vibration damping. We further introduce a datadriven inverse design framework for smart tactile metamaterials. By constraining the design space using a reduced-order model coupled with a "jumping-selection" data screening method, we achieve rapid generation of topologies exhibiting wide-range, linear stiffness responses across diverse material bases—enabling programmable mechanical memory and adaptive contact dynamics. In a second example, we demonstrate soft ultrasound metasurfaces employing inverse phase encoding. This design achieves a 9.3 dB gain in focal intensity while maintaining adaptive robustness against variable bone density, overcoming a critical barrier for deep-brain stimulation and high-resolution imaging through heterogeneous media. We also demonstrate scalable, acoustically seeded fabrication of DNA-based building blocks into sub-millimeter conductive wires on electrodes, achieving a 4.2-fold conductivity increase.

Collectively, these innovations illustrate a unified material-design framework where tailored microarchitectures mediate energy-flow—mechanical and acoustic—in real-time. This trajectory redefines adaptive structures beyond shape-change toward functional autonomy in bio-integrated systems.

Biography: Professor Fang recently joined the University of Hong Kong as a professor of Mechanical Engineering. Professor Fang earned his B.S. and M.S. degrees in Physics from

Nanjing University, China, and his Ph.D. degree in Mechanical Engineering from the University of California at Los Angeles. From 2011 to 2022, he was on the faculty of Mechanical Engineering at MIT, where he was promoted to full professor with tenure in 2018. Professor Fang teaches and conducts research in the area of micro/nanotechnology. Professor Fang's research programs have focused on scalable manufacturing processes for wave functional materials. His work was highlighted by public media such as Discovery Channel and Popular Science and raised significant public interest in the search for new metamaterials beyond optical waves. His research on nanoarchitecture metamaterials was highlighted among the top 10 Emerging breakthrough technologies of the year 2015. His recognitions also include the OSA Fellow (2021); ASME Chao and Trigger Young Manufacturing Engineer Award (2013); the ICO prize from the International Commission of Optics (2011); the NSF CAREER Award (2009) and MIT Technology Review Magazine's 35 Young Innovators Award (2008).



Professor NAM SEO GOO

Konkuk University

***Topic: Modal Identification of a Thermally Vibrated Plate
Using 3D-DIC and Physics-Informed Neural Networks***

Abstract: This study presents an integrated framework for modal identification of thin metallic plates subjected to nonuniform thermal–vibration environments. A thermal–vibration experiment was performed using a high-speed three-dimensional digital image correlation system to measure full-field out-of-plane displacements of an aluminum plate under temperatures up to 130 °C and excitation frequencies up to 800 Hz. Variational mode decomposition was applied to the output-only displacement data to extract natural frequencies and mode shapes, showing strong agreement with finite element results, with modal assurance criterion values exceeding 0.95. To reduce the cost and complexity of full-field measurements, a physics-informed neural network (PINN) was developed to reconstruct full-field mode shapes and temperature distributions from sparse displacement measurements. The PINN incorporates thermally coupled governing equations and free–free boundary conditions, ensuring physically consistent predictions. Using genetic algorithm–optimized sensor placement, accurate full-field mode shapes were experimentally reconstructed using data from only nine sensors, achieving over 90% reduction in sensing requirements. The proposed approach offers a practical and robust solution for thermal modal analysis and structural health monitoring of structures operating in high-temperature environments.

Biography: Prof. Namseo Goo is a Professor in the Department of Aerospace Information Systems Engineering at Konkuk University, Republic of Korea. He received his B.S., M.S., and Ph.D. degrees in Aerospace Engineering from Seoul National University. Before joining Konkuk University, he worked as a Senior Researcher at the Agency for Defense Development and as a Research Professor at Kyungpook National University. His research interests include digital image correlation-based deformation and modal measurements, structural analysis, and thermal protection systems for spacecraft. He has also been actively involved in the aerospace and adaptive structures communities, including serving as Senior Vice President of the Korean Society for Aeronautical and Space Sciences and as a committee member of ICAST.



Professor Chuanfei Guo

Southern University of Science and Technology

Topic: Iontronic sensing: materials, structures, devices, and future challenge

Abstract: Soft artificial skins can convert stimuli (such as pressure, strain, and vibrations) to electrical signals. Iontronic sensors, a type of novel sensing devices adopting ionic materials, outperforming traditional flexible sensors in terms of high sensitivity, minimized devices, and high signal-to-noise ratio. This technology has attracted significant attentions in robots, healthcare, and many other industrial scenarios. A key challenge in this field lies in that, flexible iontronic sensors that consist of viscoelastic soft ion materials, can often not accurately measure either the steady or dynamic pressures/strains because of the creep and hysteresis of soft materials. Other factors, such as the sensing interface, which undergoes a process of interfacial contact and detachment, may also dissipate energy to slow down the response of the sensors. Here, we focus on the material-structure-interface-property correlation of soft ionic materials, and show that iontronic skins using low-creep and low-hysteresis poly ionic liquids, together with interlayer bonding, can accurately measure pressures, vibrations, and strains with low signal drift/ delay. Such iontronic skins may provide high-fidelity data for applications in haptics of humanoid robots, physiological signal collection of humans, and detection of air pressure for aerodynamics.

Biography: Dr. Chuanfei Guo, born in Yongxing, Hunan, is now a professor at the Southern University of Science and Technology (SUSTech), National Specially-Invited Expert (Youth Project) and editor of Materials Today Physics and Soft Science. He mainly focuses on the high-performance electronic skins, flexible electronic technology for human-body and abnormal micro-nano fabrication technology. Dr. Guo has published over 130 articles in Nature Materials, Nature Communications, PNAS, LSA, JACS, Advanced Materials, Nano Letters, Advanced Functional Materials, Materials Today, ACS Nano, etc. He has applied for more than 40 patents, 24 of which have been granted by China, America, Japan, etc., including 4 USA patents. He participated in establishing one national criterion and one professional standard and editing two English books. His research findings have been widely reported by news media and scientific journals, including New York Times, Xinhuanet, Science Daily, Materials Today, and Physics Today. He achieved the second-class prize in Natural Sciences of Beijing. He is heading or participating in the innovative and entrepreneurial team of Talent Program in Zhujiang of Guangzhou Provinsecond-classd general projects of national science funds, Layout program of basic research

discipline in Shenzhen, etc.



