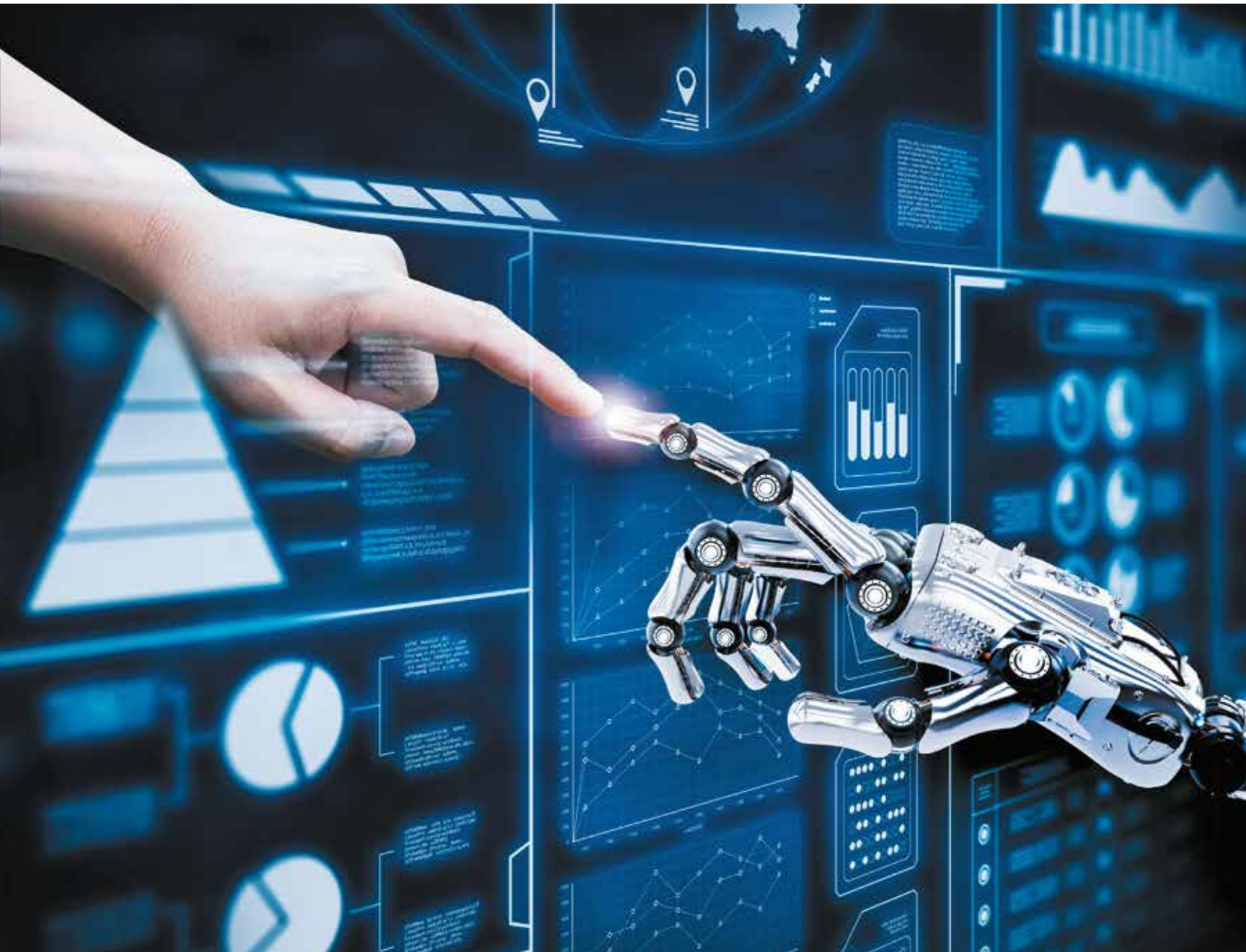
THE HONG KONG POLYTECHNIC UNIVERSITY
香港理工大學

DEPARTMENT OF MECHANICAL ENGINEERING
機械工程學系

RESEARCH IN MECHANICAL ENGINEERING

March 2019



Research Brochure

Department of Mechanical Engineering
The Hong Kong Polytechnic University

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Message from Head

We are delighted to present this new edition of Departmental Research Brochure to all those who are interested in the most updated information about the existing strength and ongoing research activities of the Department.

The History of the Department of Mechanical Engineering dates back to 1937, when the Government Trade School, the early predecessor of the Hong Kong Polytechnic University, was established. The Government Trade School was renamed the Hong Kong Technical College in 1947, the Hong Kong Polytechnic in 1972 and The Hong Kong Polytechnic University in 1994. Coupled with such changes was the research culture in this Department. Research activities started to emerge in the late 1980s and the 1990s under the Headship of the late Prof. T.P. Leung. The first international conference organized by the Department was the Third-Asian- Pacific International Symposium on Combustion and Energy Utilization, which was co-organized with CAS, with Prof CK Law of Princeton University being one of the keynote speakers. Prof. Ronald So took the headship from 1995 to 2005. Research activities intensified under his period of headship. Many internationally renowned researchers were invited to deliver talks in the Department, including Prof. James H. Whitelaw and Prof. Chang- Lin Tien. Research activities remained active and further enhanced under the leadership of subsequent heads, Prof Jian Lu and Prof. Li Cheng.

Today, ME is one of the most research-active departments in the campus, excelling in a number of research areas of strategic importance germane to Hong Kong. The Department aspires to carry out high quality research of both fundamental and applied nature, and to develop the cutting-edge technology to meet the industrial and societal needs through active technology transfer. While maintaining our strength in conventional mechanical engineering discipline, the Department strives for building up expertise in emerging areas. The existing research areas, namely Advanced Materials and Processing, Aerospace Engineering, Clean Energy and Energy Storage, Combustion and Pollution Control, Fluid-structure Interactions, Robotics and Control, and Sound and Vibration Research, provide the infrastructure to foster close collaborations with overseas research institutions, public service corporations, industries in Hong Kong and mainland, and governmental agencies. It is thrilled to note that the University has been ranked the 29th in the subject of Mechanical Engineering in Academic Ranking of World Universities (ARWU) 2018 by ShanghaiRanking.

I hope this new research brochure will give a flavor on our research capability, to a very broad readership. It is also a testimony of the tireless effort that ME faculties are making in upholding the quality of their work and the international reputation they are enjoying. Last but not least, we welcome any opportunities to explore possible collaborations with future partners.

San-Qiang Shi
Chair Professor and Head
Department of Mechanical Engineering

Introduction of Department

As one of the three founding departments of The Hong Kong Polytechnic University since 1937, the Department of Mechanical Engineering has been, in the past 80 years, the forerunner of the vast evolvement of its field. Over the years the Department pioneered the rapid development in new energy system, materials, transportation, health and biomedical systems and environment improvement.

Inventing technologies and machineries to be used in engineering systems and processes makes the career of a mechanical engineer challenging. However, the more challenging it is, the more fulfilling it can be with the vision to improve the living standard of humans imbued deeply in every mechanical engineer's mind. With a strategic emphasis on applied research, the Department firmly believes that research is an integral part of academic life. It informs teaching and advances the frontiers of knowledge and technology. The Department's efforts in research contribute to lifting the competitiveness of industry in Hong Kong, in mainland China and in the world.

The Department is determined to uphold this tradition and, at the same time, to strengthen its basis by engaging in the pursuit of the underlying arts and sciences of mechanical engineering. With rich experiences and exceptional talents among our staff, our research effort aims at possible solutions towards a better living for the human race.

Main Research Areas

Advanced Materials and Processing
Aerospace Engineering
Clean Energy and Energy Storage
Robotics and Control
Sound and Vibration
Thermofluids and Combustion

Major Laboratories

Acoustics Laboratory
Acoustic Wind Tunnel Laboratory
Advanced Materials for Energy Conversion and Storage Laboratory
Aeronautical Laboratory
Bio-mechanics Laboratory
Computational Aeroacoustics and Flow Physics Laboratory
Corrosion & Surface Technology Laboratory
Design Analysis Centre
Dynamics Laboratory
Fluid Mechanics Laboratory
Heat Transfer & Combustion Laboratory
Materials and Mechanics Technology Laboratory
Measurement and Control laboratory
Nano- & Micro-Mechanics Laboratory
Nano-scale Energy Conversion Devices and Physics Laboratory
Product Testing & Analysis Centre
Project Laboratory
Thermal Science Laboratory
Thermodynamics Laboratory
Undergraduate Computational Laboratory
Water Tunnel Laboratory
Wind Tunnel Laboratory

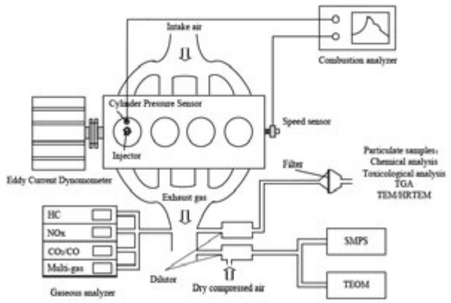
Research Centres/Consortiums

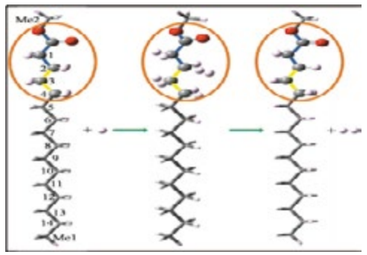
Research Centre for Combustion and Pollution Control

Currently, the CPC Research Centre is operated smoothly with collaborative effort from the key members, including Prof. WF Leung, Prof. TL Chan, Prof. CS Cheung, Prof. C.W. Leung, Dr L An and Dr. P Zhang. The Research Centre is established to create and develop a critical mass in the fundamental and applied studies in combustion and combustion-related air pollution problems and their control. We are one of the leading research groups in the areas of flames and combustion, alternative fuels, internal combustion engine performance and emissions, electrical chemical energy storage systems and nano-technology for air pollution control. Some of the ongoing research projects are shown below. Because of our excellent efforts in serving the industry, The Hong Kong Polytechnic University (PolyU) is recognized to be one of the leading institutions in dealing with combustion and combustion-led air pollution problems in Hong Kong and the Pearl River Delta region. The CPC Research Centre has made significant contribution to the development of new curriculum and new subjects for the Department/University, and has provided many research and undergraduate projects for our students. Excellent research outputs, including patents, book chapters, journal publications and conference presentations are made by the key members of the Research Centre to enhance the image of PolyU.

Application of Alternative Fuels to Diesel Engine

Feasibility in using hydrogen, biodiesel and different alcohols as fuel for diesel engines are explored. The influences of these alternative fuels on the combustion, performance, gaseous and particulate mass-number emissions, as well as the physico-chemical properties of the particulates are investigated. The application of these alternative fuels is able to reduce significantly the particulate mass-number emissions and renders the particulates easier to be oxidized.



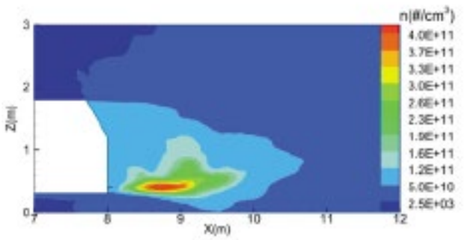


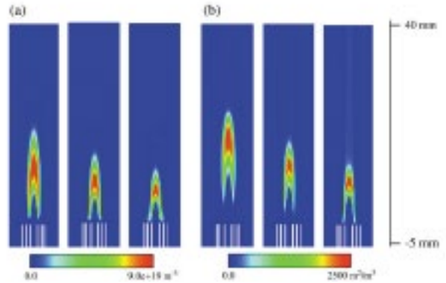
Combustion Chemical Kinetics of Large Biodiesel Molecules

Development of detailed reaction mechanism for the combustion of large biodiesel molecules is crucial to the utilization of biodiesel, while it has been hampered by the formidably time-consuming quantum chemistry computation of the molecules. Recently, the reactions of large biodiesel molecules with hydrogen radical are accurately calculated with a significantly efficient theoretical method. The method is expected to make a strong impact on the current theoretical study of biodiesel combustion.

Multiphase and Multi-component Complex Systems with Micro- and Nano-scale

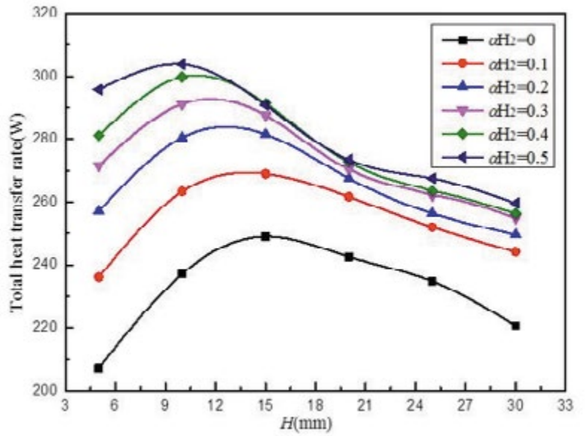
The development of novel model scheme for solving the challenging problems on multiphase and multi-component complex systems with micro- and nano-scale which have been identified in multi-disciplinary areas (i.e., thermal-fluid, materials, chemical and environmental sciences) and many potential engineering applications.

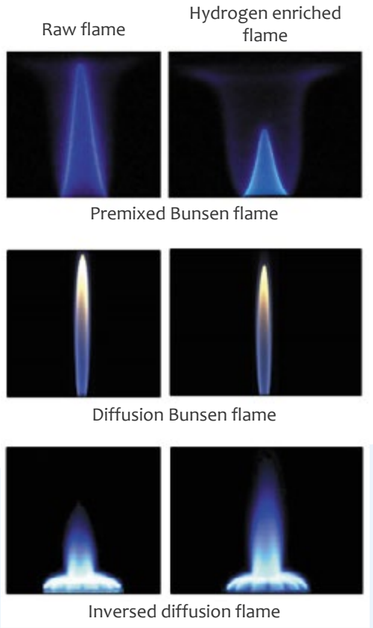




Improvement of hydrogen enrichment on heat transfer performance of biogas flame

In developing alternative fuels of hydrocarbon fuels, hydrogen enrichment technique is one of the feasible techniques. It is applied to enhance the heat transfer and combustion characteristics, as well as to improve the emission characteristics of biogas. Investigations are carried out with different types of flame including premixed, diffusion, premixed with swirl-induced and inverse diffusion.

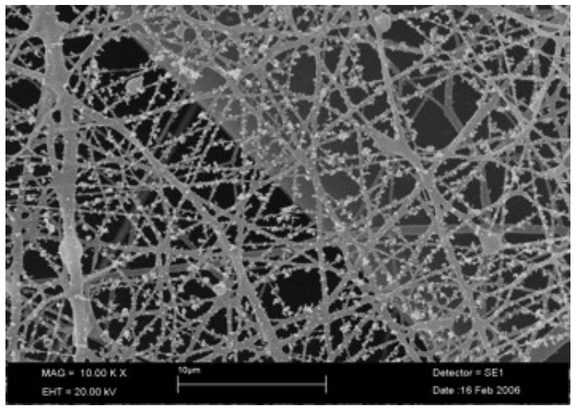




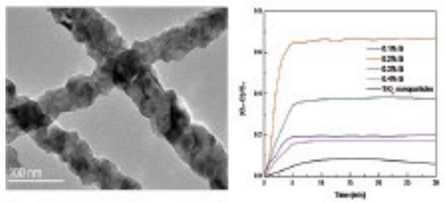
Research Centres/Consortiums

Research Centre for Combustion and Pollution Control

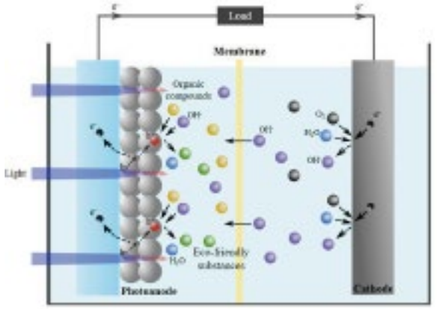
Air Filtration: Multilayer Nanofiber Filter
An antibacterial natural material made from crustaceans, has been electrospun into nanofibers with diameter 100-200 nm for use as a depth filter. Efficiency of the multilayer nanofiber filter is comparable to the filter with all the chitosan nanofibers deposited in a single layer, yet the pressure drop across the filter can be as much as 50+% smaller. This is especially beneficial for developing "breathable" face masks for combating pollutants such as virgin diesel pollutants which are typically 10-100 nm, that are the building blocks of the well-known haze/smog and PM2.5 particles.



Air-and Water Purification
Research studies are conducted on composite inorganic nanofibers to improve the photocatalyst performance, with applications to convert pollutant gas, such as NO to NO_2 and subsequently to HNO_3 or VOC (e.g. formaldehyde) to harmless CO_2 and H_2O, and to break-down harmful organics (including herbicide etc.) dissolved/ suspended in water to harmless substances.



Transport Phenomena in Electrochemical Energy Systems
Photocatalytic fuel cells: As an emerging wastewater treatment technology, photocatalytic fuel cell (PFC) can utilize solar energy to degrade the toxic organic compounds into eco-friendly substances and simultaneously harvest the chemical energy in the form of electricity, achieving environmental and economic sustainability by recovering valuable resources from wastewater. Before making the technology viable, however, the PFC performance must be substantially improved. Our current research focuses on the development of photocatalytic materials with novel properties for the light harvesting and the optimization in the structural design of the photoelectrode, which requires critical understanding of mass and charge transport through the photoelectrode.

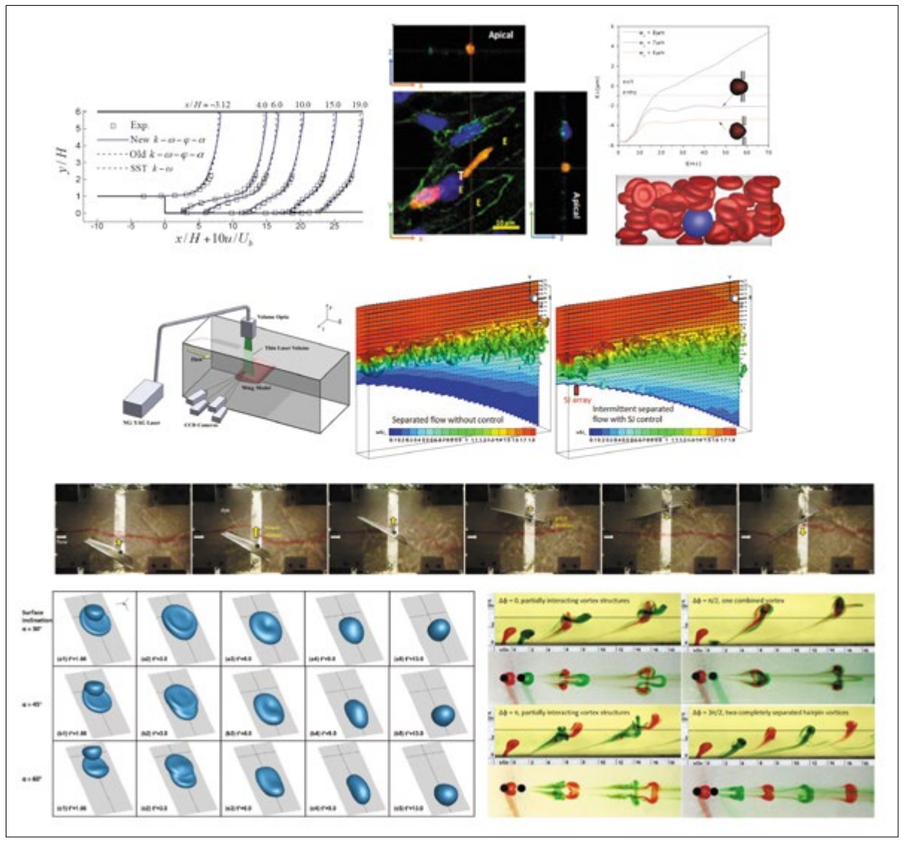


Research Centres/Consortiums

Research Centre for Fluid-Structure Interactions

In line with the strategic objective of the University to carry out research that is more application oriented, the Research Centre for Fluid-Structure Interactions (FSI) was set up to perform research in the areas of fluid-structure interaction and its control. The objectives of FSI are to seek understanding of the fundamentals of fluid-structure interactions through experimental, numerical and theoretical studies and postgraduate training, and to apply such knowledge to resolve problems that are germane to Hong Kong and also China. For example, we have studied the fluid-structure interaction problem in flow-energy harvesting and have extended our research to biomechanics such as flow in human upper airways, tumor cell adhesion in microcirculation and the mechanical reason for intraoperative floppy iris syndrome during cataract surgeries. We have also studied the problems related to wind turbine aerodynamics, urban aerodynamic noise generated by modern appliances, construction site machines and pilings, and structural design of tall buildings and large structures. In particular, the emphasis is on the application aspects that require interdisciplinary investigations and have found fruitful results with significance in academic contribution and industrial application.

With rapid economic and industrial development in China, fluid-related structural vibration and noise problems are widely encountered in many fields, as in the other parts of the world, causing increasingly grievous concerns. Turbulence clearly has a significant impact on all the problems. On the other hand, new possibilities emerge with the advent of various new techniques such as signal processing, flow visualization and diagnostics, new functional materials, sensors and actuators, etc., revitalizing research activities in an interdisciplinary area.



Research Centres/Consortiums

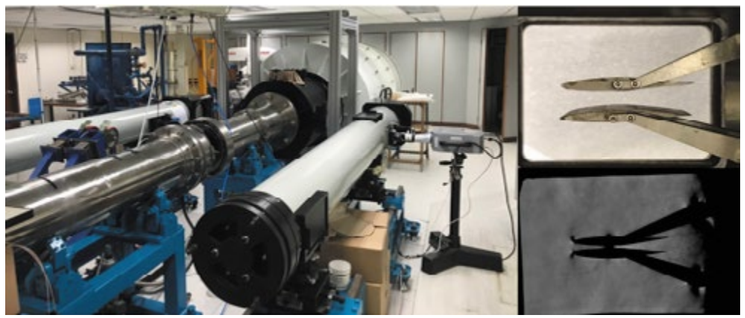
Consortium for Aerospace Engineering

Objectives

- To carry out high-quality research and development to meet the industrial, commercial and community needs of the society;
- To provide professional services to the government/industry/community in solving problems related to Aerospace and Aviation Engineering through carrying out consulting projects, arrangement of technical workshops and seminars, and development of engineering and scientific devices/systems/strategies;
- To assist/influence government Aerospace and Aviation Engineering policy and to enhance the competitive edges of HK in Aerospace and Aviation products/designs/MRO through active technology transfer;
- To underpin graduate/undergraduate teachings with knowledge created from research and development works.

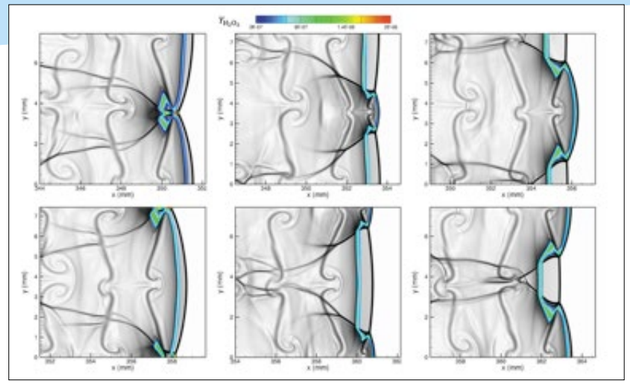
Newly Developed Ludwieg tube and Schlieren system

A Ludwieg tube, together with high-speed Schlieren imaging system, is utilized to investigate high-speed flow, such as laminar-to-turbulent transition, and flow over compressor blades. Four nozzles are designed to produce test Mach numbers of 0.8, 1.5, 2.3, and 4.0, with the maximum test time up to 40 *ms*.



Simulation of Detonation Waves

Dynamics of $H_2/O_2/Ar$ detonation waves in a rectangular channel, with thermochemical non-equilibrium.

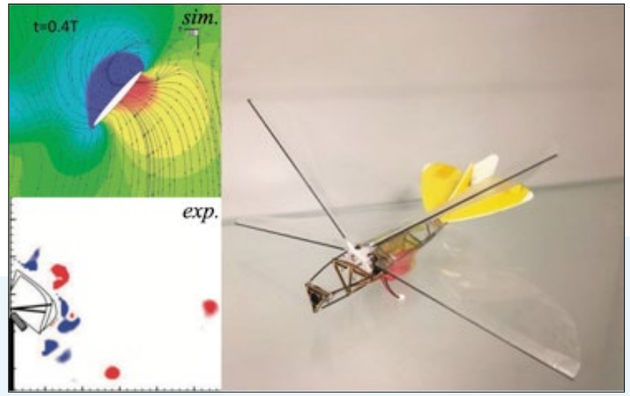


Unmanned Air Vehicle (UAV)

A vertical take-off and landing (VTOL) tail-sitter UAV was designed and manufactured with both hovering and level flight capability. The UAV utilizes the autopilot system for flight stability and autonomous flight during Intelligence, Surveillance and Reconnaissance (ISR) mission. Meanwhile, an on-board system can act as a signal relay to control and manage several UAVs in the same mission.

Micro Air Vehicle (MAV)

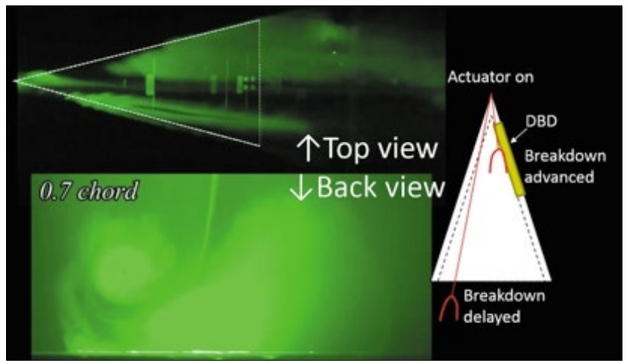
Design, analyze, and build an agile palm-sized bio-inspired flapping MAV, which can carry a light-weight camera and is suitable for both indoor and outdoor ISR mission. Computational Fluid Dynamics simulations and Particle Image Velocimetry in wind tunnel experiments have been performed for building up a complete and systematic knowledge system for the MAV design.



Research Centres/Consortiums

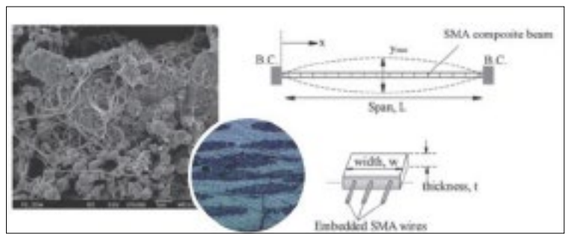
Consortium for Aerospace Engineering

Active Flow Control Using Plasma Actuators
The application of the dielectric barrier discharge plasma actuators in controlling the leading-edge vortex (LEV) breakdown on a highly-swept delta wing. The crossflow interaction between the LEVs leads to the opposite control effect on the controlled side in the symmetric and asymmetric control cases.



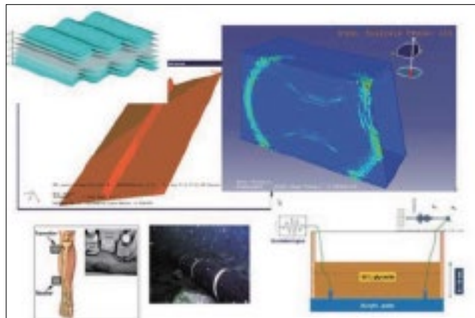
Advanced Compsite Materials
Nanoclay supported nanotube for enchancinng structural properties of polymer-based composites.

Smart Composities with embedded
Shape Memory and Stitched fiber aircraft compositie.

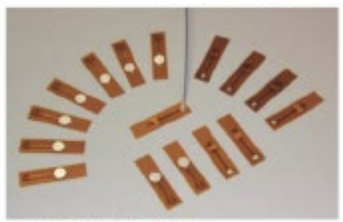


Analysis of Aircraft Structure and Noise

Guided Wave-based Structural Health Monnitiring



Fundamental Study of Elastic Waves Guided



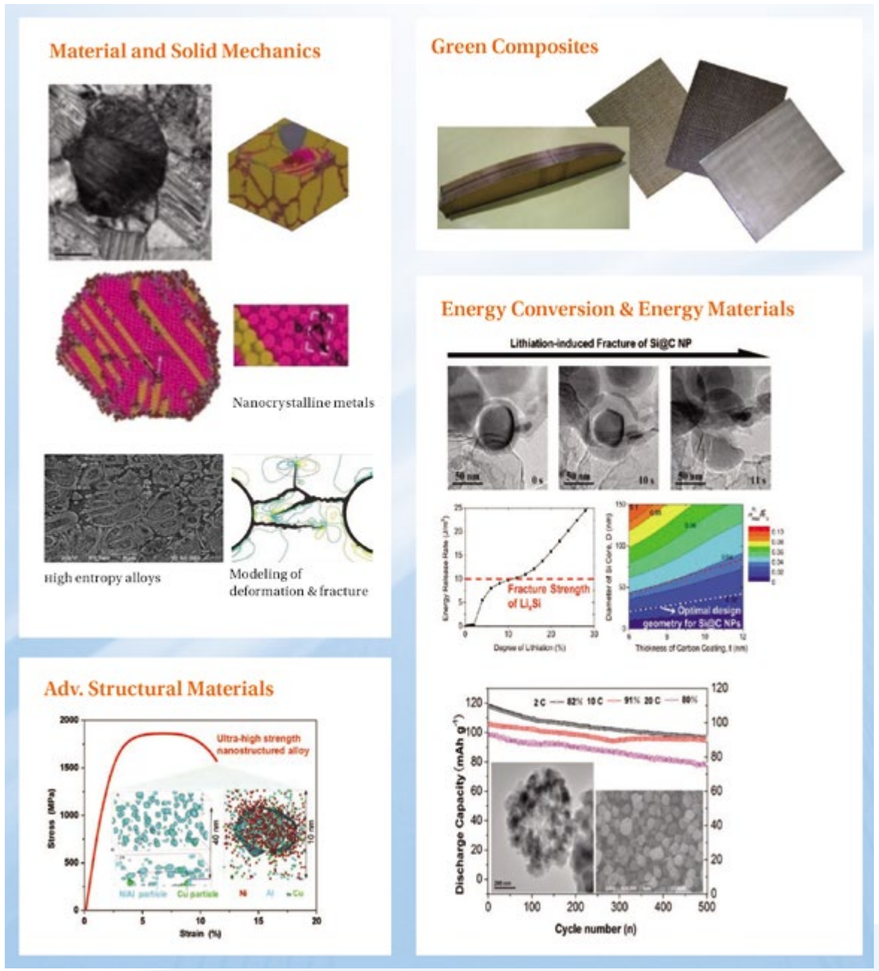
Decentralized sensing unit

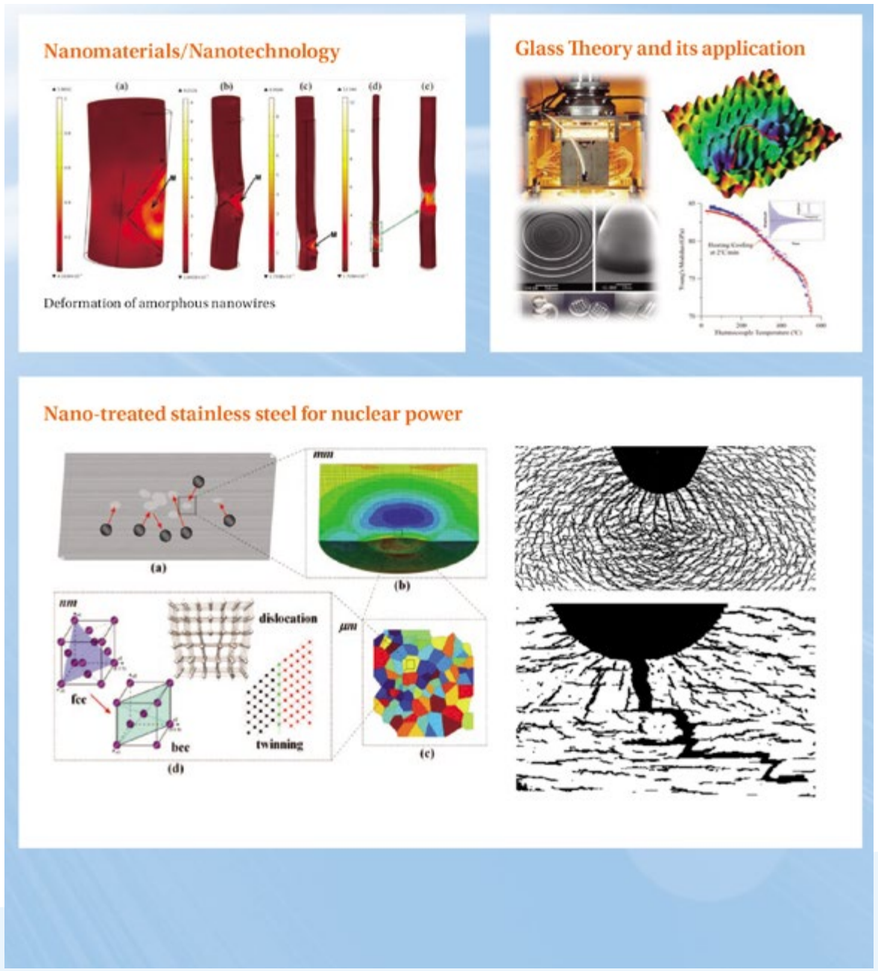
Research Centres/Consortiums

Consortium for Advanced Materials Research

Objective

The Consortium aims at enhancing the global competiveness of Hong Kong through innovative teaching, fundamental research and the application of cutting edge technologies in the areas of advanced materials sciences and engineering covering materials design & simulation, surface & interface technology, structureproperty relationships, and biomedical, functional, energy, composite, and smart materials and the structures made of these materials. In addition, the endeavors of the Consortium also go to energy conversion, product design and development, and the related technology innovation.





Research Centres/Consortiums

Consortium for Sound and Vibration Research

The Consortium for Sound and Vibration Research (CSVR) is recognized and supported by the University under its Niche Areas Development Scheme, aimed at promoting and consolidating research excellence in strategic areas in the University. With its core members from the Department of Mechanical Engineering, the Consortium regroups faculty members from different departments, providing a platform to foster close collaborations and synergy with overseas research institutions, public service corporations, local industry and governmental agencies, motivated by its mission to carry out high-quality research on sound and vibration and meet the industrial and societal needs through technology transfer.

Research themes in the Consortium cover a wide spectrum of topics in the general area of sound and vibration with both fundamental and applied nature. Since its establishment in 2001 and upgrading to University Niche Area in 2007, CSVR has firmly strengthened its reputation and academic leadership in the area of sound and vibration research. Residing on its core expertise, the group has been very successful in consistently receiving research funds from a variety of governmental agencies and industries.In the pursuit for excellence, the group enjoys high international visibility and recognition, evidenced by a large number of quality publications in top-notch journals. Consortium members also sit on the editorial boards of some most prestigious journals in the field as well as serve various committees of international conferences and professional organizations.

CSVR enjoys the first-class experimental and computation facilities. It plays an important role in underpinning teaching activities in the University where acoustics is one of the concentrations in various programmes. Nowadays, the department is the only academic unit in Hong Kong offering a cluster of very comprehensive courses in acoustics ranging from undergraduate to postgraduate level. By the same token, CSVR makes use of its expertise and facilities to provide services to industry through a large number of consultancy projects.

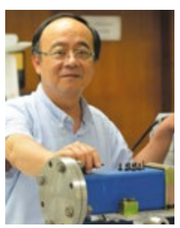
Academic Staff

SHI San Qiang (Prof.)
Head and Chair Professor of Mechanical Engineering
BSc; MSc (USTB, China); PhD (McMaster); MHKSTAM; MMRS; MTMS; FHKIE

Metallic materials; Nuclear materials; Nanotechnology; Environmental degradation of materials; Computational materials design and modeling

SU Zhong Qing (Prof.)
Associate Head and Professor
BSc (BUAA); MEng (BUAA); PhD (Syd.,)

Structural Health Monitoring (SHM); Wave Propagation; Sensors and Sensor Network; Non-destructive Evaluation (NDE); Smart Materials and Structures; Advanced Composite Materials



WEN Chih-Yung (Prof.)
Associate Head and Professor
BEng (National Taiwan University); MSc (Caltech, U.S.A.); PhD (Caltech, U.S.A.); AFAIAA; FHKIE

Aerodynamics of hypersonic vehicles; Supersonic combustion; Active flow control; Magnetic fluid flows; Fuel cell technologies

CHEN Guohua (Prof.)
Associate Vice President (Research Support), Otto Poon Charitable Foundation Professor in Smart and Sustainable Energy, and Chair Professor of Energy Conversion and Storage
B.Eng. (Dalian University of Technology), M.Eng.; PhD (McGill), FHKIE, Fellow AIChE

Advanced electrode materials for energy storage; electrochemical technologies for energy and environmental applications; drying of high value products.

CHENG Li (Prof.)
Chair Professor of Mechanical Engineering
BSc (Xi'an Jiaotong Univ.); DEA; Ph.D. (INSA, Lyon, France); FASA; FASC; FHKIE; FIMechE

Noise and vibration control; Fluid-structure interaction; Damage detection and smart material/structure/products

LEUNG Woon Fong, Wallace (Prof.)
Chair Professor of Innovative Products & Technologies

BSc(Cornell U.); MSME(MIT); ScD(MIT); Fellow of ASME, HKIE, AFS and AICHE; Senior Member of AIAA; Member of ACS and SBE

Product innovation, research and development; Physicochemical hydrodynamics; Turbine cooling; Nanofiber technologies for health (wound healing), environment (filtration of nano-aerosols and purification of gaseous pollutants; water purification), and renewable energy (Dye Sensitized Solar Cells); Separation & filtration technologies; Biotechnology separation; Membrane separation and processes; Rheology of semi-fluids; Water and wastewater treatment; Centrifugation technologies; Centrifugal microfluidics for micro-reactor and cell culture; Interactive rehabilitation robotic system; Clinical decision support system; Cancer biomarker discovery

CHAN Tat Leung (Prof.)
Professor
BSME; MSME; PhD; Ir; RPE, Eur Ing; CEng; FASME, FHKIE; FIMechE; FSAE

Multiphase and multicomponent complex systems with micro- and nanoscale; Aerosol science & technology; Combustion & emissions formation; Transport and formation of nano/microparticles and gaseous pollutants; On-road vehicle emission measurement, control and modelling techniques; Thermal-fluids science & engineering.