Professor Jae-Hung Han

**Korea Advanced Institute of Science and Technology
(KAIST)**

Topic: *Structural Issues of Small Satellites and Some Solutions: Experiences from KAIST Satellite Programs*

Abstract: Since successfully launching and operating KITSAT-1 (Uribyeol 1), Korea's first artificial satellite, in 1992, KAIST has developed and operated as many as 11 small satellites and conducted several CubeSat programs. Although there are relatively fewer structural issues compared to large satellites, a smart and reliable structural system remains essential for the success of satellite programs. Given that the weight ratio is critical compared to other structures operated on the ground, and that repairs are fundamentally nearly impossible, it is essential to design structures that maintain extremely high reliability.

Therefore, contrary to the general public's perception that cutting-edge technology is typically applied to satellite structural systems, very conservative designs are usually adopted, and so-called smart materials or structures are not often utilized. Furthermore, even under extreme space environments including vacuum, severe temperature variations, UV, and radiation, the structural system must continue to perform its function consistently throughout its mission life.

This presentation introduces several examples of satellite structural system development experienced by the presenter. First, the issue of stable deployment of solar panels or antennas will be introduced. Second, some examples of deployable structures designed to enhance CubeSat performance will be shown. Finally, an application of a contact shock-absorbing device using a mesh woven structure will be presented.

Biography: Dr. Jae-Hung Han is a Professor at department of Aerospace Engineering, KAIST (Korea Advanced Institute of Science and Technology), Korea and the Director General of the Satellite Technology Research Center (SaTReC). He is jointly appointed to the Graduate School of Advanced Security Science and Technology, and also cross appointed to the KAIST Institute of Robotics. His research area can be classified into three major categories: i) Smart Materials, Structures, and Systems; ii) Spacecraft and Satellite Systems; iii) Structural Dynamics and Control. He has more than 450 refereed publications, invited presentations and seminars, technology transfers in the field. In 2023, SaTReC KAIST launched its 10th satellite called NEXTSAT-2, and he lead the successful launch campaign and the initial operation of the satellite.



Professor Wei-Hsin Liao

The Chinese University of Hong Kong

Topic: Journey from Vibration, Energy Harvesting, to Human Motion

Abstract: Smart materials are those that alter their shape, stiffness, or other properties when exposed to changes in temperature, electrical fields, or magnetic fields. By leveraging these adaptive features, smart materials can function as sensors and actuators. When integrated with controllers, such systems can perform roles analogous to nerves, muscles, and brains in the human body. Piezoelectric materials and magneto-rheological fluids have been utilized for vibration control and have been applied to devices and systems such as hard disk drives and vehicle suspension systems. Additionally, energy can be harvested from vibration and human motion. Piezoelectric and electromagnetic power generators are used to convert the mechanical energy from vibration and human movement into electrical energy. On the other hand, exoskeletons are wearable devices that enhance human movement by providing assistance for activities such as walking and lifting. These devices can support specific body parts or the entire body, benefitting both able-bodied individuals and those with mobility impairments. Related research from the past three decades will be presented.

Biography: Wei-Hsin Liao received his Ph.D. in Mechanical Engineering from The Pennsylvania State University, University Park, USA. Since August 1997, Dr. Liao has been with The Chinese University of Hong Kong, where he was Department Chairman of Mechanical and Automation Engineering from August 2018 to July 2024 and is currently Choh-Ming Li Professor of Mechanical and Automation Engineering, and Director of Institute of Intelligent Design and Manufacturing. His research has led to publications of over 400 technical papers and 27 patents; including 8 journal papers received Best Paper or Top Cited Paper Awards from ASME, IMechE and IOP Publishing. He was the Conference Chair for the 20th International Conference on Adaptive Structures and Technologies in 2009; the Active and Passive Smart Structures and Integrated Systems, SPIE Smart Structures/NDE in 2014 and 2015. He is the recipient of the 2020 ASME Adaptive Structures and Material Systems Award and the 2018 SPIE SSM Lifetime Achievement Award, to recognize his outstanding contributions to the advancement of smart structures and materials. He is also the recipient of 2023 ASME Leonardo Da Vinci Award for the eminent achievement in machine design. Dr. Liao currently serves as an Associate Editor for Journal of Intelligent Material Systems and Structures, and on the Executive Editorial Board of Smart Materials and Structures. Dr. Liao is a Fellow of the

American Society of Mechanical Engineers (ASME), Institute of Physics (IOP), and The Hong Kong Institution of Engineers (HKIE).



Professor Yanju Liu

Harbin Institute of Technology

Topic: Shape Memory Polymer Composites and Their Biological Applications

Abstract: Shape memory polymers (SMPs), as a representative class of smart materials, can undergo programmable shape and function transformations in response to external stimuli. Owing to their excellent biocompatibility, SMPs have demonstrated significant potential in biomedical engineering applications. This study systematically investigates the functional modification and 4D printing technologies of SMPs and their composites, aiming to develop smart, implantable biomedical devices for diverse clinical scenarios. Through material composition regulation and multifunctional composite design, multiple actuation modes, including near-body-temperature triggering, magnetic actuation, light actuation, and water-driven actuation, were achieved. In addition, the materials were endowed with biomedical functionalities such as medical imaging capability, drug loading and release and antibacterial performance. In particular, the water-driven shape memory fibrous membrane can autonomously contract and conformally wrap targeted tissues in humid environments, enabling suture-free fixation and protection for soft tissues such as the heart and pancreas. By integrating bioinspired structural design with 4D printing technology, a series of intelligent implantable medical devices were further developed, including biodegradable occluders for congenital heart defect repair, reconfigurable intestinal stents for intestinal obstruction treatment, bone tissue scaffolds for bone defect repair, orbital scaffolds for enophthalmos reconstruction, biomimetic cartilage scaffolds for cartilage regeneration, magnetically responsive microspheres for dentinal tubule occlusion, smart microcapsules for controlled drug release, and shape memory micro/nanofibers with anti-scarring functionality. These devices can be delivered through minimally invasive approaches and achieve functional activation under external stimuli, exhibiting excellent capabilities in customization, biocompatibility, and biodegradability. In the future, with the development of artificial intelligence-assisted design and living smart materials, smart materials are expected to provide a critical foundation for next-generation precision biomedicine.