CHEUNG Chun Shun (Prof.)
Professor
BSc, MSc (H.K.U.); PhD (H.K.Poly.); CEng; RPE; MHKIE; MIMarE

Internal combustion engine; Engine emissions

FU Ming Wang (Prof.)
Professor
BEng; MEng (Xi'an Northwestern PolyU); PhD (National Univ. of Singapore)

Product design and development; CAD and CAE; Manufacturing technologies; Nano-processing of bulk materials and micro-realization of micro product/systems

ZHOU Limin (Prof.)
Associate Dean (Research) and Professor
BEng; MEng(Harbin); PhD(Syd)

Nanomaterials and nanotechnology for energy conversions and storages; Recyclable and reusable high performance structural composites; Functional composites; Structure health monitoring technology

CHOY Yat Sze (Dr)
Associate Professor
BEng; PhD (HK PolyU) ;MIOA

Sound induced vibration; Duct noise control; Building and room acoustics; Environmental noise measurement and control; Aeroacoustics; Sound Sources identification; Sound quality of product and its assessment; Soundscape study, planning and design

JING Xingjian (Dr)
Associate Professor
Bsci (Zhejiang Univ.); MPhil & PhD (CAS); PhD (Univ. of Sheffield)

Frequency domain methods for nonlinear systems; Nonlinear system identification and signal processing; Nonlinear sound and vibration control; Robotic systems—Analysis, Design & Control; Robust learning/control methods; Intelligent computing and optimization

LEUNG Chi Kin, Randolph (Dr)
Associate Professor
PhD; Senior MAIAA; MASME; MIED; MIOA; MHKIE; MHKIOA

Computational aeroacoustics and gas dynamics; Wind turbine aerodynamics; Flow-induced sound and structural vibration; Aviation science; HVAC compressor and system design; Product sound and vibration quality

LIU Yang (Dr)
Associate Professor
BSc(USTC); MEng(BUCT); PhD(Syd.); MHKIE

Biomechanics; CFD; Flow-induced vibration and thermal management

Academic Staff

TANG Hui (Dr)
Associate Professor
BEng(Tsinghua); MEng (Tsinghua); PhD (Manchester)

Aerodynamics; Hydrodynamics; Active flow control; Fluid-structure Interaction; Multiphase flow

ZHANG Peng (Dr)
Associate Professor
BSc (USTC); MSc (IMCAS); PhD (Princeton)

Theoretical and numerical combustion; Chemical kinetics; Droplet and spray dynamics; Rarefied gas dynamics

WONG Wai On (Dr)
Associate Professor
BEng; MSc; PhD (HK PolyU); MIMechE; CEng; MHKIE

Laser diagnostics; Structural dynamics; Signal processing

ZHENG Guang Ping (Dr)
Associate Professor
BS., MS. (Sun Yat-sen University); Ph.D. (Johns Hopkins University)

Computational materials science; Mechanical properties of nanomaterials; Applications of nanomaterials in energy conversion and storage

YAO Haimin (Dr)
Associate Professor
BEng, MEng (Tsinghua University); Dr.rer.nat. (Universitat Stuttgart)

Solid Mechanics (specialized in Fracture Mechanics and Contact Mechanics); Bio-inspired Mechanics and Materials; Advanced Energy Materials; Nanomechanics

ZHU Jie (Dr)
Associate Professor
BSc, MSc (Nanjing University); PhD (The Pennsylvania State University

Structured acoustic materials and metamaterials; Acoustic imaging technology and system; Piezoelectric material and acoustic transducers; Experimental acoustics

AN Liang (Dr)
Assistant Professor
PhD (HKUST)

Thermofluid; Energy conversion and storage technologies; Advanced materials

David NAVARRO-ALARCON (Dr)
Assistant Professor
PhD (CUHK)

Robotics

CHU Kar Hang, Henry (Dr)
Assistant Professor
BASc (University of Waterloo); MASc and PhD (University of Toronto)

Robotic manipulation; Vision-based control and automation; Micro-system design and Tissue engineering

RUAN Haihui (Dr)
Assistant Professor
PhD (HKUST)

Solid Mechanics; Plasticity; Constitutive modeling; Amorphous Materials; Nanomaterials; Impact; Collision and Crashworthiness

JIAO Zengbao (Dr)
Assistant Professor
BSc (CUGB), MEng (USTB); PhD (CityU)

Advanced structural materials; High-temperature and high-strength alloys; Nanostructured alloys; Mechanical properties; 3D atom probe tomography

Academic Staff

Adrian BEJAN (Prof.)
Visiting Chair Professor of Engineering Science (2010 - 2012 and 2015 - 2018)
BSc (MIT); MSc (MIT); PhD (MIT); HonMemASME; Academy of Europe

Thermodynamics; Heat Transfer; Constructal Law of Evolution in Nature

GAO Huajian (Prof.)
Visiting Chair Professor of Mechanical Engineering (2016 - 2018)
BS (Xian Jiaotong); MS (Harvard); PhD (Harvard)

Nanomechanics of engineering and biological systems

CHENG Ping (Prof.)
Visiting Chair Professor of Mechanical Engineering (2014 - 2016)
B.S., Mech. Engg.(Oklahoma State University); M.S., Mech. Engg. (M.I.T.); Ph.D., Aeronautics & Astronautics (Stanford University)

Microscale heat transfer; Porous media heat transfer; Mesoscale simulation of transport phenomena; Radiative gasdynamics

Sylvie LORENTE (Prof.)
Visiting Chair Professor of Engineering (2015 - 2018)
BSc; MSc; PhD

Vascularized materials; Constructal Theory; Fluid Mechanics; Porous media; Heat and mass transfer

SO Ming Cho, Ronald (Prof.)
Emeritus Professor (2005 - Present)
Visiting Chair Professor of Fluid Dynamics and Aeroacoustics (2010 - 2014 and 2016 - 2018)
BSc(Hons); MEng; MA; PhD; DSc; Hon DEng; FWIF; FIMechE; FASME; MIAA; FRAeS; FAIAA

Turbulence modeling; Fluid-structure interaction; Flow-induced vibration; Direct aeroacoustics simulation; Lattice Boltzmann-type equation

TONG Timothy W (Prof.)
President of PolyU and Chair Professor of Mechanical Engineering (2009 - 2018)
Emeritus Professor (2019 – Present)
BSc; MSc; PhD; FASME; FHKEng; JP

High performance computing of radiative heat transfer; Heat transfer in porous media; Energy conservation; Thermal insulation systems; Thermal control of aerospace systems; Thermal radiation; Heat transfer in fuel cells

XU Qiang (Dr)
Distinguished Honorary Professor of Materials Science and Engineering (2017 - Present)
Ph.D. (Osaka University); FRSC; Member of European Academy of Sciences (EURASC)

Materials chemistry; Energy storage and conversion; Porous materials (MOFs, carbons, etc); Nanoparticles; Catalysis; Fuel cells; Batteries; Supercapacitors; Hydrogen generation and storage

ZHANG Tong-Yi (Prof.)
Visiting Chair Professor of Mechanical Engineering (2016 – Present)
Master (USTB); PhD (USTB)

Materials science and engineering, and solid mechanics

Research Highlights

SHI San Qiang (Prof.)
Head and Chair Professor of Mechanical Engineering

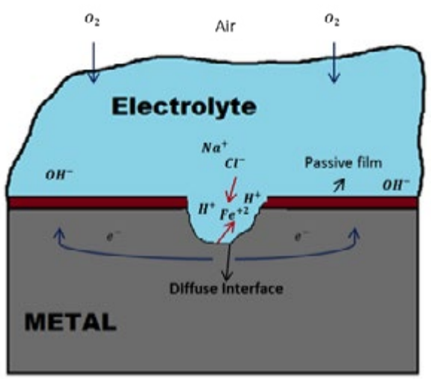
Prof. Shi's research and consultancy interests are focused on environmental degradation of materials and protection, computational materials modelling and advanced materials development. Here are some of his current research projects.

Phase field modeling of localized corrosion kinetics

In developed countries, corrosion of metals has been costing about 3% of gross national product every year, much more than the costs arisen from all natural disasters combined. Well-designed experimental tests can evaluate key parameters that affect and control the corrosion process, while theoretical work can improve our understanding of the phenomena, which is important for the development of design tools for corrosion prediction and protection. The goal of this proposal is to develop a theoretical framework based on phase field method (PFM) for predicting corrosion kinetics, especially for localized corrosion such as pitting, crevice and stress corrosion cracking. This project will deliver important tools for the development of new corrosion resistant materials as well as for the prediction of life time of materials in corrosive environment.

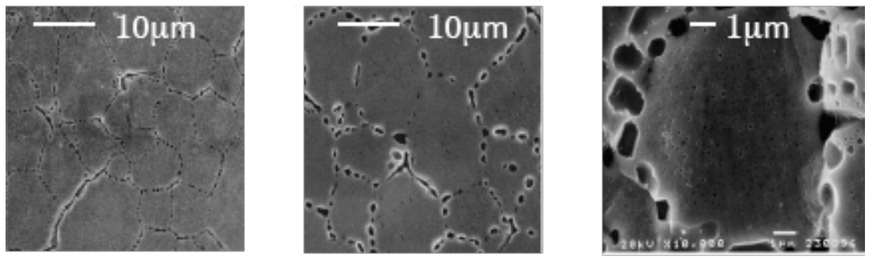
Gas bubble evolution in nuclear fuels

The fission gases xenon and krypton are unceasingly generated in irradiated nuclear fuel, which is a sintered compact of granular uranium dioxide in the current commercial light water reactors (LWRs). As a consequence of their low solubility in UO_2, the fission gases tend either to precipitate into bubbles or to be released to the free volume in the rod. Fission gas release and gas bubble



Electrochemical reactions occurring during pitting corrosion process.

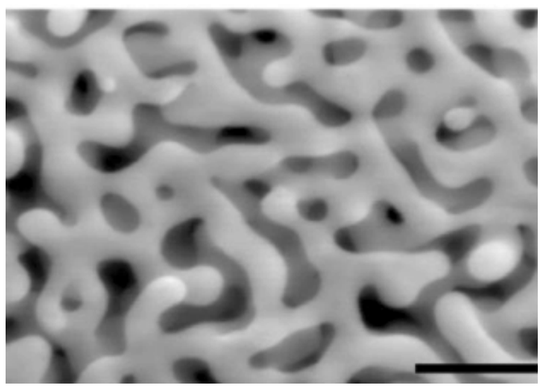
swelling are critical issues for the fuel performance of LWRs. Released fission gas can reduce the thermal conductivity of the fuel-clad gap and cause temperature and pressure increases in the fuel pellet, whereas gas bubble swelling can increase the contact pressure between the fuel and clad, and lead to clad failure. We aim to develop an atomistically informed and microstructurally resolved phase-field model for predicting the fission gas behavior in UO_2 and providing accurate thermodynamic and kinetic data to enhance the prediction capability of nuclear fuel performance codes.



SEM images of the gas bubble evolution in UO_2 during post-irradiation annealing (Zacharie et al., J. Nuclear Materials 255(1998)92).

Modeling of the evolution kinetics of porous metals during electrochemical dealloying

Dealloying is the selective dissolution of one or more active elemental components of an alloy in electrolyte. It can be a key failure mechanism for engineering structures such as in power plants and aging aircraft. In recent decade, researchers found that dealloying of binary alloys can result in the formation of porous metals with porous size ranging from a few nanometers to a few tens of micrometers, which attracted significant attention for applications in catalysis, electrochemical supercapacitors, sensing and actuation, bone tissue engineering, mass and/or heat transport, high-temperature templates/scaffolds, radiation damage–tolerant materials, and battery electrodes. This project aims to develop a theoretical modeling framework for the formation and evolution of porous metals during dealloying using the phase-field methodology (PFM). Combining with the modeling methods in macro and atomistic scales, our project will deliver important tools for the mechanistic understanding of porous evolution, design and development of advanced porous metals, as well as for the prediction of the behaviors of porous metals in engineering environment.



Scanning electron micrograph of nanoporous gold made by selective dissolution of silver from Ag-Au alloys in HNO_3 (Erlebacher J, et al. 2001. Nature 410(6827):450–53).

SU Zhong Qing (Prof.)
Associate Head and Professor

Nano-engineered, Sprayable Sensing Network Coating for Acousto-ultrasonics-based Real-time Structural Health Monitoring:

larger responsive bandwidth, lower cost and greater versatility

The research group, led by Prof. Zhongqing Su in Department of Mechanical Engineering at the Hong Kong Polytechnic University, has long been dedicated to both fundamental and applied research on structural health monitoring (SHM), non-destructive evaluation (NDE), wave propagation, smart materials and structures, sensors and sensor networks, and advanced composite materials. The group enjoys burgeoning growth since its establishment, consistently outputting high-quality publications in top-tier journals and securing research grants from various sources. In the pursuit for excellence in research, the group is proactively extending research outcomes to real-world engineering applications, and one paradigm is the SHM technology developed for high-speed trains.

Based on intensive research endeavors in the past few years, the group has recently developed a new breed of nanocomposites-inspired sensors which can be sprayed directly on flat or curved engineering structural surfaces, such as train tracks and aeroplane structures. The sprayed sensors can be networked, to render rich real-time information on the health status of the structure under monitoring. Due to its light weight and low fabrication cost, large quantities of such sensors can be deployed in a sensor network for detecting hidden flaws of structures, paving the way for a new era of structural health monitoring.

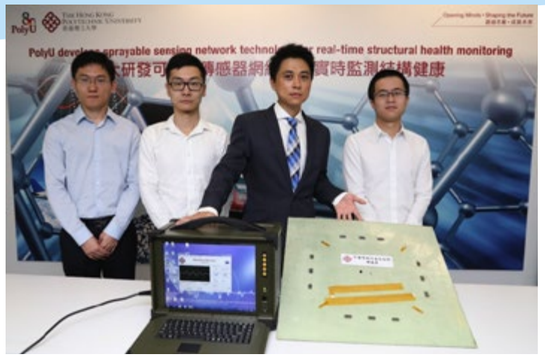
With an innovative sensing mechanism, this flexible carbon nanocomposite sensor is made of a hybrid including graphene, carbon black and polyvinylidene fluoride. In virtue of the tunneling effect in the conductive network formed in the nanocomposite hybrid, the sensor can be responsive to acousto-ultrasonic wave signals with ultralow magnitudes in a broad frequency range. To advance the insight into the sensing mechanism, a series of morphological analysis using scanning electron microscopy (SEM) and X-Ray diffraction (XRD) is conducted, to explore the dispersion of nanofillers and the crystal characteristic of the sensor, on which basis the nanostructure of the hybrid is optimized. The sensing ability of the developed sensor is testified through the acquisition of acousto-ultrasonic signals from low frequency cyclic tensile loading to high frequency ultrasonic guided waves. Based on excellent mechanical and electrical properties of selected nanofillers, the sensor, fabricated with a solution film-forming method, can reach a high gauge factor of ~60, responsive to ultrasonic signals up to 1 MHz. The acquisition of wave scattering in an ultrasonic regime allows detection of cracks as small as 1 to 2 mm in most engineering materials.

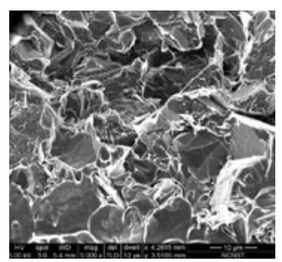
Currently, the number of conventional ultrasound sensors, such as those made of lead zirconate titanate (PZT), used for in-situ monitoring is usually limited by the factors related to the sensor's cost and weight. These sensors are usually stiff (unwieldy to adapting to curved structural surfaces), introducing remarkable weight and volume penalty to a structure to which the sensor is to be mounted. The nanocomposite sensors developed by the group, however, can be fabricated in large quantities to form a dense sensor network for structural health monitoring at a much lower fabrication cost and weight than using conventional sensors. Compared to the conventional ultrasound sensors which costs over US$10 each and weighs few grams, this new sensor costs only US$0.5 and 0.04g for each. As such more sensors can be adopted in one structure, generating rich information of the structural health status, whereas with less weight added to the structure.

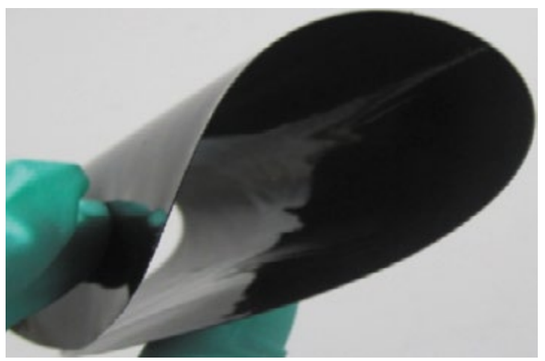
"This nanocomposite sensor has blazed a trail for implementing in-situ sensing for vibration, or ultrasonic wave-based structural health monitoring, by striking a balance between 'sensing cost', i.e. the cost of sensors, and 'sensing effectiveness', the quantity of data acquired by the sensors," said Professor Su.

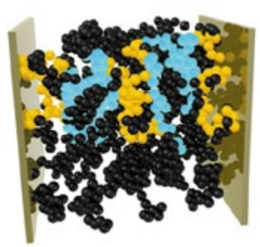
In addition, the new sensor has excellent flexibility and can adapt to curved structure surfaces. That allows a wide range of practical engineering applications. It is also sprayable on the surface of a moving structure to transmit the structural health information in a real-time manner. Being lightweight and chemically stable, the developed sensor can be coated onto or embedded into engineering assets with minute weight penalty and favorable environmental adaptation. The simplified fabrication process significantly reduces the sensing cost while maintaining high sensing efficiency, benefiting ultrasonic-wave-based structure health monitoring.

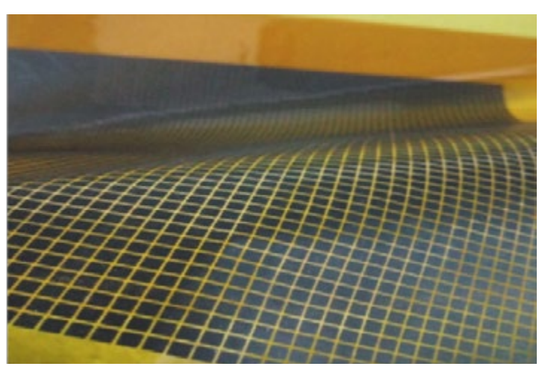
This new research has recently been published in top-tier journals in this field, including Ultrasonics, Carbon, and Smart Materials and Structures. "Due to its light weight, the novel nanocomposite sensors can be applied to moving structures like trains and aeroplanes. That will help to pave the way for real-time monitoring of these structures in future, enhance safety of the engineering assets and retrofit the traditional system maintenance philosophy," said Professor Su.

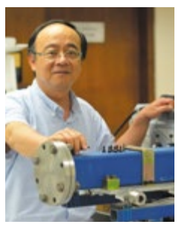












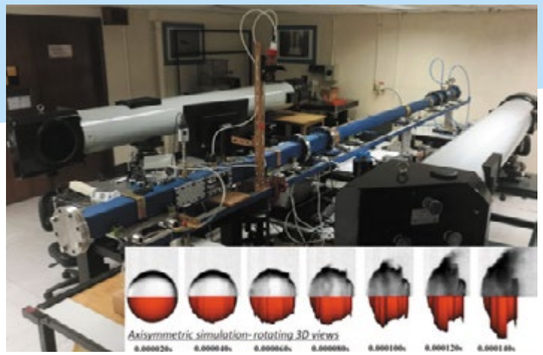
WEN Chih-Yung (Prof.)

Associate Head and Professor

High-speed flow researches

Studies on the fascinating high-speed flow promote the development of supersonic to hypersonic vehicles. The research team led by Prof. Chih-Yung Wen at the Department of Mechanical Engineering of the university focuses on a few key elements in this field: 1) Shock/Droplet interaction–the interaction of the detached shock with rain droplet during the reentry of a space shuttle and the secondary breakup of the liquid fuel in the Supersonic Combustion Ramjet (SCRamjet); 2) Hypersonic Boundary Transition–controlling the boundary layer transition during hypersonic flight; 3) Chemical Non-equilibrium Flow over a Hypersonic Vehicle where the real-gas effect has to be considered; 4) Detoantion–interpreting the effect of vibrational non-equilibrium mechanism on gaseous detonation and pursuing its accurate simulation; 5) Shock/Bubble interaction–Richtmyer–Meshkov Instability.

Both numerical and experimental platforms have been built and researches are proceeding based on them. The in-house space-time CE/SE (Conservation Element and Solution Element) CFD method has shown good performance in capturing shock waves and contact discontinuities in simulating compressible single- and multi-fluid problems and the algorithm itself is under further development. A shock tube implemented with the shadowgraph/Schlieren visualization systems has produced reliable shock/droplet interaction images which not only validated the numerical simulations but also facilitated other high-speed flow researches. A boundary layer transition control strategy is conducted numerically on a flat-plate at Mach 6 using heating or cooling strip, where an



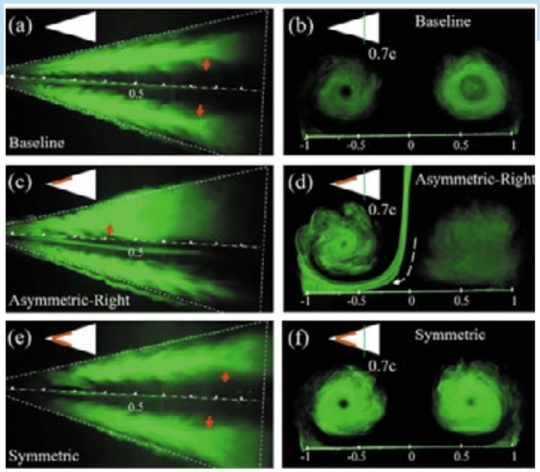
efficient way to stabilize the hypersonic boundary layer is obtained. A Ludwieg tube up to Mach 4 is under construction and will be used to test the novel meta-material for delaying the hypersonic boundary layer transition. Considering the vibrational non-equilibrium effect, a modified steady one-dimensional Zel'dövich-von Neumann-Doring detonation model has been proposed, which confirms its important role played in the detonation cell size change. Also, via extensive numerical simulation on detonation, the vibrational relaxation in the chemical reaction has also been testified to be a crucial mechanism.

Applications of Plasma Actuators

Plasma actuators have attracted considerable attention in the aerospace industry due to their features of simple mechanism, easy maintenance, low cost and fast response, and they can be formed to various shapes of vehicles. The plasma actuator ionizes the gas molecules and forms the plasma. Electric field induces the motion of plasma and results in the ionic wind which alters the velocity profile inside the boundary layer through the particle collisions and finally changes the aerodynamic characteristics of the vehicle. The research team experimentally investigated the effects of Dielectric Barrier Discharge (DBD) plasma actuators on the aerodynamics of a slender delta wing. The leading edge vortex breakdown locations under both symmetric and asymmetric control forms and various control frequencies are summarized. The aerodynamic response to the controls suggests that the DBD plasma actuator is a promising technique for delta wing maneuvering. More investigations on the delta wing maneuvering will be conducted in the near future.

Unmanned Aerial Vehicle (UAV) and Micro Aerial Vehicle (MAV)

Wilderness search and rescue entails performing a wide-range



of works in complex environments and large regions. Given the concerns inherent in large regions due to limited rescue distribution, the UAV-based framework is a promising platform for providing aerial imaging. The research team led by Prof. Chih-Yung Wen developed an all-in-one camera-based target detection and positioning system and integrated it into a fully autonomous UAV. It is capable of on-board, real-time target identification, post-target identification and location and aerial image collection for further mapping applications. A UAV communication relay solution was also developed by the research team to extend the communication range and bypass obstacles in complex environments. In the application of tail-sitter Vertical Take-Off and Landing (VTOL) UAV, a hardware-in-loop simulation environment was established which is capable of real-time dynamic simulation and supports a robot operating system (ROS)-based open-source autopilot. An independent ROS package was well prepared for data communication between a simulator and flight control computer. In the MAV field, the first personal view flight is well realized on a four-wing flapping MAV by which a camera was installed on the MAV and the clap and fling mechanism was proven to play a key role in the lift generation. The understanding of MAV structure and aerodynamics has promoted the designing of flapping MAVs.

Prof. Wen's UAV researches quickly drew the attention from the local industries. He is now sponsored by DJI (the world-leading Drone company) to design a VTOL UAV and has helped ARUP (a global consulting firm of construction and planning) to build the Building Information Modeling system (BIM) using UAV aerial photography. His team has earned many awards including the Gold award in the 45th International Exhibition of Invention of Geneva, 2017, and Champions in Innovation Design Category and in Navigated Flight category in 2016 Taiwan UAV Competition.

Widespread Recognition

Research efforts at The Hong Kong Polytechnic University have gained worldwide recognition. Many domestic and international collaboration projects have been established, including collaboration with Department of Spacecrafts, Institute of Aerodynamics and Flow Technology, German Aerospace Center (DLR), Göttingen, Germany, The State Key Laboratory of High Temperature Gas Dynamics (LHD), Institute of Mechanics, Chinese Academy of Sciences, and Department of Mechanical Engineering, University of Ottawa, Canada. Prof. Chih-Yung Wen at the Department of Mechanical Engineering of the university currently serves as the associate editor of AIAA Journal and editor of the Shock Waves Journal, and has also been invited to give plenary talks in many international conferences on his research works.

CHEN Guohua (Prof.)

Associate Vice President (Research Support), Otto Poon Charitable Foundation Professor in Smart and Sustainable Energy, and Chair Professor of Energy Conversion and Storage

Professor Chen obtained his Bachelor of Engineering from Dalian University of Technology. Upon his graduation, he was awarded the Scholarship of State Education Commission for further studies in Canada. He obtained his Master of Engineering and PhD from the Department of Chemical Engineering at McGill University. His research topic was heat and mass transfer in the drying process of paper, a major industry in Canada. After he joined the Department of Chemical Engineering, Hong Kong University of Science and Technology, Prof. Chen started working on various technologies on industrial wastewater treatment. His major focus was then the electrochemical technologies for wastewater treatment. His review paper on this topic published in Separation and Purification Technology in 2004 has been one of the top downloaded papers ever since. Professor Chen's research at Mechanical Engineering, Hong Kong Polytechnic University would focus on the advanced materials for energy conversion and storage.

Prof. Chen developed novel anode materials for photoelectrochemical process in the degradation of pollutants and also in the splitting of water for H_2 and O_2 production. One typical material is the novel phosphorus doped carbon nitride modified TiO_2 nanotube arrays with improved photoelectrochemical performance. The prepared P-C_3N_4/TiO_2 NTs exhibit enhanced light-absorption characteristics and improved charge separation and transfer ability, thus resulting in a 3-fold photocurrent (1.98 mA cm−2 at 0 V vs. Ag/AgCl) compared with that of pure TiO_2 NTs (0.66 mA cm−2 at 0 V vs. Ag/AgCl) in 1 M NaOH solution. The prepared P-C_3N_4/TiO_2 NT photoelectrodes also present excellent photocatalytic and photoelectrocatalytic capabilities in the degradation of methylene blue (MB). Figure 1. illustrates the mechanism and also shows the results of H_2 production.

Professor Chen's recent research interests are the synthesis of novel materials for lithium ion batteries. His research group has published papers on various materials for cathode and anode with improved cycling and rate effect.

For the cathode part, the lithium manganese oxide produced from his lab can withstand high working temperature and delivers high power at relatively high capacity. It is being commercialized with industrial partners. The humidity effect on $LiFeSiO_4F$ has been systematically studied with the mechanism found as shown in Figure 2.

Li-S battery is another research focus from his research lab. Different encapsulation methods of S have been investigated with much improved effect in terms of cycling and rate performance. The Maganeli phase Ti_4O_7 nanotube array was found to be an excellent host for sulphur in the making of Li-S battery with extra long service life and small decay rate as shown in Figure 3.

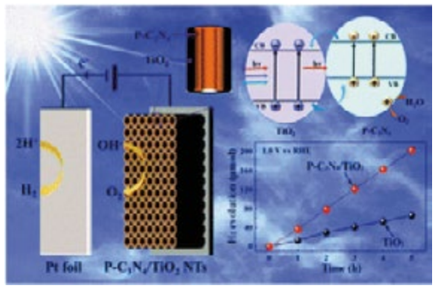


Figure 1. P-C_3N_4/TiO_2 nanotube arrays for photoelectrochemical H_2 production from water splitting

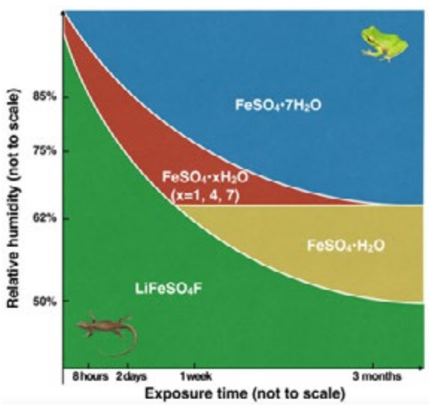


Figure 2. Effect of humidity on $LiFeSO_4F$ at different exposing time

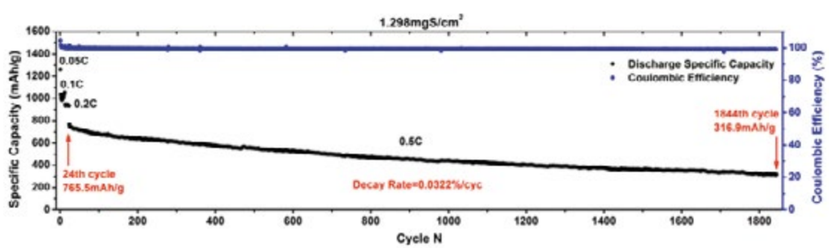


Figure 3. Cycling performance of Li-S cell battery at 0.5 C with 1.3 mg S/cm² loading.

CHENG Li (Prof.)

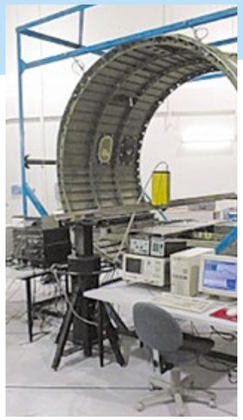
Chair Professor of Mechanical Engineering

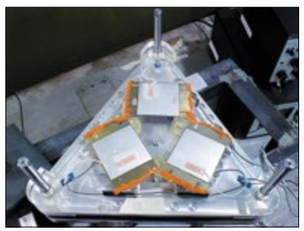
Towards a quieter world

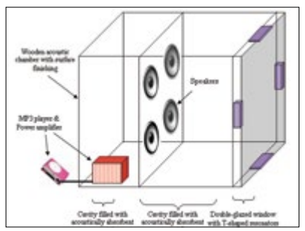
Modern society suffers from the ever increasing noise problems. Hong Kong is no exception. With the rapid economic growth, we live in a society over-saturated with transport which significantly pollutes our environment. It is imperative that efficient noise control measures be developed for creating a better living environment for city dwellers. In a slightly different perspective, a primary common denominator of the industrial sector is probably the growing importance of noise issues in the design of manufactured products, be it for machines of limited production, everyday consumer product, or even the high-end noble aerospace industry. The necessity to tackle the noise and vibration problem at the design stage starts to be better understood by industrial people. The paradox of the real world is such that technical progress does not necessarily go hand in hand with a decrease in the noise level. Manufacturers strive to build lighter goods, with an increase in the pace and the performance, which is generally accompanied by a degradation in the acoustic quality. Airplanes of new generation are the best example, in which the increasing use of light weighted composite materials deprives the mass needed to achieve good noise isolation. Industry wishes at all costs to distance itself from the approach that consists in using after-the-fact palliatives, even if it is still being practiced for the lack of something better. Therefore, development of innovative noise control measures, along with efficient simulation and optimization tools is of vital importance.

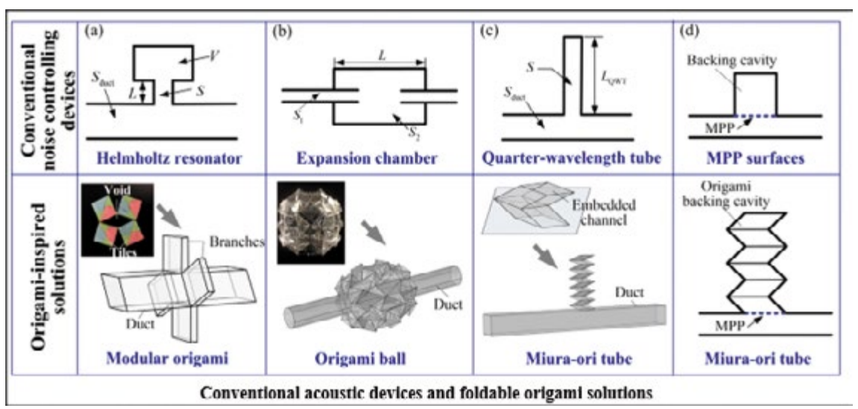
Prof. Cheng has been leading a sizeable research group in PolyU working in sound and vibration research under the umbrella of CSVR (Consortium for Sound and Vibration Research). He has been mainly engaged in three research arms pertinent to sound and vibration and germane to environmental and industrial application in general: Noise and vibration control, structural health monitoring and fluid-structure-sound interaction.

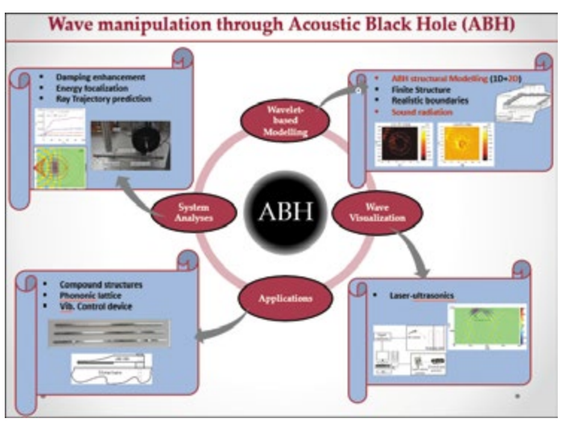
As an example, vibration and noise control inside an enclosure is a typical problem with great application potentials, exemplified by the cabin noise of passenger vehicles, machinery noise in enclosures, noise in rooms and the payload safety inside launching vehicle in spacecraft etc. Research has been carried out in his research group to develop the enabling technology for various applications, such as aircraft or automobile cabin noise. Major topics include 1). Development of efficient simulation, design and optimization tools, with the ability of dealing with structural complexity on one hand, and covering broad frequency range on the other hand; 2). Identifications of noise and vibration sources; 3). Passive control techniques including damping treatment, vibration isolation, sound absorption and structural modifications; 4). Active noise and vibration control including the design of sensor/actuator and controllers. Recent progress in developing micro-perforated panel (MPP) absorbers in complex vibroacoustic environment offers new alternatives to replace the conventional non-environmental-friendly fibrous and porous materials for sound absorption applications. MPP absorbers are now being designed and used in the design of Wave Trapping Barriers for traffic noise control, hybrid silencers for duct noise control, acoustic windows allowing natural air ventilation and interior noise suppression inside future spacecraft.











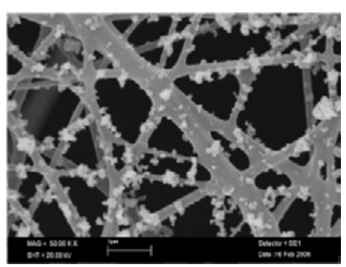
LEUNG Woon Fong, Wallace (Prof.)

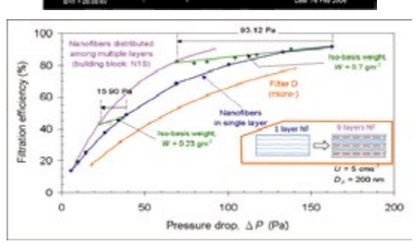
Chair Professor of Innovative Products & Technologies

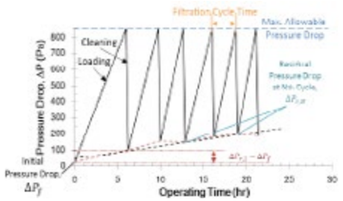
(A) ENVIRONMENTAL ENGINEERING

1. Air Filtration removing aerosols down to 10nm:

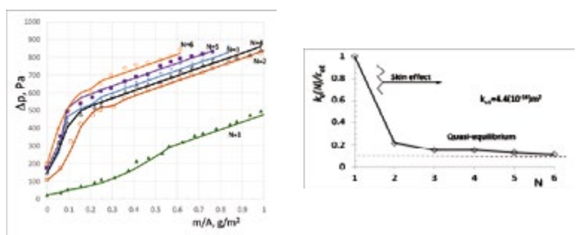
High-efficiency, low-pressure-drop nanofiber filter for filtration of air-borne nano-aerosols of size 10-300+ nm (e.g. diesel pollutants, air-borne pathogens including influenza – H3N4 that killed over 200 people in Hong Kong summer 2017, H5N1, SARS etc., and allergens) under respective, light and heavy aerosol loading for use in space/cabin ventilation and personal protection. Our proprietary multilayer nanofiber and dual-layer microfiber-nanofiber filter technologies reduce significantly pressure drop while maintain high filtration efficiency for clean and loaded filtration applications.



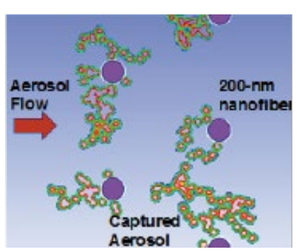




6 cycles of loading and cleaning by backpulse and backblow cleaning of a nanofiber filter with 280nm fiber diameter.



Δp vs. specific aerosol loading on cyclic loading of nanofiber filter. Measurements vs. prediction Skin layer permeability over 6 loading/cleaning.



Computational Fluid Dynamics (CFD) software has been used to investigate the capture mechanisms of nano-aerosols (80nm) by means of diffusion and interception on the 200nm nanofiber mat and the formation of dendritic structure of trapped aerosols. Further, the transition from depth filtration to surface filtration is investigated.

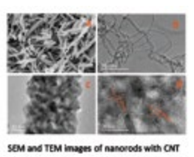
2. Air and Water Purification removing harmful gases and organics in water:

Photocatalyst in high surface-to-volume ratio TiO_2-composite nanofibers with embedded graphene and operable under visible light for purifying pollutant gas (e.g. NO_x and VOC) and water contaminated with organic pollutants. It can also carry out disinfection function killing bacteria and viruses.