Biography: Professor Liu obtained her PhD degree in Materials Science from Centre for Composite Materials and Structures of HIT, China in 1999. Now, she is a full professor at School of Astronautics in Harbin Institute of Technology (HIT), China. Her research interests are focused on smart materials and structures, including electrorheological & magnetorheological fluids, dielectric elastomers, shape memory polymers and their

composites, as well as applications based on these materials. Professor Liu has published over 200 scientific papers in journals and conference proceedings, with Google Scholar Citations over 9000. Besides, she has been authorized with more than 70 invention patents and participated in the writing of 7 books. Prof. Liu currently serves as Associate Editor of Smart Materials and Structures, member of the Asia Pacific Committee on Smart and Nano Materials, member of the Mainland China committee of the Society for the Advancement of Material and Process Engineering, and director of the Smart Composites Committee of the Chinese Society for Composite Materials.



Professor Yingxiang Liu

Harbin Institute of Technology

Topic: Recent Progress of Piezoelectric Actuators and Piezoelectric Robots

Abstract: The piezoelectric actuators have attracted a lot of attentions by their merits of high resolution, quick response, simple structure, small size and high power-weight ratio, which make them good candidates for fields of high-precision platforms, cell manipulations, optical equipment, ultra-precision machining and robots. Our research about the piezoelectric actuators focus on three main issues: how to achieve high performance macro-micro-nano cross-scale motion, how to expand the degrees of freedom of the actuation, and how to design different configurations of piezoelectric actuators. The solutions to these three problems will be discussed. Furthermore, the concept of piezoelectric robot is proposed, which is a new type of robots actuated by piezoelectric materials directly, and they inherit the merits of piezoelectric actuators, which make them good candidates for fields of cell manipulations, optical equipment, and so on. Some of our recent works of piezoelectric robots for cross-scale and multi-DOF locomotion and manipulations will be discussed.

Biography: Professor Liu obtained her PhD degree in Materials Science from Centre for Composite Materials and Structures of HIT, China in 1999. Now, she is a full professor at School of Astronautics in Harbin Institute of Technology (HIT), China.

Her research interests are focused on smart materials and structures, including electrorheological/magnetorheological fluids, dielectric elastomers, shape memory polymers and their composites, as well as applications based on these materials. Professor Liu has published over 200 scientific papers in journals and conference proceedings, with Google Scholar Citations over 9000. Besides, she has been authorized with more than 70 invention patents and participated in the writing of 7 books.

Prof. Liu currently serves as Associate Editor of Smart Materials and Structures, member of the Asia Pacific Committee on Smart and Nano Materials, member of the Mainland China committee of the Society for the Advancement of Material and Process Engineering, and director of the Smart Composites Committee of the Chinese Society for Composite Materials.



Professor Yang Lu

University of Hong Kong

Topic: Multifunctional Microlattice Mechanical Metamaterials

Abstract: Mechanical metamaterials customize the macroscopic mechanical properties through the design of their microstructures, providing nearly infinite possibilities for high-performance structural design and novel multifunctional design. Building upon our previous research on metal microlattice metamaterials, our recent studies have further demonstrated the fabrication of a high-strength and ductile carbon lattice mechanical metamaterial through partial pyrolysis of 3D-printed polymer microlattices. This carbon microlattice material, with an integration of rigidity and flexibility, exhibits excellent biocompatibility. By functionalizing its surface with semiconductor coatings and assembling it into multifunctional devices with superior mechanical performance and reliability, we have showcased the ability of mechanical metamaterials to control overall mechanical and functional properties through the artificial construction of their geometric and material characteristics. Utilizing the excellent strength and ductility of partially carbonized micro lattices, which also provide good thermal impedance effects, we have manufactured three-dimensional thermoelectric generators that demonstrate an energy absorption of approximately 30 J/g and a power conversion efficiency of about 10%. Furthermore, through the sophisticated design of nanocomposite precursors and the utilization of high-precision micro/nano 3D printing technology, we have created high-performance transparent glass microlattices with complex three-dimensional submicron features, showing outstanding mechanical and optical properties. In conclusion, multifunctional mechanical metamaterials are driving a new paradigm shift in high-performance structural design and advanced manufacturing, providing new inspiration for applications in energy conversion, biomedical engineering, flexible electronics, and other fields.

Biography: Professor Lu Yang is Chair Professor of Nanomechanics in the Department of Mechanical Engineering, and Kingboard Professor in Materials Engineering at The University of Hong Kong (HKU). He received his Bachelor's degree in Physics (Microelectronics) from Nanjing University and PhD degree in Mechanical Engineering from Rice University, and did his postdoctoral research in the Nanomechanics Lab at MIT. Prior to joining HKU in 2022 as HKU-100 Scholar, he worked at City University of Hong Kong where he rose through the academic ranks to full Professor. In his current role, Professor Lu serves as Associate Dean (Mainland Affairs) in the Faculty of Engineering.

Professor Lu is a leading expert in experimental nanomechanics and its interdisciplinary applications in materials engineering, advanced manufacturing, and semiconductor technologies. He has published more than 300 journal articles in peer-reviewed academic journals including Science, Nature Materials, Nature Nanotechnology etc., 2 book chapters and 7 US patents granted. He has been among Clarivate Analytics worldwide Top 1% Scientists by citations since 2023, and presented Opening Plenary Keynote in International Conference on Diamond & Carbon Materials in 2021. He serves as Associate Editor for high-impact journals such as Materials Today and Science Advances, and sits on Editorial Board for leading journals such as National Science Review, Acta Mechanica Sinica, Science China Technological Sciences, International Journal of Extreme Manufacturing, Functional Diamond, Materials for Quantum Technology. Professor Lu is a recipient of University Grants Committee (UGC) Early Career Award 2013/14, the 2019 National Natural Science Foundation of China (NSFC) Excellent Young Scientists Fund (Hong Kong and Macau), the inaugural Research Grants Council (RGC) Research Fellow Scheme (RFS) 2020/21, and the 2025 NSFC Young Scientist Fund (Type A) (formerly the National Science Fund for Distinguished Young Scholars). He is an elected member of the Hong Kong Young Academy of Sciences (YASHK) and the Hong Kong Academy of Engineering (HKAE) Young Member Section (YMS).