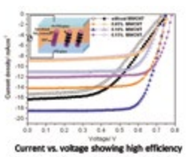
(B) RENEWABLE ENERGY

Perovskite Solar Cell (PSC) and Dye Sensitized Solar Cell (DSSC) for renewable energy:

Graphene nanofibers have been installed first time in the perovskite solar cell resulting in higher charge transport, better crystallinity, larger crystals, and less crystal interfaces for recombination. Power conversion efficiency of 20% efficiency has been reached. Several innovative technologies leading to high efficiency (8.7 - 10.2%) have been developed on DSSC made from electrospun TiO2 nanofibers/nanorods and electrosprayed nanoparticles with unit cost 1/10 of that of conventional silicon cells: scattering layer made of nanofibers / polydispersed nanoparticles, co-sensitizing core-shell structure, and carbon nanotube (CNT) in TiO_2 nanorods.



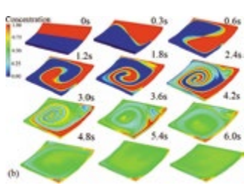
SEM and TEM images of nanorods with CNT

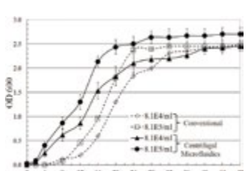


Current vs. voltage showing high efficiency

(C) HEALTH - Tissue Engineering

Wound dressing using materials from crustacean made into biodegradable and biocompatible nanofibers provide antibacterial function (with 6-8 log cycles of reduction in both E. coli and S. Aureus) as well as haemostasis. Further the nanofiber provides a scaffold for improving cell growth and repair during healing.





(D) OTHERS

1. Mixing in Centrifugal (or Rotating) Microfluidics (CM)

Mixing in micro- and milli-chambers: By continuously accelerating/decelerating a micro-/milli-chamber over time, a 3D complex spiral toroidal vortex is generated providing mixing of momentum, mass and energy in the chamber. This has important applications for micro-reactors, fast diagnostics, lab-on-a-chip, and life science applications using small samples as it provides process intensification in an otherwise viscous dominated condition rendering mixing difficult.

Micromixing can be realized in the time frame of seconds rather than hours and days.

Cell culture taking place much faster in CM (207 mL) when compared to that of conventional method using a large flask (500 mL) consuming a large sample too. Measurement of optical density at 600 nanometers (OD600) indicates cell concentration.

Mixing in micro- and milli-channels: Coriolis acceleration, local centripetal acceleration in flow over bends, and centrifugal acceleration have been used alone, or in combination, in various geometries including radial, zigzag, and obstructed channels to promote mixing of momentum, mass and energy.

2. Gas turbine cooling in Power Generation

Stator vane and rotor blade of the turbine have to bear hot exhaust gas from upstream combustor at temperature higher than that of the melting point of the construction materials. Research is carried out on developing effective cooling by jet impingement and convection in stationary and rotating channels.

The left picture shows an actual stator vane with local burnt area supposedly cooled by jet impingement. We have developed a numerical model for stator vane and rotating blade, in which we can investigate temperature distribution in coolant supply channel skewed by rotational effect, temperature distribution of cooling jet in leading edge of rotating blade, and Jet velocity at the leading edge of the blade/vane.

3. Centrifugal bioseparation and classification

Various important separations in biotech and biopharm applications include, but not limited to, recovering recombinant protein expressed by mammalian, bacteria and yeast cells during harvest; separation after crystallization; serum separation in vaccine production, product liquid from biomass in enzyme production, etc.

Fine particles 0.1 - 2 μm $CaCO_3$, kaolin, and SiC are of great value and can be separated by centrifugation.

CHAN Tat Leung (Prof.)
Professor

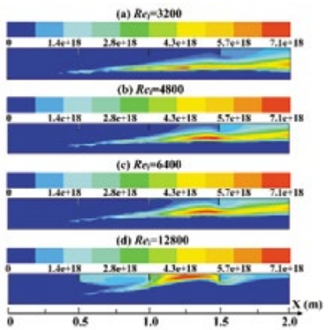
Multiphase and Multi-component Complex Systems with Micro- and Nanoscale

These challenging problems in multiphase and multi-component complex systems with micro- and nanoscale have been identified in the areas of thermal-fluid, materials, chemical and environmental sciences, and their engineering applications. It is important to understand the formation and transport mechanisms in such multi-scale multiphase flows in order to achieve efficient applications in many areas of science and engineering.

Below are some significant findings of research which are led and participated by Prof. Tat Leung Chan at the Department of Mechanical Engineering of The Hong Kong Polytechnic University:

A Coupled CFD-Monte Carlo Method for Simulating Complex Aerosol Dynamics in Turbulent Flows

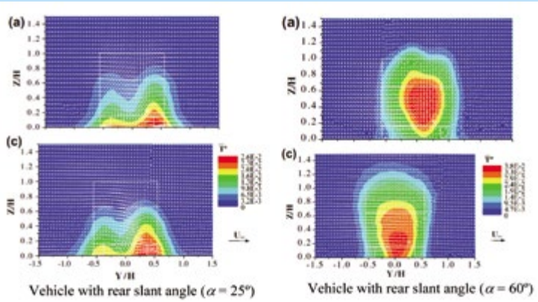
Turbulent flows with complex aerosol dynamics of polydispersed particles are encountered in many scientific and engineering problems. Examples mainly include the exhaust particle formation and evolution in the wake of the studied ground vehicle, the dynamics and dispersion of nanoparticles in urban atmospheric environment, the nanoparticle synthesis in turbulent reacting flows, and the formation of soot particles in combustion engines/burners. Particles involved in the aerosol processes are characterized by a polydispersed particle size distribution (PSD). The control over PSD of the particles in turbulent flows is of paramount significance in many industrial and engineering applications because PSD reveals the basic properties of product particles or emission particles, which in turn determines the engineering application or environmental effect. The enhancing effect of turbulence on complex aerosol dynamic processes as well as the competition and transition between different aerosol dynamic processes are noted and analyzed. The results demonstrate that jet Reynolds (Re_j) number has significant impact on a single aerosol dynamic process (e.g., coagulation) and the simultaneous competitive aerosol dynamic processes in turbulent flows.



Typical particle number density (#/m^3) contour for simultaneous coagulation, nucleation and growth in turbulent flows (First published in Aerosol Sci. Technol. 51(3), 269-281, 2017).

Vehicle Queue Effect on the Characteristics of Air Flow, and Exhaust Scalar Dispersion and Distribution Fields in the Vehicle Wake

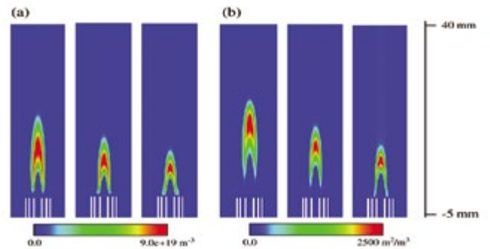
The wake structure behind a queue of studied scale-model vehicles in a closed-circuit wind tunnel facility is mainly dominated by the last one, while the preceding vehicle(s) will lead to a stronger downwash flow in the wake. For the studied vehicle with rear slant angle ($\alpha < 30°$) which has a pair of trailing vortices in the wake flow, the vehicular exhaust jet plume is mainly trapped inside these two trailing vortices and fills an "*m*-shaped" scalar distribution region behind the vehicle. Half of the *m*-shaped region which is on the vehicular tailpipe exit side shares a larger portion of scalar distribution than the other half. This unbalanced scalar distribution is enhanced by the preceding vehicle(s). It is clearly shown that the two- or three-dimensional flow behind the studied vehicle can provide different shapes of exhaust scalar dispersion and distribution fields in the vehicle wake.



Typical normalized mean temperature excess (scalars) $\overline{T}^*$ and normalized mean velocity vectors $\overline{VW}^*$ in *Y-Z* plane at *X/H* = 2 behind the studied model vehicle(s) with rear slant angle(s) (α = 25°and 60°) at 10 km/h for (a) one-vehicle and (c) three-vehicle cases. The white circle represents the tailpipe exit at *Z/H*= 0.222 and *Y/H*= 0.278 (First published in Int. J. Heat Mass Transfer 55 (25-26), 7981-7990, 2012).

Nanoparticle Synthesis in Diffusion Flame Reactor

Flame synthesis has drawn many attentions because it produces the preferred nanoparticles in large scale in a more cleaner and energy-effective ways than the traditional wet chemistry route. A one-step chemical kinetics approach was used to model titanium tetraisopropoxide decomposition that leads to homogeneous nucleation and titanium dioxide (TiO_2) particle formation. Based on the particle size distributions, an efficient quadrature method of moments is used to approximate the general dynamics equation of particle, and the eddy dissipation concept combustion model is used to estimate the flame temperature field, respectively. Increasing the oxygen flow rate leads to higher particle residence time in the high temperature zone which results in more irregular agglomerates made up of more primary particles. An agglomerate contains more primary particles, its shape is more irregular, and the collision rate is higher. It also reveals that coalescence is more important than coagulation to dominate final produced particle morphology. An analysis of the geometric standard deviation shows the distribution of the final produced particles for flame reactor can reach self-preserving state, which is consistent with the experimental results.



Typical contours of (a) nanoparticle number and (b) total surface area intensity from the studied burner at different oxygen flow rates (First published in Powder Technol. 181(1), 9-20, 2008).

Achievements and Recognitions

Most of Prof. Chan's research findings are published in top-tier journals and are cited in prestigious journals of the respective fields, such as *Progress in Energy and Combustion Science, Renewable & Sustainable Energy Reviews, Applied Energy, Energy Conversion Management, Fuel, Environmental Science & Technology, Journal of Hazardous Materials, Environmental Health Perspectives, Atmospheric Chemistry and Physics, Atmospheric Environment, Journal of Aerosol Science, Aerosol Science and Technology, Combustion and Flame, International Journal of Heat and Mass Transfer, International Journal of Multiphase Flow, Journal of Fluid Mechanics etc.*

His research achievements, leadership and contributions to his academic field and professional societies/institutions in the mechanical engineering discipline have been duly recognized locally and internationally. He received many honorable awards and fellowships including the prestigious National Honor, "2012 First Class Natural Science Award (自然科學一等獎)" bestowed by the Ministry of Education of the People's Republic of China (中華人民共和國教育部) with the support of his long-term research collaboration teams from Zhejiang University and China Jiliang University. He was also elected Fellow of the American Society of Mechanical Engineers (ASME), USA, Fellow of the Society of Automotive Engineers International (SAE), USA, Fellow of the Institution of Mechanical Engineers (IMechE), UK and Fellow of the Hong Kong Institution of Engineers (HKIE), which are among the highest respectable elected grades in these international and local professional engineering societies/institutions.

CHEUNG Chun Shun (Prof.)
Professor

Alternative Fuels for Diesel Engine

Diesel engines are a major source of air pollutants. They are the major emitter of particulates and nitrogen oxides. We have been active on the investigation of alternative fuels on diesel engines so as to improve engine performance and reduce engine emissions. Alternative fuels investigated include alcohols (methanol, ethanol, butanol, pentanol), biodiesel (waste cooking oil biodiesel and palm oil biodiesel), dimethyl carbonate, hydrogen, methane, LPG, among others. The liquid fuels are used in the blended mode or in the fumigated mode, while the gaseous fuels are used in the fumigation mode.

Investigations have been conducted on an engine test bed with a 4-cylinder direct injection diesel engine. A pressure sensor and a shaft-encoder are available for measuring in-cylinder pressure and a combustion analyzer is available for converting the in-cylinder pressure into combustion data. Gas analyzers are available for measuring both regulated and unregulated gases like CO, NOx, HC, benzene and formaldehyde. Particle sizer is available for measuring number-size distribution of particles in the engine exhaust and a tapered oscillating microbalance is available for measuring particulate mass emissions in the engine exhaust. In addition, particulate samples have been collected to investigate the fuel type and engine operating conditions on the properties of the particles, including the organic fractions, the nano-structure and the fractal properties.

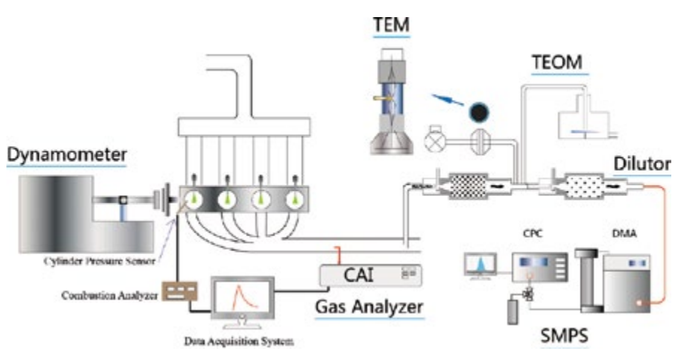


Figure 1: Experimental Facilities

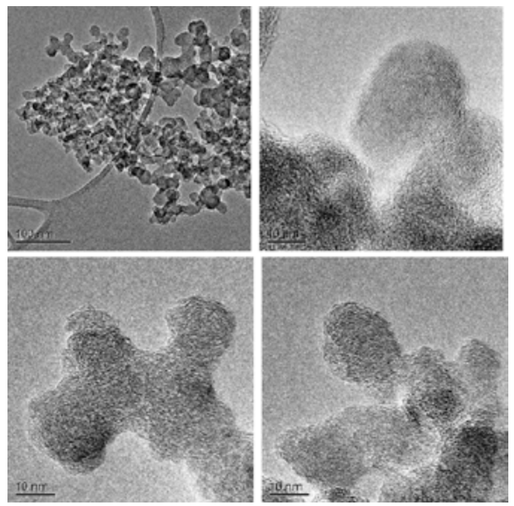


Figure 2: TEM and HRTEM images for diesel particles sampled at 1800 rpm, air/fuel ratio 79.6 : (a) low magnification TEM image and (b–d) HRTEM images of different primary particles

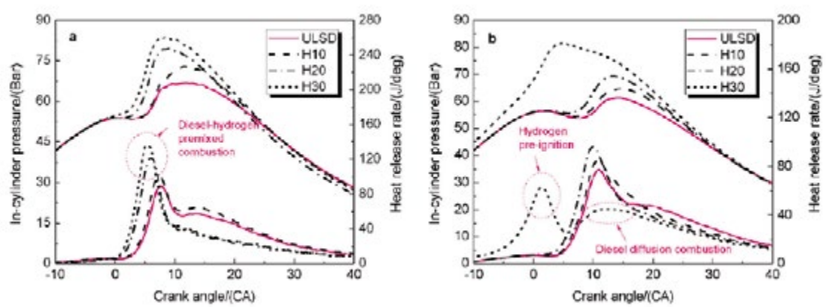


Figure 3 : Abnormal combustion of diesel engine with hydrogen addition at high engine loads (a) 1920 rpm, 90% load; (b) 2560 rpm, 80% load

FU Ming Wang (Prof.)

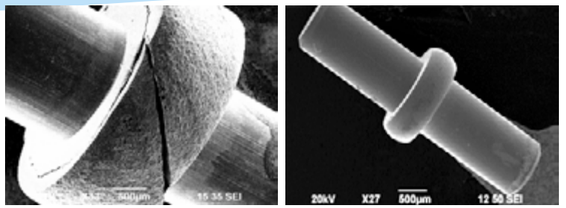
Professor

Professor Mingwang FU's research endeavors are more focused on product design and development aided by CAD and CAE, advanced manufacturing technologies, and processing of advanced materials. In addition, the micro-scaled product development by micro-forming process is one of his key research areas. One main goal of these research endeavors are to develop the state-of-the-art technologies in these areas, the other, on the other hand, is to seek for the epistemological understanding of the science behind these explorations, advancing knowledge in these areas, and successfully addressing a plethora of challenges and bottleneck issues the explorations face. His research findings have benefited the development of metal forming technologies and led to about 165 published/accepted SCI journal papers, 4 monographs published by the world famous publishers including Marcel Dekker (New York), Springer-Verlag London Ltd, etc., and a few highly cited papers based on the Web of ScienceTM.

For the design and development of metal forming products aided by finite element simulation, the main objective is to change the traditional product design and development paradigm by reducing trial-and-error in design and development stage and ensure "design right the first time". The traditional metal forming product design has long been linked to many years of apprenticeship and skilled craftsmanship and the conventional design and development paradigm appears to involve more heuristic know-how and trial-and-error than in-depth scientific calculation, analysis and simulation. The design paradigm thus cannot meet the current demands for short development lead-times, low production costs and high product quality. With the advent of numerical simulation technologies, the design and development of forming processes and metal formed products are carried out with the aid of FE simulation, allowing all the potential design spaces to be identified and evaluated, and the best design to ultimately be determined and implemented. Such a design and development paradigm aims at "design right the first time" and reducing the need for trial-and-error in the workshop. This simulation based design paradigms efficiently supports metal formed part design, forming process determination, tooling design, and product quality assurance and control via FE simulation.

Regarding the micro-scaled product development via micro-scaled plastic deformation, more endeavors are focused on size effects and size effect affected deformation behavior, fracture phenomenon, and product quality from defect-free and forming dimensional control and accuracy assurance perspectives. Due to the size effect, the data, information and knowledge obtained and developed in macro-scaled deformation scenarios are not fully valid in micro-scaled ones and the existing knowledge of macroforming cannot be directly leveraged into the micro-scaled product development. The research endeavors in this arena are to explore the in-depth understanding of size effects arising from different sources and the detailed mechanisms of size effects, and the insight into them from the nature of physics. From the aspects of size effect affected deformation and fracture behaviors and phenomena, the main objective to study the difference of the deformation and fracture behaviors and phenomena in micro- and macro-scaled domain and develop the needed knowledge to support micro-scaled product development from the perspectives of accurate forming of shape and geometry of microformed part and efficient tailoring of the required product quality.

Figure 1: Monographs arising from researches Monographs arising from researches



(a) Flanged upsetting (2.0mm×7.0mm) (b) Flanged upsetting (1.0mm×5.5mm)

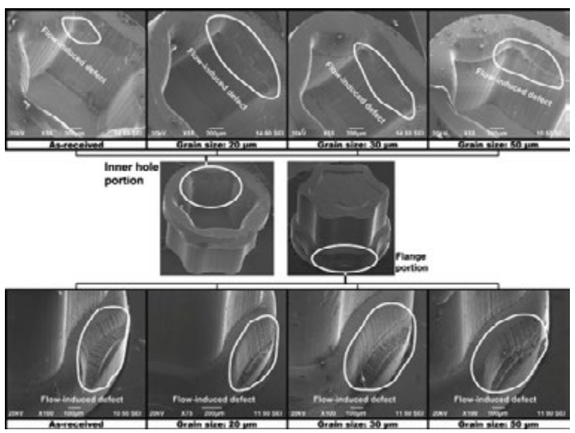


Figure 2: Fracture occurrence at the larger scaled deformation

Figure 3: Folding defects in macro-scaled flanged parts

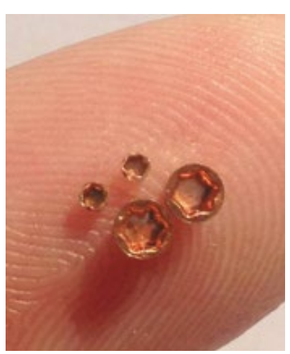


Figure 4: Folding defects in micro-scaled flanged parts

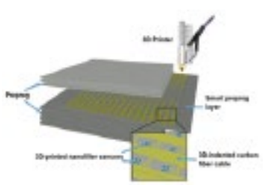
ZHOU Limin (Prof.)
Associate Dean (Research) and Professor

Prof. Zhou's research and consultancy interests are focused on advanced composite materials, nanomaterials and nanotechnology for energy conversions and storages, smart materials and structures, and structure health monitoring technology.