Professor Ramin Sedaghati

Concordia University

Topic: Magnetoactive Soft Continuum Robots Under Nonuniform Magnetic Fields: Three-Dimensional Magneto-Viscoelastic Model and Experimental

Validation

Abstract: Traditional minimally invasive interventions, including thrombectomy catheterization, can suffer from limited steering accuracy and may increase the risk of vascular trauma, including endothelial injury and arterial dissection. Magnetoactive soft continuum robots (MSCRs) have recently emerged as a promising alternative to the steerable distal segments of conventional catheters and guidewires. MSCRs are typically fabricated by embedding hard-magnetic particles within a compliant elastomeric matrix. When actuated wirelessly by external magnetic fields, they can undergo large, reversible deformations and achieve precise navigation through highly tortuous anatomical pathways, such as sharply curved vasculature, under relatively low magnetic flux densities (up to ~ 80 mT). Despite these advantages, predictive modeling remains a major challenge due to strong geometric nonlinearities and the coupled interactions between magnetic actuation, viscoelasticity, gravity, and axial strain. Existing models have predominantly focused on uniform magnetic fields. Uniform-field actuation, however, commonly relies on electromagnets that are bulky, expensive, heat-generating, and constrained in workspace, which limits clinical practicality. In contrast, permanent magnets generate inherently nonuniform fields and offer a compact, energy-efficient approach for steering MSCRs in confined and complex environments. Motivated by the practical relevance of permanent-magnet actuation and the modeling gaps associated with nonuniform fields, this work presents a unified theoretical and experimental study. An efficient three-dimensional analytical magnetoviscoelastic model is developed using an energy-based formulation combined with a Galerkin discretization scheme. The geometrically nonlinear dynamics, including coupled stretching, twisting, and nonplanar bending, are represented using Euler-angle kinematics. The model explicitly captures permanent-magnetbased actuation by incorporating distributed magnetic body torques and body forces. To enable the efficient evaluation of field-dependent terms, a dedicated deep neural network surrogate is also designed and integrated into the modeling framework. Gravitational loading, viscous effects modeled via a standard Kelvin–Voigt formulation, and axial strain are also included, yielding a physically consistent and computationally tractable description of MSCR dynamics. A dedicated experimental

platform is subsequently developed in which a fabricated MSCR is actuated by a six-degree-of-freedom robotic arm that positions and orients a permanent magnet within a calibrated workspace. Benchmark tests demonstrate excellent agreement between simulation and experimental results.

Biography: Prof. Ramin Sedaghati is currently full professor of Mechanical Engineering in the Department of Mechanical, Industrial and Aerospace Engineering at Concordia University and also Concordia Research Chair (CURC-Tier 1) in smart materials and adaptive structure. He received his PhD in mechanical engineering from University of Victoria, BC, Canada in 2000. Following his PhD study, Prof. Sedaghati was awarded Natural Science and Engineering Research Council of Canada (NSERC) post-doctoral fellowship in Canadian Space Agency, John. H. Chapman Space Center, Quebec. Prof. Sedaghati is director of smart materials and adaptive structure lab (SMASL) at Concordia University and his main research activities include smart materials particularly magnetoactive materials, smart and functional elastomers and composites, adaptive structures, adaptive vibration absorbers and isolators, magnetoactive soft robots and structural optimization. He has published over 140 journal articles and 150 conference papers and technical reports and supervised over 85 graduate students and post-doctoral fellows as well as 100 undergraduate students for their research projects. He is Fellow of the American Society of Mechanical Engineers (ASME), Fellow of the Canadian Society of Mechanical Engineering (CSME) and Associate Fellow of the American Institute of Aeronautics and Astronautics (AIAA). Prof. Sedaghati is currently serving as associate editor of the Journal of Intelligent Material Systems and Structures and on the editorial board of number of journals including Vibration and Actuators (MDPI). He was also the general chair of 30th International Conference on Adaptive Structures and Technologies (ICAST2019), one of the oldest and well-known conference in the area of smart materials and adaptive structures.



Professor Jinjun Shan

York University

Topic: Dynamics and Control of Smart Structures for Space Applications

Abstract: Smart materials are materials that are capable of changing their properties in a controlled fashion, typically based on a supplied input. These types of materials can be incorporated into structures to create smart, or intelligent, structures capable of sensing and reacting to changes in their operating environment. A sensor is used to monitor the system and its output is connected to a control unit which will generate a response to the sensor signal, which is then applied to the actuator to generate a desired system behaviour. There are many forms of smart materials including shape memory alloys, piezoelectrics, magnetorheological and electrorheological fluids, and magnetostrictives and electrostrictives. The possibility to change a materials property in a controlled fashion is fascinating and has found applications in a diverse number of fields including positioning, shape and vibration control, and fault detection and mitigation. Within the space sector, as more is demanded of systems in increasingly complex applications in harsh environments, smart materials present themselves as one of the most viable solutions to these engineering problems. In this talk, Prof. Shan will provide a summary of his research on dynamics modeling and control system design of smart materials and structures, as well as their applications in active vibration control of flexible systems, active flatness control of space membrane structures, high-precision motion control, and high-spatial space spectrometer.

Biography: Jinjun Shan is a Full Professor in the Department of Earth and Space Science and Engineering at York University, Canada. He earned his Ph.D. in Spacecraft Design from the Harbin Institute of Technology, China, in 2002. As the founding director of the Spacecraft Dynamics Control and Navigation Laboratory (SDCNLab), Prof. Shan focuses his research on the dynamics, control, and navigation of space, autonomous, and mechatronic systems. His extensive contributions include over 240 peer-reviewed publications and two issued patents. A distinguished leader in his field, he is a Fellow of the Canadian Academy of Engineering (CAE), the Engineering Institute of Canada (EIC), and the American Astronautical Society (AAS), as well as a member of the European Academy of Sciences and Arts (EASA).



Professor Jiong Tang

University of Connecticut

Topic: Temporal Modulation of Piezoelectric Shunt-Supported Metasurfaces – The Fifth Dimension Exploration

Abstract: Metamaterials and metasurfaces, consisting of periodically arranged unit cells, have shown exciting prospects of yielding unusual properties. While traditional metamaterials and metasurfaces are engineered through mechanical designs in the three-dimensional space, many recent efforts have focused on integrating various smart materials into the unit cells, leveraging the electromechanical, thermo-mechanical or magneto-mechanical couplings, to form programmable or even real-time adaptive systems, which can be considered as the fourth-dimension expansion of the design domain. This research reports the latest work on the fifth-dimension exploration, i.e., temporal modulation of the unit cell, to facilitate enhanced bandgaps of metasurfaces for vibration isolation. Specifically, we start from piezoelectric shunt-supported unit cell featuring local LC resonance that is realized through self-contained analog circuit. We then integrate time-varying resistors into synthetic impedances to yield continuous harmonic inductances with dynamic reconfigurability. Subsequently, the resultant unit cell can open temporal modulation-induced sidebands, thereby producing additional wave attenuation zones by the corresponding metasurface that are experimentally verified. The entire design is scalable and remains real-time adaptivity.

Biography: Dr. Tang's principal teaching and research interests are in the general areas of system dynamics, control, sensing and automation. He received the B.S. and M.S. degrees in Applied Mechanics from Fudan University, China, in 1989 and 1992, respectively, and the Ph.D. degree in Mechanical Engineering from the Pennsylvania State University in 2001. Prior to joining UConn in 2002, he worked in GE Research Center as a research engineer.

Dr. Tang has studied a series of research subjects including smart materials, motion and vibration controls, sensing and signal processing, uncertainty propagation, design optimization, computational intelligence, and modeling and analysis of multi-physics systems and processes. Dr. Tang's research has been supported extensively by federal agencies and industrial companies.



Professor Li Zhang

The Chinese University of Hong Kong

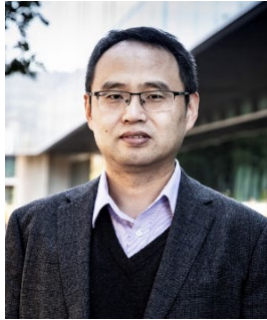
Topic: *Bioinspired and Biohybrid Designs of Small-Scale Robotics*

Abstract: The concept of miniature robots, famously envisioned by Nobel laureate Richard Feynman in 1959, has inspired decades of innovation and led to a wealth of research outcomes. These tiny machines convert various forms of energy into motion, serving as human “hands” in the microscopic world, attracting sustained and significant attention due to their broad application prospects. Drawing inspiration from nature has served as a vital pathway to advance the design of robotic systems. In recent years, by emulating the structures and functions of biological organisms or integrating natural materials with artificial systems, researchers have developed a variety of bioinspired and biohybrid small-scale robots, establishing this area as a research frontier. This presentation will focus on the bioinspired and biohybrid designs of small-scale robots, introduce the latest progress in the field, discuss the key challenges, and provide an outlook on future research directions.

Biography: Li Zhang is a Professor in the Department of Mechanical and Automation Engineering (MAE) and a Professor by Courtesy in the Department of Surgery at The Chinese University of Hong Kong (CUHK). He is also a director of the Shenzhen Institutes of Advanced Technology (SIAT) of the Chinese Academy of Sciences (CAS) – CUHK Joint Laboratory of Robotics and Intelligent Systems. Before he joined CUHK as an Assistant Professor in 2012, he worked in Prof. Bradley Nelson’s group as a postdoc and then as a senior scientist and lecturer in the Institute of Robotics and Intelligent Systems (IRIS), Swiss Federal Institute of Technology (ETH) Zurich, Switzerland. Dr. Zhang is elected as a Fellow of IEEE (FIEEE), The American Institute for Medical and Biological Engineering (FAIMBE), The American Society of Mechanical Engineers (FASME), Royal Society of Chemistry (FRSC), Asia-Pacific Artificial Intelligence Association (FAAIA), The Hong Kong Institution of Engineers (FHKIE), a member of the Hong Kong Young Academy of Sciences (YASHK), and an Outstanding Fellow of the Faculty of Engineering at CUHK, and he was appointed as a Distinguished Lecturer by IEEE NTC in both 2020 and 2021.

Dr. Zhang’s primary research interests include small-scale robotics and their applications for translational biomedicine. He has authored or co-authored over 400 publications, including *Science Robotics* (5), *Nature Machine Intelligence* (3), *Nature Materials*, *Nature Synthesis*, *Nature Biomedical Engineering*, *Nature Reviews Bioengineering*, *Nature Nanotechnology*. His research work on artificial bacterial flagella was indexed by the Guinness Book of World Records 2012 for the “Most Advanced Mini Robot for Medical

Use.” And his research works on magnetic slime robot and microrobotic swarm for endovascular application at CUHK was selected as “Top 10 Innovation and Technology News in Hong Kong” in 2022, 2023 and 2024, respectively. Dr. Zhang has received several medals from international inventions, such as The Geneva International Exhibition of Inventions including one Gold medal with congratulation of the Jury in both 2023/2025 and one Gold medal from the International Invention Fair in the Middle East (IIFME2024). He won several awards from IEEE international conferences, including NANOMED 2010, ICRA 2010, IROS 2012, Living Machines 2013, CASE 2020, ICARM 2020, 3M-NANO 2021, and MARSS 2022. He won the Hong Kong Research Grants Committee (RGC) Early Career Award in 2013, CUHK Young Researcher Award 2017, United College Early Career Research Excellence Merit Award 2018, CUHK Research Excellence Award 2019-20, and RGC Research Fellow (RFS) Award 2021/22. He serves as Editor/Associate Editor/Editorial Board Member of ten international journals, such as Science Advances, IEEE T-RO, IEEE/ASME T-MECH, IEEE T-ASE. Since 2012 (after he joined CUHK), he has been acted/acting as PC/PI for over 30 competitive grants from Hong Kong RGC (18 projects including Early Career Award, RFS Award, STG, RIF, CRF, EU-RGC, NSFC-RGC, GRF, JLFS, and PROCORE-HK JRS), ITC (9 projects including MRP, Tier-2, MHKTCFS, Tier-3, PSTS, and TSSSU), the Croucher Foundation (3 projects), NSFC and Shenzhen government. He is also Co-PI in 1 National Key Research of China funded by the Chinese Ministry of Science and Technology (MOST).



Professor Shujun Zhang

City University of Hong Kong

Topic: Piezoelectric materials for electromechanical applications

Abstract: Perovskite ferroelectric materials are at the heart of electromechanical devices, including the piezoelectric sensors, piezoelectric actuators, ultrasonic transducers and mechanical energy harvesting applications, to name a few. $\text{Pb}(\text{Zr}_x\text{Ti}_{1-x})\text{O}_3$ (PZT) solid solution system with morphotropic phase boundary (MPB) is the mainstay piezoelectric materials in the last 70 years because of their good dielectric/piezoelectric properties. Domain engineered relaxor-PT single crystals are found to possess high electromechanical coupling factor k_{33} of >0.9 , far outperforming commercially available PZT based ceramics (~ 0.75), greatly enhance the bandwidth and sensitivity of medical imaging transducers. The acceptor doped relaxor-PT crystals give high mechanical quality factor, greatly decrease the power dissipation, potential for HIFU application. Of particular interest is that the modified PNR engineered relaxor-PT ceramics show promising high piezoelectric d_{33} of $>1400\text{pC/N}$ and ultrahigh dielectric constant of $>10,000$, which will benefit the transducer array applications. In addition, the nonferroelectric piezoelectric crystals are found to possess ultrahigh electrical resistivity and mechanical quality factors, warrant the NDE transducers and acoustic emission sensors operational at elevated temperature, up to $>1000^\circ\text{C}$. This presentation will also survey other piezoelectric materials and discuss the figure of merits for their applications in transducer applications.