Functional composites

Embedding nanomaterial sensors inside composite structures

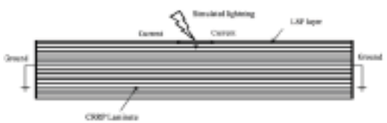
The smart prepregs are developed with 3D-printed nanomaterial sensors and 3D-indented carbon fiber or CNTs based cable networks. The pattern of sensing system, optimal printing parameters and resin curing conditions are extensively investigated in this project. Upon curing, the carbon fiber or CNTs based cables can act as further reinforcement to the host composite panels. Such smart composites can be applied to provide both structural and monitoring functions.



Smart prepregs with 3D-printed nanomaterial sensors and cable networks.

Functional carbon Fibre Composites for Lightning Strike Protection

The enhancement of functional properties in carbon fiber reinforced polymer (CFRP) composites is a requirement for lightning strike protection (LSP) applications in aircraft structures to solve the parasitic electrical and thermal management issues. Composites are fabricated with the outermost ply modification by growing carbon nanotubes (CNTs) on carbon fiber fabric and incorporating graphene nanoplatelets (GNPs) into epoxy matrix. The forming conductive network between CNTs and GNPs has substantially enhanced functional conductivities in both fiber and through-thickness direction and also improved mechanical properties. The lightening damage of composites is simulated based on a coupled thermal-electrical analysis to predict damage in CFRP composites with/without LSP layer. The modified carbon fiber composites provide an alternative potential functional CFPR composites with adequate capability to withstand lightning strikes.

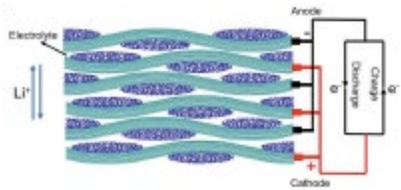


CFRP composites with LSP layer.

Rechargeable batteries

Structural battery based on carbon fibre composites

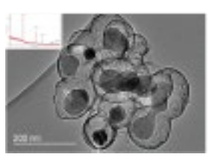
Composite structural battery consists of carbon fibres as electrodes and matrix as electrolyte to store energy and at same time fulfill a structural role in various applications. Co-polymers with applicable ionic conductivity and mechanical properties are developed by the research team for being used as matrix materials playing role of solid electrolyte. Carbon clothes are used as cathode and anode materials with different treatments on fibre surfaces. To achieve a good capacity, active materials are being incorporated into porous structures of carbon fibres. Mechanical behaviors of interfaces between fibres and solid electrolyte are being studied under both electrochemical and mechanical loadings. Meanwhile, numerical simulation for full cell composite structural battery will also be integrated to validate the experimental results.



Structural battery using carbon fibres as electrodes and matrix as electrolyte..

Silicon based nanocomposite anode for Li-ion batteries (LIBs)

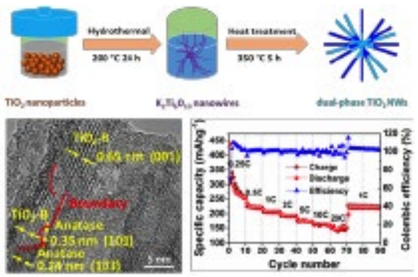
Traditional anode, graphite, reaches its limit for its low energy density in LIB application. Silicon, which is claimed as the most promising anode material, possesses high specific capacity (4200 mAh g−1) but suffers from fracture and pulverization due to its large volume change (~400%) during cycling, leading to poor cycle performance. Our main research interest is the fabrication of novel silicon based nanocomposites anodes. In order to achieve high capacity and long shelf life, the lithiation and delithiation processes of silicon nanoparticles/nanosheets are studied. Simulations on fracture mechanism of yolk-shell carbon-coated silicon nanoparticles are conducted with mechanics-based theoretical modelling. The optimal design guideline is proposed and verified to ensure structural integrity and maximize capacity for the nanoparticle anode.



Yolk-shell carbon-coated silicon nanoparticles.

Dual-phase TiO2 nanowires for Na storage

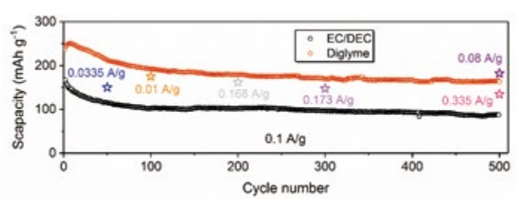
The development of superb anode materials has long been a big challenge in sodium-ion battery (SIB) research. TiO2 is a promising candidate, but it faces critical issues of low initial coulombic efficiency and rapid capacity decay. To address the problem, dual-phase TiO2 nanowires consisting of anatase phase and TiO2-B phase are fabricated using a facile hydrothermal and heat treatment method. The SIB anode exhibits ultrahigh reversible capacities, long and stable cyclabilities. The two-phase interface can offer additional venues for Na ion storage and improve the Na ion diffusion.



Dual-phase TiO_2 nanowires and the battery performance as SIB anode.

Ether electrolyte enables better Na storage

Electrolyte is an important component influencing the performance of the rechargeable SIBs. It is elucidated that using an ether-based electrolyte instead of a conventional ester-based electrolyte can significantly improve the SIBs performance because of the enhanced sodium ion transport at the electrode/electrolyte interface. Insights into the structural evolution and sodiation dynamics obtained by in operando Raman, XRD and electrochemical kinetic studies reveal that the charge transfer characteristics of the electrolyte/electrode interface play a vital role in determining the performance, which is also confirmed for Sn, rGO and CMK-3 anodes.



Cyclic performance of TiO_2 SIB anode using different electrolytes, and comparison with cyclic performance reported in the literature.

CHOY Yat Sze (Dr)

Associate Professor

Noise pollution control, sound sources localization and identification

Noise pollution, such as traffic noise and air conditioning noise, is a serious problem especially in mass populated places like Hong Kong. The low frequency component which is regarded as rumble noise that causes annoyance to human beings is very difficult to control. Many researchers have developed different approaches to deal with such low frequency noise. The technique of active noise control is seen to be an appropriate means for low frequency noise control. It requires sensors and a control loudspeaker to generate anti-sound. Apart from the cost, sophistication in design and reliability, the bulky loudspeaker is required to generate low frequency noise. Therefore, passive noise control remains as a reliable and attractive alternative for future development. Passive noise control method can be further categorized into absorption and reactive noise control method. For the dissipative noise control measures such as the traditional porous material in a ducted system, sufficiently long attenuation path is often required for desirable noise reduction performance. In addition, it also creates the problem of the deposition and accumulation of dusts in the pores of the porous material and results in the hygiene and environmental issues. Therefore, low frequency noise control still remains a technical challenge.

On the other hand, the sound source localization and identification by using microphone array are found to be very useful in many applications such as non-contact diagnoses of structural failure or cracks, aircraft position tracing, speech signal enhancement of speakers and product noise source identification. It remains a technical challenge to localize multiple sound source and at the same time to characterize the signal of each sound source.

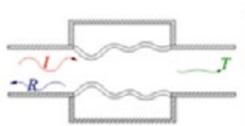
A significant step forward

Dr. Choy and her research team members at The Hong Kong Polytechnic University worked at developing an alternative for the low frequency noise control through the use of flexible plate leading to a prototype device of plate silencer in which a segment of plate lines part of the duct wall, and each of the plates is backed with hard-walled cavity. It can be installed at the downstream side of the sound source to undergo sound reflections. It can also be used to house an axial fan to suppress sound radiation.

With such side mounting plate system, there is no pressure loss and hence no extra power consumption of the fan is required. In order to achieve effective noise reduction contributed by the plate, the most desirable structural properties of the plate inside the silencer are high bending stiffness but low density, which contrast with the characteristics of the existing use of plates in noise control. It is difficult to obtain such kind of plate from traditional homogenous engineering materials. Her team established a method to fabricate the reinforced composite plate using carbon fiber tows with very high strength-to-weight ratio.

Moreover, her research team developed an approach for signal elimination and reconstruction based on time-domain beamforming. Apart from localization of the multiple sound sources, this approach has advantages of obtaining the temporal feature of each sound source. Besides, the interference effect due to the sound source with strong strength on the weak source and sidelobes effect can be eliminated.

The importance of her work on noise control was recognized by Innovation and Technology Fund and The Research Grants Council of the Hong Kong SAR government to support the project. The result experimentally and theoretically shows that there is good performance in the low frequency range and it allows noise mitigation measures to more readily deploy in built up area where extra space is not available. It can be widely used in the automobile, air conditioning and ventilation system and hair dryer. Apart from noise reduction, it can achieve the purpose of energy saving. In addition, the results show that development of high performance of composite plate in noise control is promising. In addition, her work on sound source identification was supported by China Academy of Space Technology (CAST) and it can be widely adopted in many applications such as fault diagnosis of the structural failure, machine and product noise detection, environmental and traffic noise identification.



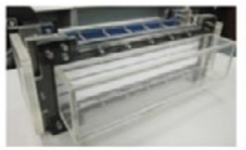
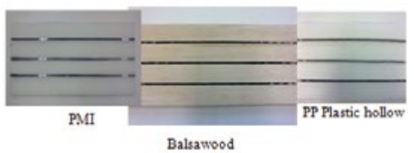


Plate silencing device



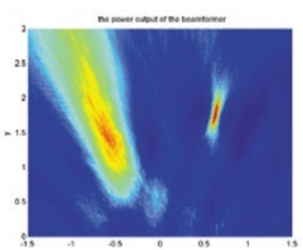
Carbon fibre attached on the panel

Wind tunnel test

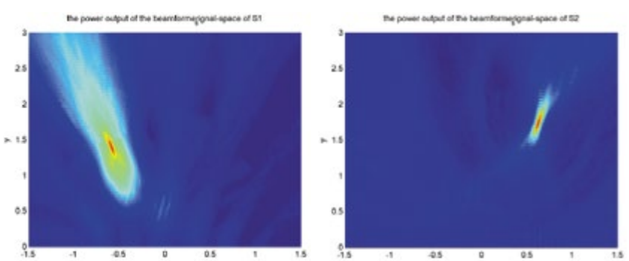
Air conditioning and ventilation system

Exhaust system of Automotive

Hairdryer



Conventional beamforming Method



Our proposed method for identification of two kinds of sound source

JING Xingjian (Dr)
Associate Professor

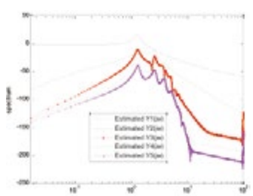
Nonlinear Dynamics, Vibration, and Control: Tackling Challenging Engineering Issues

Nonlinearities are ubiquitous and always incur two-fold influence, which could be a source of troubles bringing uncertainty, inaccuracy, instability or even disaster, and might also be a superior and beneficial factor for system performance improvement, reduction of energy cost, or safety maintenance etc. The research and development in the nonlinear systems and signal processing (NSSP) group led by Dr XJ Jing aim at:

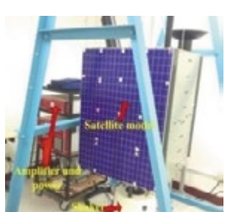
- Development of frequency domain theory for nonlinear analysis and design;
- New methods for nonlinear system identification, signal processing and control;
- Applications of nonlinear theory and methods to sound and vibration control, energy harvesting, fault diagnosis and sensor technology etc by exploiting nonlinear benefits;
- Intelligent robotic systems including autonomous mobile robots, construction robots, UAV, human-robot interaction and other bio-inspired robots etc;
- Nonlinear robust learning and computing methods.

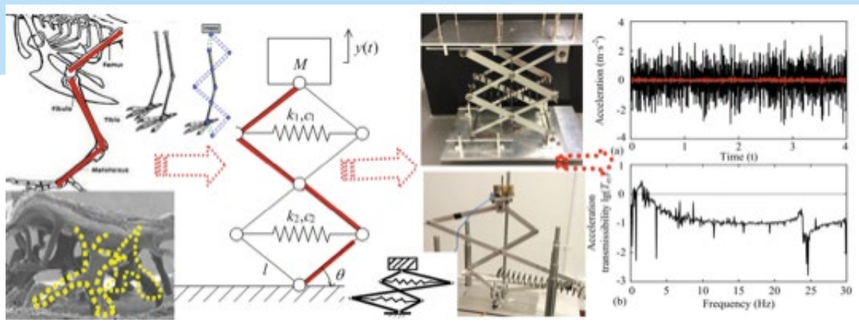
The one objective of the research group is to develop effective methods theoretically and practically for nonlinear analysis and design in the frequency domain based on the generalized frequency response function (GFRF), nonlinear characteristic output spectrum (nCOS) and parametric analysis method. A theoretical scheme for the analysis, characterization and design of a class of nonlinearities will be developed, together

with a supplementary time-domain adaptive identification and characterization of system nonlinearities and uncertainties. The methods allow a frequency domain analysis and design of the nonlinear effects on system output spectrum by exploiting nonlinear benefits, which would be generic and not limited to a particular application case. The nonlinearities that are addressed are not limited to a specific nonlinear form but a class of nonlinear dynamics. The results will provide a new insight into the analysis and design of a class of nonlinear dynamics, and also shed light on characterization and understanding of nonlinear behavior in the frequency domain.



The other topic is to investigate novel methods for nonlinear system identification, signal processing, and control with robustness to noise, low complexity in computation and parsimony in model structure, which can be used for control, complex behavior reproduction, state prediction, filter design, feature characterization, and fault detection etc for nonlinear ODE/PDE systems.
One major application of these theoretical methods is to explore nonlinear benefits in various

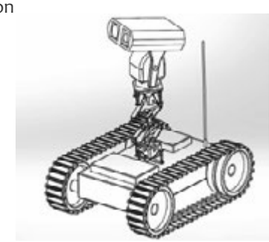




engineering applications including new generation of vibration isolation/suppression/control systems, nonlinear vibration energy harvesting, nonlinear features based fault diagnosis, and nonlinear dynamics based sensor technology (quasi-zero or zero stiffness bases sensors) and so on.

Recently, a bio-inspired limb-like or X-shaped structure is investigated. It is shown to be an innovative technology for providing passive and nonlinear stiffness and damping characteristics ideally beneficial to various engineering vibration control problems. The X-shaped structure can provide high static and low dynamic stiffness, and high damping around resonant frequency but low at others, which are all the ideal nonlinear stiffness and damping properties sought in the literature for many years. A series of novel vibration control systems have therefore been done from traditional vibration control problems such as vibration isolation platforms and vibraiton absorbers, to novel contruction tools such as anti-vibration exoskeleton for jackhammers, and to robotic design and aerospace engineering etc. This technical innovation was granted the TechConnect global innovation award in U.S. May 2017.

Robotic design, control and application are another reseach focus of this research group. Exoskeleton technology for eldy people, contruction robots for various specific tasks, mobile



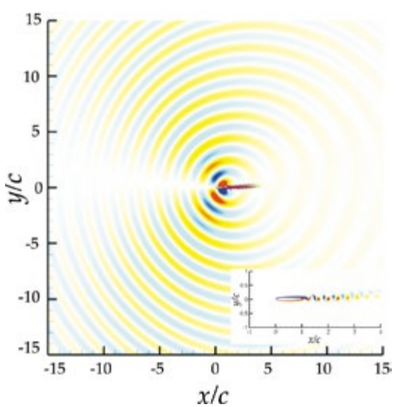
robots for carrying loads and security monitoring and so on are all under development, involving various industrail supports.

The research group has close relation with industry and secure financial supports from various industrial companies including those from mainland of China and local or international companies such as the China Oilfield Service Limited, China Aerospace International Holding Company, China Academy of Space Technology, Gammon Contruction, Hilti (Hong Kong) and Guangzhou Purple River Technology Limited etc.

LEUNG Chi Kin, Randolph (Dr)
Associate Professor

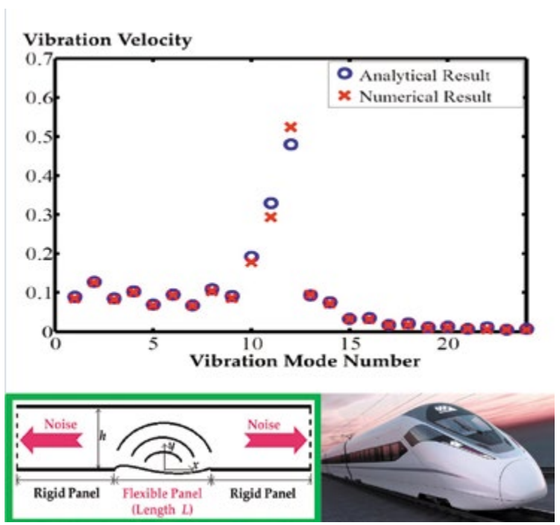
Aircraft Wing Noise-Computational Aeroacoustics

Computational Aeroacoustics (CAA) is a salient numerical approach that calculates the acoustics and the flow unsteadiness of an aeroacoustic problem simultaneously. This is achieved by solving the Navier-Stoke (NS) Equations and the equation of state. The Conservation Element and Solution Element (CE/SE) method is adopted as the solver. CAA aids the investigations of the aeronautical engineering problems related to the fluid and acoustics. It allows detailed investigations of various source mechanisms and the interactions between the acoustic and the aerodynamic fields occurring in aeronautical, automotive and product engineering. The figure below shows a CAA analysis of noise generation by an aircraft wing profile. The noise propagation is correctly predicted. Noisy and quiet zones are clearly identified.



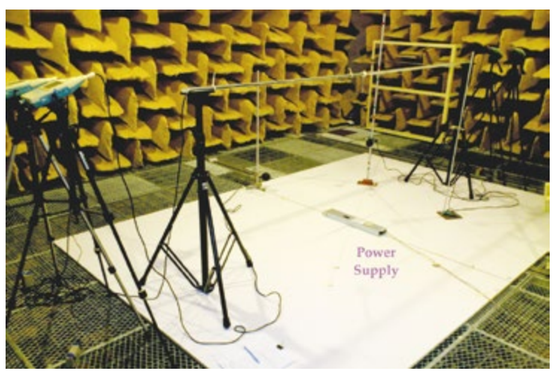
Train Cabin Noise-Flow-Induced Structural Acoustics Analysis

Flow-induced structural acoustics of flexible panels is a major consideration in quieting and efficiency for design of many applications in railway, aircraft and automotive engineering. The high-speed boundary layer passing over an aircraft in flight set the aircraft fuselage flexible panels to vibrate which in turn generates noise into the cabin. In aircraft ventilation system, the noise generated by the turbulent flows in ducts or by the operations of air-moving machines, propagates in the ductworks, which is usually built with thin flexible panels, transmits to aircraft cabin through the thin duct wall and causes annoyance to passengers. Usually such problems involve complex interactions between flow, acoustic wave and structure. The aim of this work is to study flow-induced structural acoustics of flexible panel by a time domain method
which tightly couples the aeroacoustics and panel structural dynamics. The figure below shows a computational analysis of the flow-induced vibration of a flexible panel (i.e. a window) installed on a high-speed train. The numerical results are consistent with those obtained from theoretical/experimental analyses.