Biography: Prof. Shujun ZHANG received his B.Sc. (1994) and Ph.D. (2000) in Solid State Chemistry from Shandong University. From 2000 to 2015, he held various academic and research positions—including postdoctoral scholar, research associate, assistant professor, associate professor, and professor—in the Materials Research Institute and Department of Materials Science and Engineering at The Pennsylvania State University, USA. In 2015, he joined the University of Wollongong, Australia, as a professor and was later appointed Distinguished Professor. In 2025, he became Chair Professor of Ceramics in the Department of Chemistry at City University of Hong Kong.

Prof. Zhang's research focuses on electronic materials, with particular emphasis on dielectric and ferroelectric materials for applications in transducers, sensors, electrocaloric, energy harvesting, and energy storage. He has been recognized as a Clarivate Highly Cited Researcher in either Cross-Field or Materials Science since 2021. He has received many awards and honours, including election as an Academician of the World Academy of Ceramics, IEEE Fellow, Fellow of the American Ceramic Society and

ARC Future Fellowship. He is the recipient of the visiting Cheung Kong Scholar award, the Ross Coffin Purdy Award from the American Ceramic Society, the NSW Premier's Prize for Science & Engineering, the Vice-Chancellor's Research Excellence Award for Researcher of the Year at the University of Wollongong, the IEEE UFFC Society's Ferroelectrics Young Investigator Award and the Ferroelectrics Recognition Award.

Poster

PO.1

A Parametric Variable-Length Flexure Joint with decoupled bending and compression stiffness

Lai Yin Garmisch Wong¹, Ming Chun^{1*}

1. Hong Kong University of Science and Technology

Tendon-driven continuum robots (TDCRs) excel in unstructured environments but face limitations due to the inherent kinematic coupling of bending and compression in traditional continuous backbones, which causes parasitic compression and buckling under load. To overcome this, we present a parametric, variable-length compliant flexure joint that mechanically decouples bending and compressive stiffness. The design utilizes a hollow architecture integrated with a waterbomb-inspired origami pattern, granting high torsional rigidity against twisting while permitting full-range multi-directional bending and axial compression. By optimizing the compression-to-bending stiffness ratio, the joint requires significantly less force to bend than to compress. During differential-tendon actuation, the joint bends directionally without buckling; simultaneous actuation of all tendons allows axial compression. Empirical validation confirmed minimal axial deviation during uncoupled bending maneuvers. This anisotropic stiffness profile enables highly predictable, independent control of length variation and bending, paving the way for scalable, high-payload segments in next-generation soft continuum robots.

PO.2

A Spatiotemporal Physics-Informed Neural Network for Thermo-Viscoelastic Shape Memory Polymer Composites: Unified Forward Prediction and Inverse Identification

Haobo Wang¹, Liwu Liu¹

1. Harbin Institute of Technology, China

Thermo-viscoelastic shape memory polymer composites (SMPCs) exhibit strongly coupled thermo-mechanical behavior governed by temperature-dependent viscoelasticity and long-term memory effects. Accurate modeling of such materials remains computationally demanding when conventional finite element simulations are repeatedly required for structural analysis, parameter identification, or design optimization. Data-driven surrogate models provide a potential alternative, but purely data-based approaches often require large datasets and may violate physical constraints when extrapolating beyond the training regime.

PO.3

Optimization of Condensation Surface Structuring for Dew Point Detection: A Comparative Study on Condensation Behaviors and Optical Contrast

Rongrui Gu¹, Jing Nie^{1*}

1. School of Instrumentation Science and Optoelectronic Engineering, Beihang University, Beijing, China

Precision dew point detection fundamentally relies on the response of condensation process evolving on the sensing surface, while the stochastic droplet growth and unpredictable coalescence inherently compromise signal stability and measurement reproducibility. This work presents a comprehensive comparative study on the optimization of surface structuring to regulate condensation behaviors. The structural geometries are quantified for both the intra-pattern and background etching strategies with various etching depths. Results demonstrate that synergizing preferential condensation with structural droplet pinning successfully transitions stochastic droplet behaviors into an ordered condensation mode. The background-etched surfaces with a 100 nm etching depth achieve optimal performance according to the in-situ microscopic imaging results. This surface structuring minimizes random droplet coalescence and maintains a dropwise condensation mode, establishing a highly ordered spatial distribution of the condensate. The practical applicability of this optimal design was validated through optical response analysis, confirming that the engineered surface preserves a robust signal contrast required for reliable photoelectric sensing in dew point detection.

PO.4

Numerical Simulation and Performance Investigation of Wake-Induced Galloping Piezoelectric Energy Harvesters

Jingyuan Yang¹, Xuhui, Zhang^{1*}

1. Xi'an University of Science and Technology, China

The stable operation of coal mine equipment is critical to mine production safety and operational efficiency, while the power supply of equipment condition monitoring nodes remains a key constraint. This paper proposes a wake-induced galloping piezoelectric energy harvester to convert underground mine wind energy into electricity for self-powered wireless monitoring nodes. A multi-field coupling dynamic model of the harvester is established. Based on the FLUENT platform, a numerical method coupling the fourth-order Runge-Kutta method and computational fluid dynamics is adopted to solve the multi-field coupling dynamic equations. The effects of flow cylinder attack angle, spacing ratio and wind speed on the harvester's output performance are systematically analyzed, with simulation accuracy verified by experiments. Results show that the harvester achieves optimal output performance and significantly broadened effective working wind speed range at 30° attack angle and bluff body spacing $L=4D$. This study provides theoretical and technical reference for the design and engineering application of mine-used wind-induced vibration energy harvesters.

PO.5

Design and Performance of a Piezoelectric Energy Harvester with Magnetically Coupled Indirect Excitation under Hybrid Excitation

Jialin Zhang¹, Xuhui, Zhang^{1*}

1. Xi'an University of Science and Technology, China

This paper proposes a hybrid-excited piezoelectric energy harvester based on magnetically coupled indirect excitation to meet the self-powering requirements of wireless monitoring nodes in coal mine environments, where wind energy and vibration energy may coexist or appear alternately. The harvester consists of an excitation unit and a power generation unit. Under wind flow, the cantilever beam of the power generation module inside a sealed cavity is vibrated through magnetically coupled indirect excitation, thereby avoiding direct exposure of the power generation module to the complex wind environment and enabling the conversion of wind and vibration energies into electricity. The feasibility of the proposed harvester is verified through theoretical analysis, simulation, and experiments. The results show that the output performance of the harvester under combined wind and base excitation is significantly better than that under a single excitation condition. This study provides an alternative solution to the failure problem of piezoelectric energy harvesters in harsh environments.

PO.6

Numerical Study on WIV Energy Harvesting of a Trailing Cylinder in Triangular Multi-Cylinder Arrangement

Bo Yun¹, Xuhui, Zhang^{1*}

1. Xi'an University of Science and Technology, China

The underground coal mine environment is complex and space-constrained, where traditional wired power supply suffers from difficult wiring, high maintenance costs and insufficient safety. Thus, a sustainable wiring-free power supply technology is urgently needed to support underground low-power electronic devices and wireless sensor networks. Wake-induced vibration, a typical fluid-structure interaction, enables vibration energy harvesting to convert environmental fluid kinetic energy into electrical energy, adapting well to underground coal mine conditions and becoming a research hotspot. This paper studies the wake vibration and energy harvesting mechanism of a special configuration: three cylinders at triangle vertices (upstream flow-disturbing structures) and a fourth downstream energy-harvesting cylinder. It analyzes wake field characteristics, explores how upstream cylinder arrangement affects downstream cylinder's vibration and clarifies the correlation between wake disturbance and vibration response. The findings reveal energy conversion principles, regulatory mechanisms of the triangular configuration, and provide theoretical support for the design and optimization of such energy harvesting systems.

PO.7

Hydrodynamic Load Mapping and Dynamic Modeling of Bio-inspired Pulsed-Jet Propulsion for Adaptive Underwater Systems

Yuzhe Zhou¹, Xiao Fan^{1*}

1. The University of Hong Kong; Hong Kong, China

This study utilizes computational fluid dynamics (CFD) to quantify transient hydrodynamic loads and establish a comprehensive dynamic model for bio-inspired pulsed-jet propulsion in autonomous underwater vehicles (AUVs). While cephalopods achieve high efficiency through cavity deformation, designing equivalent adaptive underwater systems requires precise characterization of unsteady fluid forces. Using a high-fidelity 2D axisymmetric dynamic mesh, we integrate prescribed boundary deformations with flow-induced rigid-body motion to accurately map transient pressure forces and vortex ring evolution.

PO.8

Syntera: Programmable multipoint in-situ forming for complex electronic ceramics

Riran Liang¹, Yi Zheng¹, Zhengbao Yang^{1*}

1. Hong Kong University of Science and Technology, Hong Kong, China

Non-planar ceramics exhibit exceptional multifunctionality through intricate geometries, enabling signal amplification and conformal adaptation to irregular substrates. Conventional 3D printing of ceramics, necessitating slurry preparation and debinding, frequently leads to structural collapse and material-specific limitations. Inspired by the viscoplastic deformation dynamics of sintering, we introduce a shape-morphing strategy that synchronously shapes and densifies ceramics in situ. Our approach couples a Joule heating apparatus—delivering rapid thermal excitation via current-driven carbon felt—with a multipoint array apparatus that applies controlled displacement during shaping. At temperatures inducing viscoplastic flow, the multipoint array exerts spatially variable forces on the green compact, transforming planar precursors into customized 3D configurations. This integrated platform enables the fabrication of diverse non-planar shapes, as demonstrated with BaTiO₃. Its versatility is further validated through the production of additional electronic ceramics, such as Al₂O₃, and structural ceramics, including ZrO₂ and SiC. This efficient, material-independent method addresses key constraints of 3D printing, offering significant potential for precision-engineered ceramics in advanced applications.

PO.9

Comparison of PZT Ceramic and PZN-PT, LiNbO₃ Single Crystals for Electromagnetic Radiation as Mechanical Antenna

Yuanyi Wang¹, Zhengbao Yang^{1*}

1. Hong Kong University of Science and Technology, Hongkong, China

Electromagnetic radiation in the low-frequency (LF, 30–300 kHz) regime is vital for long-range communication due to its unparalleled penetration through dissipative media. However, the prohibitively large dimensions of conventional antennas at these wavelengths preclude portability. Piezoelectric mechanical antennas (PMAs), which exploit strain-driven currents, can reduce the antenna dimensions by up to five orders of magnitude compared to conventional antennas. Despite recent progress, systematic comparisons between ceramic- and single-crystal-based PMAs remain limited. Here, we present a comprehensive study of PMAs fabricated from PZT ceramics, LiNbO₃ (LN) single crystals, and PZN-PT single crystals. We integrate theoretical modeling and experimental characterization to establish a unified framework that links material properties with antenna radiation performance. Our results reveal that PZT4 ceramics and LN single crystals outperform other counterparts in terms of radiation efficiency and communication stability, while PZN-PT offers giant piezoelectric coefficients but suffers from thermal instability and low Q. Furthermore, we demonstrate amplitude-shift keying (ASK) modulation, confirming the feasibility of wireless communication using these compact antennas. This study provides the first head-to-head comparison between different piezoelectric materials in communication scenarios, offering key physical criteria for material selection for next-generation LF portable communication systems in underwater, underground, and biomedical applications.

PO.10

Integrated Ultrasound Platform for Imaging-Guided Precise Sonodynamic Therapy of Deep-Seated Tumors

Jiayi Zhang¹, Liang Wang¹, Zhengbao Yang^{1*}

1. Department of Mechanical and Aerospace Engineering, Hong Kong University of Science and Technology, Clear Water Bay, Hong Kong, People's Republic of China

Deep-seated tumors present significant clinical challenges due to their complex anatomical locations and proximity to critical structures, which limit surgical accessibility and treatment precision. Current therapeutic strategies remain suboptimal. Systemic chemotherapy lacks spatial selectivity, radiotherapy is limited by dose deposition accuracy in heterogeneous biological tissues, and conventional ablation techniques are constrained by their invasiveness and insufficient real-time guidance.