Product Sound Design-Source Identification and Noise Mitigation

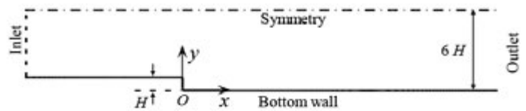
Product sound design (PSD) contributes to the consumer's overall evaluation of a product in terms of its acceptability and functionality. The need for product design engineers to develop products for high-value international and national markets has driven PSD important product attribute. Nowadays product development firms are often faced with customer' negative reactions to the sound of their products (noise annoyance complaints). However, sound may enhance/detract from the pleasure in using a product, and may indicate how well the product is working. Through extensive PSD research, it generates acoustical knowledge of product design which can be incorporated into product engineering design processes so that the positive attributes of product sound are enhanced but those negative ones are reduced. Shown in the figure is an example PSD analysis and sound improvement for a power supply of computer server.

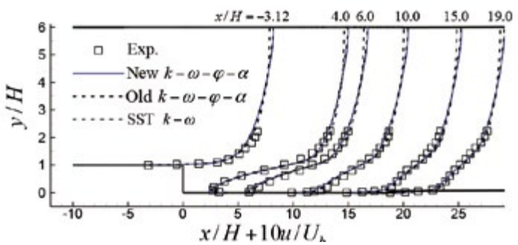


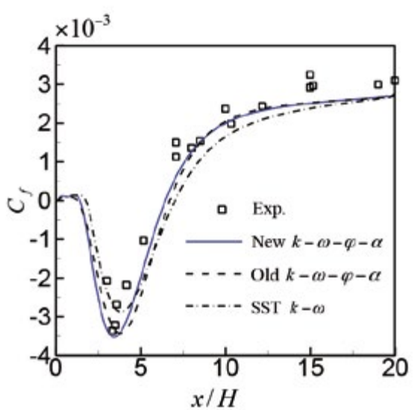
LIU Yang (Dr)
Associate Professor

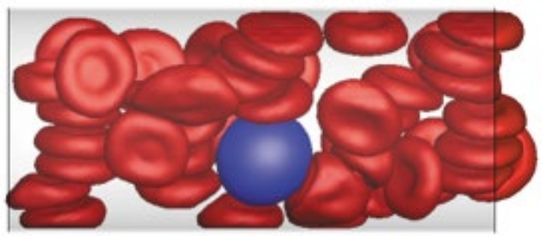
Turbulent model development

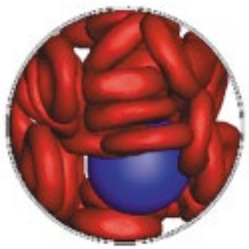
A turbulence model based on elliptic blending concept is developed and verified. This model consists of four governing equations. Among them the k and ω equations are based on the latest version of the Wilcox's $k-\omega$ model with some modifications and improvements, and the φ and α equations are extracted from the $\mathrm{BL}-\overline{v^2}/k$ model directly without any change. This new $k-\omega-\varphi-\alpha$ model is applied to near-wall, separated and impinging jet flows and convective heat transfer, i.e. the 2D fully developed channel flow, the 2D backward-facing step flow, the 2D impinging jet flow, and the convective heat transfer in the 2D fully developed channel flow and the 2D impinging jet flow. The computational results are compared with available DNS and experimental data and also with those computed using the old $k-\omega-\varphi-\alpha$ model and the popular Menter's $\mathrm{SST}\ \ k-\omega$ model. It is shown that the new $k-\omega-\varphi-\alpha$ model has more concise form and better numerical stability than the old $k-\omega-\varphi-\alpha$ model. Moreover, compared with the old $k-\omega-\varphi-\alpha$ model, the new $k-\omega-\varphi-\alpha$ model can yield almost indistinguishable velocity and temperature profiles in the fully developed channel flow and shows some improvements on the predictions for the fluid flow in the step flow and heat transfer in the impinging jet flow. For all tests in present paper, both of the new $k-\omega-\varphi-\alpha$ model and the old $k-\omega-\varphi-\alpha$ model predict better results than the $\mathrm{SST}\ \ k-\omega$ model does.







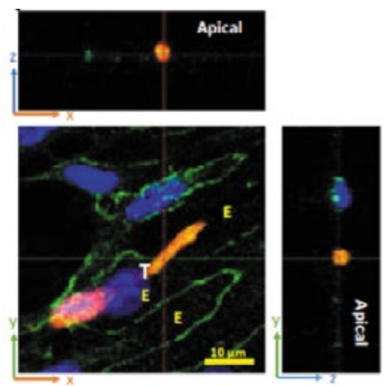


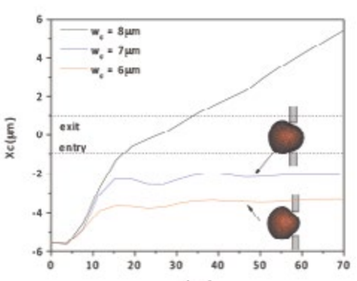


Microvascular Transport and Tumor Cell Adhesion in the Microcirculation.

One critical step in tumor metastasis is tumor cell adhesion to the endothelium forming the microvessel wall. Understanding this step may lead to new therapeutic concepts for tumor metastasis. Vascular endothelium forming the microvessel wall and the glycocalyx layer at its surface are the principal barriers to, and regulators of the material exchange between circulating blood and body tissues. The cleft between adjacent ECs (interendothelial cleft) is the principal pathway for water and solutes transport through the microvessel wall in health. It is also suggested to be the pathway for high molecular weight plasma proteins, leukocytes and tumor cells across microvessel walls in disease.

Thus we introduced the mathematical models for water and solutes transport through the interendothelial cleft. These models, combined with the experimental results from in vivo animal studies and electron microscopic observations, are used to evaluate the role of the endothelial surface glycocalyx, the junction strand geometry in the interendothelial cleft, and the surrounding extracellular matrix and tissue cells, as the determinants of microvascular transport. Then we demonstrated how the microvascular permeability, hydrodynamic factors, microvascular geometry and cell adhesion molecules affect tumor cell adhesion in the microcirculation.

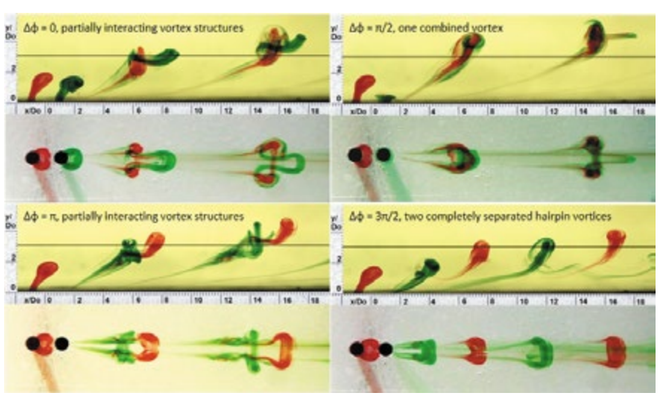




TANG Hui (Dr)
Associate Professor

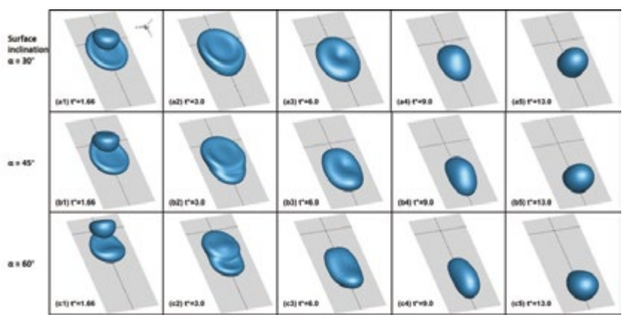
Interaction of Twin Synthetic Jets in Boundary Layers

A synthetic jet (SJ) consists of a train of vortex rings/pairs that are produced through an orifice/slot by the oscillation of a diaphragm. Owing to its zero-net-mass-flux feature, the use of SJ eliminates the need for compressed air supply and associated piping system, making it very promising for active flow control. The capability of SJ in delaying flow separation has been well demonstrated in many laboratory experiments. However, the fluid mechanics of this concept, especially when multiple SJs are arrayed and operate in a crossflow, has not been fully understood. Hence a series of studies has been conducted to investigate the interaction of twin SJs in various boundary layer flows, using both experimental fluid dynamics (EFD) and computational fluid dynamics (CFD) methods. When the twin SJs are arranged in-line with the crossflow and separated by two center-to-center orifice diameters, three types of vortex structures are identified depending on their operational phase difference: one combined vortex, two completely separated hairpin vortices and partially interacting vortex structures. The capability of these vortex structures in delaying boundary layer separation was also compared, and significant difference was found. Furthermore, effects of other parameters for this flow system on the resulting vortex dynamics were also studied, including the Reynolds number, Strouhal number, jet-to-crossflow velocity ratio.



Flow Energy Harvesting Using Passively Oscillating Hydrofoils

In this study a novel flow-energy harvester has been designed and developed, which consists of single or multiple passively oscillating hydrofoils. Different from most of existing flapping motion based flow-energy extractors, under certain conditions the hydrofoil is able to periodically heave and pitch, solely driven by a uniform flow. In another word, it can do fully passive, two degree-of-freedom motions in the flow. With these flow-driven motions, the device converts the flow-carried kinetic energy into the oscillating hydrofoil's mechanical energy, which can then be further converted into electrical energy if a power take-off system is implemented. A prototype was developed and tested in the water tunnel laboratory. As shown in the snapshots, at a Reynolds number of 1.0 × 105, it does oscillate in the cross-flow direction with both heave and pitch motions. Dye visualization and particle image velocimetry (PIV) measurements also revealed that ample flow phenomena, such as flow separation, vortex generation and propagation, vortex-vortex and vortex-structure interactions, accompany the movement of the hydrofoil. In addition, real-time force and motion measurements further reveal that the heave force and pitch moment are both generally in phase with their corresponding motions, which confirms that this device is able to effectively extract energy from the flow. Without any optimization, this device can extract power of 5.7 W with an extraction efficiency of 41% in a water flow of 0.8 m/s. Further investigation will be conducted on improving this device in the near future, targeting at achieving higher power extraction efficiency at water speeds of less than 0.5 m/s.



Oblique Impact of Successive Droplets on a Flat Surface

Using the lattice Boltzmann method, numerical studies were conducted to investigate the oblique impact of two successive droplets on a flat surface. The focus was placed on the effects of surface inclination and lateral/longitudinal offset on the impact dynamics of the two droplets and the subsequent dynamics of the combined droplet. The evolution of the topology, contact lines and spread factor of the two droplets under various conditions was compared and analyzed. Compared to single droplet impact, the impact of successive droplets shows quite different dynamics due to the involved coalescence process. The surface inclination causes asymmetric spreading of the droplets. The increase in surface inclination leads to faster downward spreading and reduced lateral spreading. The non-zero offset between the two droplets further enhances this asymmetry. Furthermore, the intermixing between the two droplets during the oblique impact was also examined. It was observed that the surface inclination changes the mass distribution of the combined droplet.

WONG Wai On (Dr)
Associate Professor

Vibration Absorbers Help to Improve and Save Lives

Design optimization of dynamic vibration absorbers help to reduce noise and vibration from machineries and save lives and properties in earthquakes

Dynamic vibration absorber (DVA) is a mechanical device designed to be attached to another structure, called the primary system, for the purpose of reducing or controlling the resonant vibration of machines, structural surfaces and panels.

Machine noise and vibration problems

Machine or product casings are usually in the form of thin plates or shells which may act like loudspeakers when they are vibrating due to internal excitation. The vibration and sound radiation of machine casings excited at one or a few discrete frequencies may be suppressed in an economic way by attaching one or more vibration absorbers onto the casings.

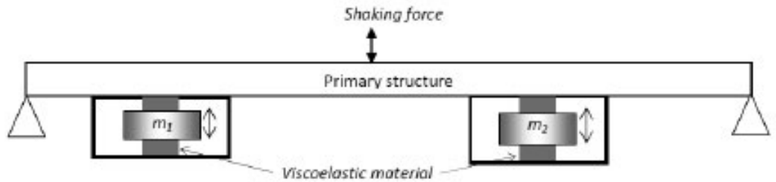
Dynamic vibration absorber is an auxiliary mass-spring system which, when correctly tuned and attached to a vibrating plate or shell subject to a harmonic excitation, causes to cease the steady-state motion of the point to which it is attached. The device has been invented for more than one hundred years but it is still not commonly used. One reason is the lack of a systematic way to find a good attachment point for the absorber such that the vibration amplitude and the sound radiation of the whole structure can be reduced. Optimisation of the tuning parameters and location of attachment is highly computationally intensive. An improper selection of attachment point for the absorber may lead to an amplification of vibration and sound radiation in other parts of the structure.

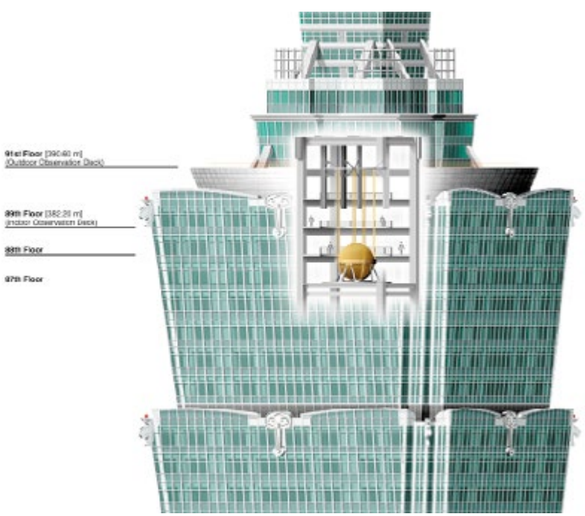
Earthquake absorption

The conventional seismic resistance-based design approach of civil structures is to increase their strength and ductility in order to resist the earthquake loads. However, this approach is found to be very expensive, and hence the alternative seismic response control design approach has recently been gaining wide acceptance. The response control design approach of vibrating structures basically uses additional dynamic devices mounted to the vibrating structures in order to reduce the vibration energy of the primary structure. The dynamic vibration absorber can be tuned and mounted to a flexible structure in order to reduce its resonant vibration. Dynamic vibration absorber has successfully been used to suppress excessive vibrations in many modern civil structures such as the Taipei-101 skyscraper and the London Millennium Footbridge. These absorbers are big structures and tuned to absorb the resonant vibrations of the whole civil structure.

Vibration reductions for human comfort

The lightweight floor construction with longer spans in modern buildings often suffers from excessive low-frequency vibrations, usually less than 10 Hz, due to human and machine activities. Comfort studies of automobiles and aircraft passenger indicate that the natural frequency of human internal organs is in 5-8 Hz ranges. Therefore, floor systems with natural frequency range





The vibration absorber installed in Taipei-101 skyscraper. (By Someformofhuman - Own work, GFDL, https://commons.wikimedia.org/w/index.php?curid=3799263)

matching that of human internal organs will possibly cause human discomfort. Another approach to suppress floor vibration is to dissipate the vibration energy without removing the positive attributes of modern-floor construction. Dynamic vibration absorber (DVA) is a mechanical device designed to be attached to another mechanical system or structure, called the primary system, for the purpose of reducing or controlling the vibration (and consequent sound production) of machines, structural surfaces and panels. A properly designed DVA could be used to dissipate the vibration energy of floors system of existing buildings. The cheapest and easiest way to construct a vibration absorber is to incorporate a viscoelastic material, functioning as both the resilient and the energy dissipating component. The viscoelastic material acts as a damped spring.

Optimum design of vibration absorbers

Working with his research students and colleagues, Dr. WO Wong have established the optimum designs of various types of dynamic vibration absorber for suppression harmonic and random vibrations in single degree-of-freedom and continuous vibrating structures. More than 10 research papers have been published in the top class journals including the Journal of the Acoustical Society of America, Journal of Sound and Vibration etc. New absorbers with improved absorption performance have been designed. The optimum designs of vibration absorber are suitable for absorbing machine noise and vibration as well as random vibration in earthquakes.

YAO Haimin (Dr)
Associate Professor

Bio-inspired Mechanics and Materials

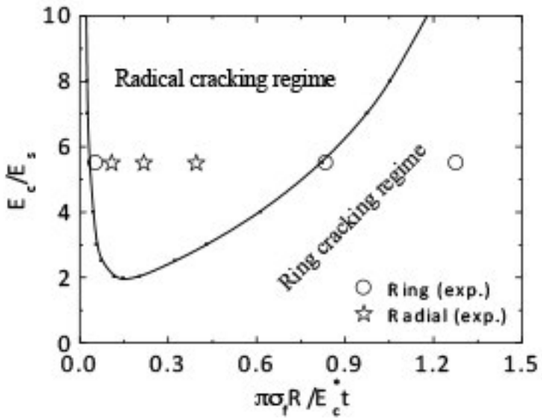
Through millions of years' evolution, nature has developed numerous materials and structures with unparalleled properties and capabilities in comparison to the engineering counterparts. If we can extract the ingenious strategies of design from these natural feats and then transfer them to engineering practices, the properties and performances of engineering materials should be enhanced greatly. Inspired by this conception, Dr. Yao and his group members have been devoting themselves to the studies on a variety of unique natural materials in an attempt to unveil the material design strategies concealed in them by nature.

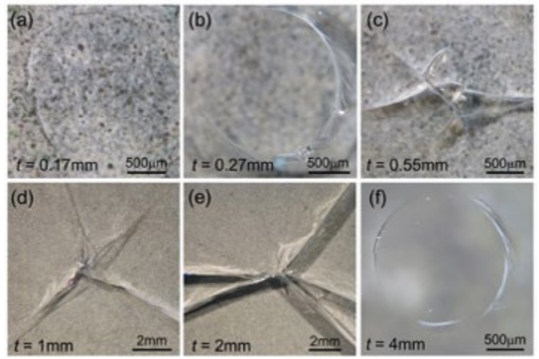
Strategy for controlling fracture modes learned from black carp teeth

Brittle coatings, upon sufficiently high indentation load, tend to fracture through either ring cracking or radial cracking. Inspired by the fracture mode of black carp teeth under indentation, we systematically studied the factors determining the fracture modes of bilayer material under indentation. We found that the fracture mode of brittle coatings due to indentation is determined synergistically by two dimensionless parameters being functions of the mechanical properties of coating and substrate, coating thickness and indenter tip radius. Such dependence can be graphically depicted by a diagram called 'fracture-mode map', whereby the fracture mode can be directly predicated based on these two dimensionless parameters. Experimental verification of the fracture-mode map is carried out by examining the fracture modes of fused quartz/cement bilayer materials under indentation. The experimental observation exhibited good agreement with the prediction by the fracture-mode map.

Spiral interface: A reinforcing mechanism for laminated composite materials learned from nature

Helical structures are ubiquitous in nature at length scales of a wide spectrum. Here, we studied a helical architecture called microscopic screw dislocation (μ-SD), which is prevalently present in the biological laminated composites such as the shells of mollusks P. placenta and abalone. Our results showed that the failure of the μ-SD under tension involves the delamination of the prolonged spiral interface, giving rise to much higher strength and toughness compared to those of the planar counterpart. In addition to the individual μ-SD, the cooperative effects between multiple μ-SDs were also studied and found to result in additional reinforcement. The operation of the reinforcing mechanism of μ-SDs is not automatic but on the condition that the fracture toughness of interface should be less than 60% of that of the lamina material. These findings not only uncover the reinforcing mechanisms of the μ-SDs in biological materials but imply great promise of applying μ-SDs to improve the mechanical performance of the synthetic laminated composites.