To address these challenges, an integrated ultrasound platform is developed to enable imaging-guided, precise sonodynamic therapy (SDT) for deep-seated tumors. The system establishes a closed-loop theranostic workflow that links real-time visualization with localized therapeutic activation. It incorporates a miniaturized 6.5 MHz, 64-element phased-array endoscopic probe with an outer diameter of less than 2.5 mm, enabling high resolution imaging and dynamic beam steering under endoscopic guidance within natural luminal environments. A multi-channel ultrasound architecture is established to provide programmable control of transmission and reception, allowing flexible switching between imaging and therapeutic modes while enabling real-time modulation of acoustic fields. In addition, a multifunctional nanosystem is introduced that serves simultaneously as an ultrasound contrast agent and a sonosensitizer. This enables contrast-enhanced imaging and ultrasound-triggered reactive oxygen species (ROS) generation within a unified theranostic framework. Through real-time phased-array beam steering, spatially selective activation is achieved, enabling precise energy deposition confined to tumor regions while minimizing damage to surrounding healthy tissue. Importantly, therapeutic effects are achieved through ultrasound-based spatial control, supporting broad applicability across multiple tumor types with reduced off-target effects. Phantom experiments validate imaging performance and beam steering capability, while in vitro studies demonstrate efficient ROS generation and significant cytotoxicity across multiple cancer cell lines.

Overall, the proposed platform integrates real-time visualization with localized therapy, offering a minimally invasive and highly controllable strategy for treating deep-seated tumors. This approach holds strong potential for improving targeting accuracy, reducing

off-target tissue damage, and advancing clinical translation in complex oncological applications and precision medicine treatment.

PO.11

Reader-Side Simulation and Enhanced Echo Frequency Estimation for Passive Wireless Resonant SAW Interrogation

Yinuo Gao¹, Nianwei Liang², Hongbo Yu³, Suxiao Zhao⁴, Chenhui Gai⁵, Yulin Lei⁶, Hong Hu^{1*}

1. School of Robotics and Advanced Manufacturing, Harbin Institute of Technology, Shenzhen, Shenzhen, China

Bolt preload strongly affects the integrity and long-term reliability of structural joints, and passive wireless surface acoustic wave (SAW) sensing is attractive for preload related monitoring because it requires no onboard power supply, supports wireless interrogation, and encodes the measurand in resonance frequency. In resonant SAW systems, however, the reader side remains a major bottleneck, since the returned echo is weak, transient, and often contaminated by silent intervals, decaying tails, and noise, making stable frequency extraction difficult when conventional full-frame fast Fourier transform (FFT) peak search is applied directly. To address this issue, this paper develops a reader-side simulation framework and an enhanced echo frequency estimation method for passive wireless resonant SAW interrogation at 434 MHz. The framework combines a superheterodyne RF receiving front-end with a digital echo-processing chain, in which the received echo is down-converted to an intermediate frequency near 10.7 MHz, sampled at 60 MSPS, digitally translated to approximately 700 kHz, and then processed through multistage decimation and FFT-based analysis. On this baseline chain, an enhanced estimator is introduced by incorporating valid-segment extraction, mean removal, Hann windowing, three-point logarithmic spectral peak interpolation, and output-validity judgment with invalid-frame hold. Simulation results confirm the expected signal path from transient RF echo to low-frequency analysis input. For a representative 700 kHz case, the baseline full-frame FFT identifies the correct frequency region but is limited by the discrete FFT grid, whereas the enhanced method refines the estimate from coarse bin-level localization to sub-bin precision under the same frequency planning and processing chain. The present study is limited to reader-side simulation under controlled conditions and does not yet establish a direct quantitative relationship between frequency estimation error and preload resolution, nor does it include hardware experiments.

PO.12

Ultra-Thin Silent Micro Piezoelectric Actuated Cooling Device

Guan-Lin PAN¹, Yi-Wei Zhuang¹, Wen-Jong Wu^{1*}

1. National Taiwan University, Taiwan

A compact piezoelectric cooling device integrating a piezoelectric actuator and a microfluidic channel was developed using MEMS fabrication and aerosol deposition methods. To satisfy miniaturization requirements, the device dimensions were limited to below 10 mm and designed with a cantilever beam structure. Finite element analysis was used to optimize structural parameters, while modal analysis identified the first resonant mode as the most effective for airflow generation due to its largest volumetric displacement.

PO.13

Intelligent Design of Adaptive Structures: From Machine Learning to Physically Embodied Systems

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The design of adaptive structures is undergoing a paradigm shift from intuition-driven approaches toward data-driven and physically intelligent systems. A unified framework for the intelligent design of adaptive structures is presented, spanning from machine learning-enabled material discovery to the realization of architected systems with embodied functionality. The approach integrates artificial intelligence, mechanics, and advanced manufacturing into a closed-loop design process. At the material and architectural level, machine learning-based inverse design methods are developed to directly map target mechanical responses to high-dimensional design spaces. These approaches enable the programmable control of strain fields, elastic modulus, and nonlinear deformation behaviors in hierarchical metamaterials. Representative examples include inverse-designed architectures with prescribed strain distributions, modulus-tunable hierarchical systems, and data-driven optimized B-spline honeycombs with enhanced energy absorption performance. In parallel, generative and predictive frameworks are extended to 4D-printed structures, enabling the design of stimuli-responsive systems with controllable shape morphing and time-dependent behavior. Beyond static functionality, adaptive structural performance is further explored through energy-dissipative and deployable systems. This includes compression-to-tension adaptive energy dissipators, interlocking negative Poisson's ratio connectors for reconfigurable impact mitigation, and multi-material lattice metamaterials exhibiting reusable and programmable energy absorption. These designs demonstrate how structural intelligence can be embedded through geometry, material distribution, and nonlinear mechanics. At the system level, the framework is extended to bio-inspired soft robotic systems, combining finite element modeling, machine learning, and digital twins to enable integrated design, prediction, and control. Multi-material 3D printing facilitates the realization of complex hard-soft coupled architectures, such as origami-based robotic grippers with enhanced adaptability and functionality. Overall, this work establishes a coherent pathway from machine learning-driven design to physically embodied adaptive systems. By bridging data-driven intelligence with material and structural intelligence, it lays the foundation for next-generation adaptive structures capable of sensing, responding, and evolving in complex environments.