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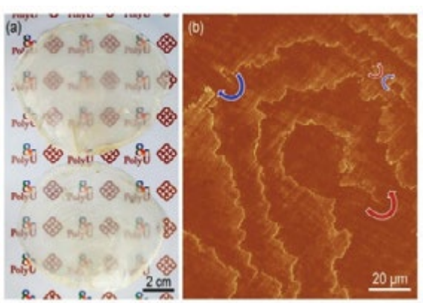

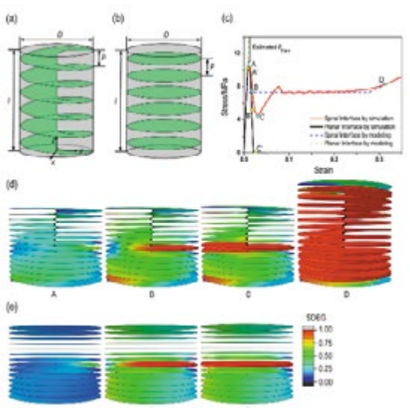

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ZHANG Peng (Dr)
Associate Professor

Toward Clean and Efficient Combustion and Propulsion

Advances in chemical kinetics and fluid mechanics help to understand the complex phenomena in combustion engines.

The “Holy Grail” problem for contemporary combustion researchers is to develop "a validated, predictive, multi-scale, combustion modeling capability to optimize the design and operation of evolving fuels in advanced combustion energy conversion devices".

Chemical kinetics of biofuel combustion

The increasing concerns over energy sustainability, energy security, and climate change have been urging a global effort to develop and utilize non-petroleum-based fuels. The development of alternative fuels coupled with even a small improvement in the efficiency of and emission from their energy conversion devices, achieved through a corresponding improvement in our understanding of the associated combustion process, holds immense payoff for the sustenance of the life style that we know today.

Among various alternative fuels, biofuels have gained most attention due to their attractive advantages. Particularly, biofuels can replace or blend with petroleum-based fuels for direct utilization in engines without or with only minor modifications to the engine and fueling system. Correspondingly, considerable effort is currently being devoted to the development of quantitatively predictive mechanisms for biofuel combustion chemistry, which are required by the increasingly prevailing computer-aided design for combustion energy conversion facilities.

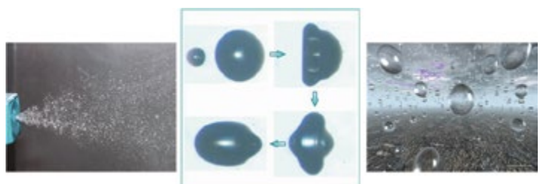
Recent progress in theoretical chemistry and chemical kinetics enable the ab initio (means “from the beginning”, namely from solving the quantum mechanical Schrodinger equation) calculation of reaction rate constants that are required by every reactions in a reaction mechanism. Dr. Peng Zhang and collaborators have been devoted to the ab initio chemical kinetics for various biofuels and conventional aviation fuels. Their aspiration is to do something useful for the combustion community and the society to win the campaign against climate change and energy crisis.

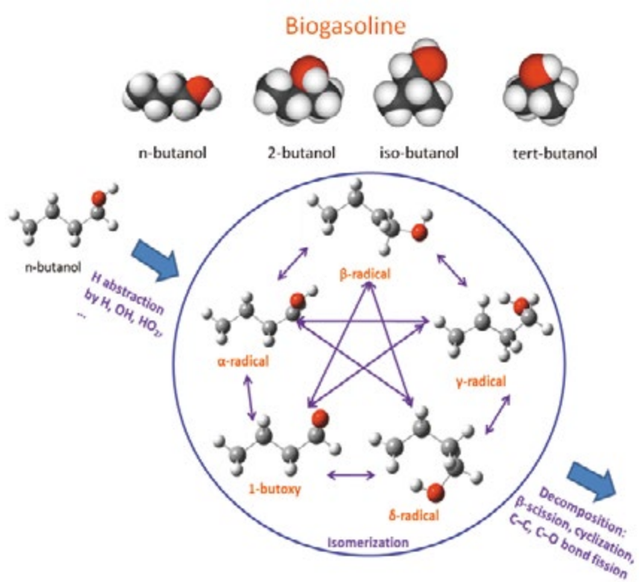
Collision dynamics of liquid droplets

Collision dynamics of liquid droplets in gaseous environment is relevant to innumerous phenomena in nature such as raindrop formation, ocean mist production and atmospheric aerosols circulation. Droplet collision is also integral in many industrial processes, especially those involving spraying such as ink-jet printing, spray printing and coating. A prominent example is the propensity of droplet collision in the dense spray region downstream of the injector in diesel and rocket engines. The frequent collision and subsequent coalescence and separation can significantly modify the size and velocity distributions of the droplets in the spray, which in turn affect the eventual combustor performance.

Droplet collision can have many distinct outcomes—the droplets might merge with small deformation, bounce off one another, coalesce following large deformation, or separate after temporary coalescence. Most earlier research has focused on the binary collision of identical water droplets in atmospheric air. Dr. Peng Zhang and collaborators have been devoted to gaining deep and comprehensive understanding to the collision dynamics of liquid droplets. How do the physical properties such as surface tension, viscosity and gas pressure influence the dynamics? How do the collision parameters such as impact velocity, impact angle and size disparity influence the collision outcomes? Why do hydrocarbon droplets show different collision behavior from water droplets? To answer the questions, the integrated research approach including theory, experiment and computer simulation is required in general.

In the recent work on unequal-size droplet collision, Dr. Zhang and collaborators experimentally demonstrated and theoretically interpreted that the size disparity can significantly promote the permanent coalescence of colliding droplets. The enhanced coalescence may help the utilization of gelled hypergolic propellants for rocket engines, since the ignition of such propellants requires permanent coalescence and rapid mixing of fuel and oxidizer droplets.

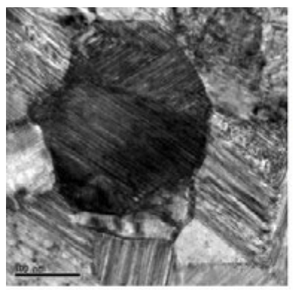


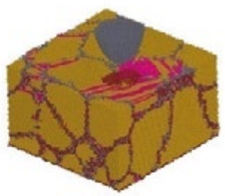


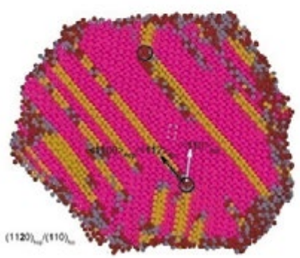
ZHENG Guang Ping (Dr)
Associate Professor

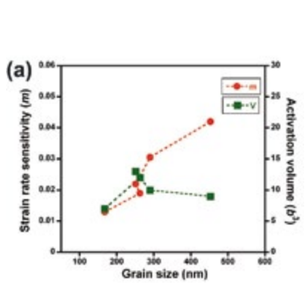
1. Mechanical properties of nanostructured HCP metals and alloys

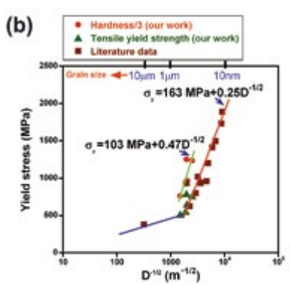
Mechanical properties of nanostructured hexagonal close-packed (HCP) metals are investigated. This research provides in-time solution to the problems of deformation mechanisms of nanostructured metals. The computer simulation methods (molecular dynamics, phase-field modeling and ab initio simulation) developed to model the mechanical properties of nanostructured metals are state-of-the-art, which are among the best techniques to simulate the microstructures and deformation mechanisms of nanocrystalline materials. It is the first time that deformation induced allotropic transformation in nanostructured materials is observed. Combined with the first-principles results, the deformation mechanisms observed in the simulation are convincing. In this research the deformation mechanisms of nanostructured HCP metals are systematically investigated by simulation and experiments. The project could lay a solid foundation for comprehending the relationship between atomic processes, microstructure, and mechanical properties, which will add tremendous value to the engineering applications of nanocrystalline HCP metals and alloys such as Ti and Mg alloys as structural or medical implant materials.







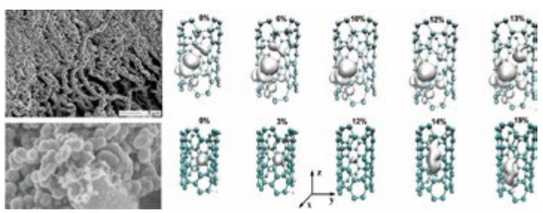




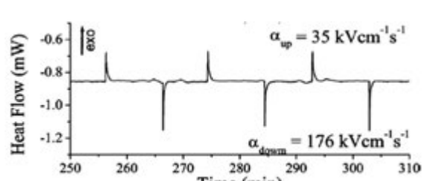
This research is supported by Research Grants Council GRF (project No. PolyU 7200/05E), The Innovation and Technology Commission ITF (project No. ITS/240/12), and Shenzhen Innovation and Technology Fund for Basic Research (2012-2014).

2. Materials for energy harvesting and energy efficiency

Dr. Zheng investigates the synthesis and physical properties of carbon nanotube-metal composites by atomistic simulation and experiments. It is the first time that the magneto-mechanical coupling is observed in the carbon nanotube-metal hybrid structures and composites. The carbon nanotube-metal hybrid structures are highly desirable to be used as electrodes of battery and as hydrogen storage media. The research provides the in-depth understanding of the processes involved. This research is supported by Research Grants Council GRF (project No. PolyU 7195/07E).

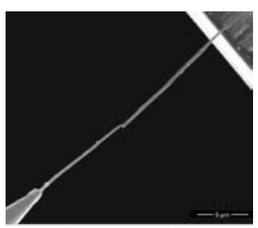


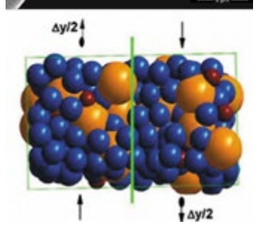
Dr. Zheng investigates novel energy saving, environmentally friendly solid-state refrigeration. The refrigeration effect of the electro-caloric materials developed in this research is the highest among those directly measured to date. The electro-caloric materials are also developed for the application in the energy harvesting using their properties of thermal-electrical energy conversion. This research is supported by The Innovation and Technology Commission ITF (project No. ITS/314/09). This research leads to the invention entitled 'Lead-free ferroelectric based microrefrigerator', which was awarded a Gold Medal at The 40th International Exhibition of Inventions of Geneva in Switzerland.

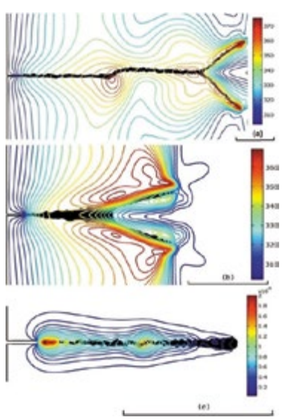


3. Deformation mechanisms of metallic glasses

Dr. Zheng develops the computer simulation method which is the best techniques to simulate the atomistic details of deformation defects in bulk metallic glasses (BMGs), which are still not accessible by experimental investigation to date. It is the first time that the mesoscopic theory and phase-field modeling are developed to investigate the shear banding in BMG. Combined with the first-principles results, the phase-field modeling could become useful tool in the characterization of shear banding. The theory and modeling could provide direct connection between the shear band properties and the mechanical behaviors of BMG, which has not been done by any other theories or simulations before. The theoretical investigation and atomistic calculations of the deformation open up many new opportunities for design and applications of BMGs. Besides benefiting the engineering applications of BMGs, the research has significant scientific impact on deformation mechanisms of non-crystalline solids. Such achievement is significant in the field of deformation mechanisms of metallic glasses. This research is supported by Research Grants Council GRF (project No. PolyU 7196/06E).







ZHU Jie (Dr)
Associate Professor

Acoustic metamaterials and metasurface

An acoustic metamaterial is a material that contains periodically arranged small unit cells, to control, direct, and manipulate acoustic waves in a unique way that natural materials can not accomplish. Those unit cells are artificially designed structures whose geometrical features are much smaller than the acoustic wavelength. The special properties of acoustic metamaterials are decided by those artificial structures instead of the base materials. Research on acoustic metamaterials and metasurface has drawn considerable interests recently. It not only has significant scientific value, but may also benefit quite a lot applications ranging from environmental noise control to biomedical ultrasonography.

Helical-structured acoustic metamaterials

Marked control over the velocity at which wave propagates is a significant matter that remains unsolved. Typically, there are two ways to do it. One takes advantage of the material resonances induced by waves. For example, waves can be slowed down inside dispersive materials near resonances. The other relies on resonances induced by the specifically designed structure. Both types of slow wave manipulations are resonance-based and therefore generally suffer from a very limited range of operating frequency. To overcome the narrowband problem, techniques of adiabatic control over dispersion have been proposed to break the fundamental restriction on the attainable delay-bandwidth product, which eventually leads to the 'rainbow' trapping effect. Still, strong dispersion associated with rainbow trapping materials could cause massive distortion of pulse envelopes.

What we try to develop is a type of dispersion-free helical-structured metamaterials that can slow down acoustic waves at broad bandwidth, by introducing helical wave rotation and wavefront revolution to the propagating waves. In our approach, the helical-structured metamaterials enabled sound deceleration can bring a notable phase change in the subwavelength scale. The phase change is decided by the helicity of the proposed metamaterials, hence tunable by adjusting the thread lead. Such flexibility is highly desirable in phase engineering applications, such as designs of innovative ultrathin flat acoustic lenses, acoustic rectifiers, high efficient couplers for surface acoustic waves and self-accelerating beam generators.

Broadband gradient impedance metamaterial matching layer for ultrasonic transducers

Ultrasonography, as a non-invasive and non-radiative technology, has opened a new era of real-time diagnostic medical imaging. Currently, it is being applied in broad applications of gynaecologic, intravascular, endoscopic and molecular imaging. To generate and receive ultrasound signals, transducers for ultrasonography systems are built with encased piezoelectric materials to convert electrical signals to mechanical vibrations, and vice versa.

Typically, the acoustic impedances of piezoelectric materials are one to two orders of magnitude higher than of those of human body tissues. Such an impedance mismatch not only causes most piezo-generated acoustic energy to be reflected at the boundary but also devastatingly lengthens ultrasound pulses and transducer ring-down time. The single quarter-wavelength matching layer approach has been proposed and extensively studied to tackle the problem by taking advantage of destructive and constructive interference of ultrasound. Theoretically, total transmission is achievable at the operating frequency if the matching layer is fabricated with the proper material.

However, the transmission coefficient drops off substantially away from the operating frequency, leading to a narrow pass-band window. This has not been an issue for conventional piezoelectric materials whose intrinsic operational bandwidth is confined but poses a threat to the introduction of the new emerging generation of relaxation ferroelectric single-crystal materials such as PMN-PT. These single crystals present exceptional piezoelectric performance, providing more than 5 times higher strain energy densities and significantly higher electromechanical couplings than conventional PZT ceramics. However, with the operational percentage bandwidth of single crystals reaching over 110%, developing a corresponding broadband acoustic impedance matching scheme remains an unsolved matter.

We develop a type of anisotropic cone-structured acoustic metamaterial as the ideal matching layer for broadband ultrasound transducers. It consists of periodically arranged subwavelength silica-epoxy composite unit cells with the fraction volume ratio of the silica cone decreasing away from the piezoelectric material. It can effectively be treated as an inhomogeneous material whose acoustic impedance gradually changes along the ultrasound propagation direction. This metamaterial matching layer, fabricated by etching the peeled silica optical fibre bundles with hydrofluoric acid solution, can provide a corresponding – 6 dB percentage bandwidth as large as 100% by itself. With such a broad passband window, ultrasonography systems can enjoy the full potential of single-crystal piezoelectric materials, especially regarding better axial resolution and higher mode harmonic imaging.

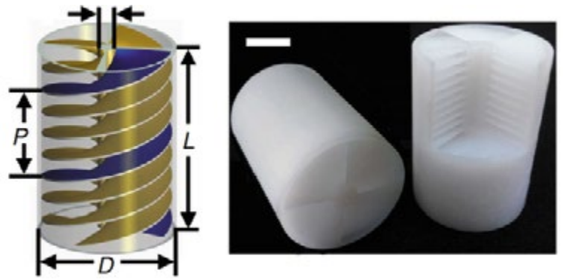


Figure 1. helical-structured acoustic metamaterials

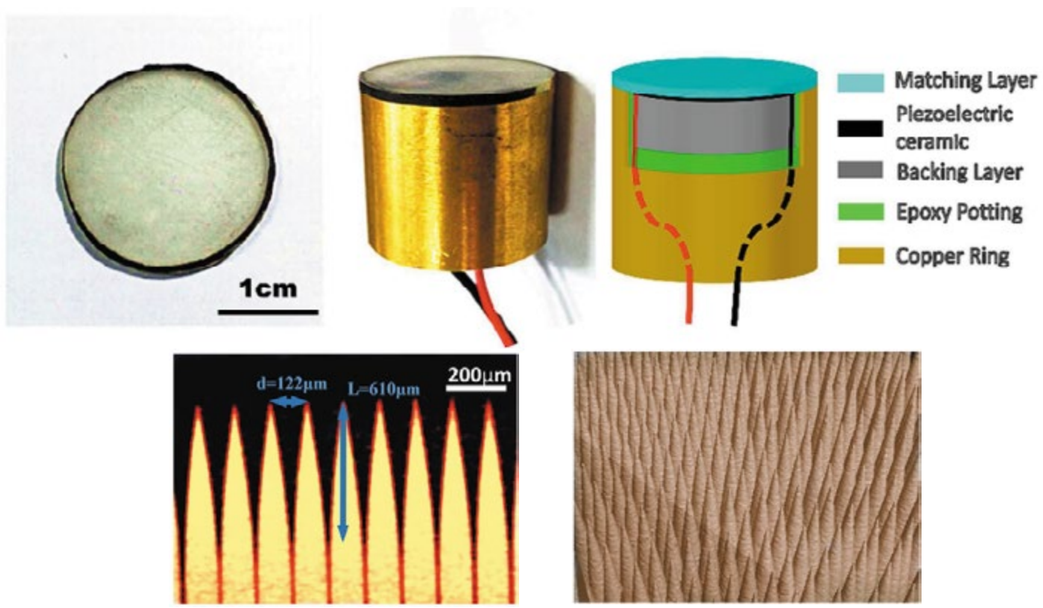


Figure 2. Broadband ultrasonic transducers with gradient impedance metamaterial matching layer

AN Liang (Dr)
Assistant Professor

Photocatalytic fuel cells for simultaneous wastewater treatment and electricity production:

As an emerging wastewater treatment technology, photocatalytic fuel cell (PFC) can utilize solar energy to degrade toxic organic compounds into eco-friendly substances and simultaneously harvest the chemical energy, achieving environmental and economic sustainability by recovering valuable resources from wastewater. This striking feature makes the PFC become one of the most promising wastewater treatment technologies for a sustainable future. However, the conventional PFC employs two big half-cells connected with an ion exchange membrane to form an H-shape cell structure, which creates a large barrier for the transport and absorption of the incident light, the delivery and degradation of organic compounds, as well as the migration of hydroxide ions, simultaneously limiting the degradation rate of organic compounds and the power generation. Before making the technology viable, therefore, the PFC performance must be substantially improved. The realization of performance improvement depends not only on the development of photocatalytic materials with novel properties for light harvesting, but also on a substantial reduction in the electron-hole recombination rate, as well as the optimization in the structural design of the photoanode, which requires critical understanding of mass and charge (including ions, electrons and holes) transport through the porous photoanode. Our current research focuses on the understandings of transport phenomena in PFCs.

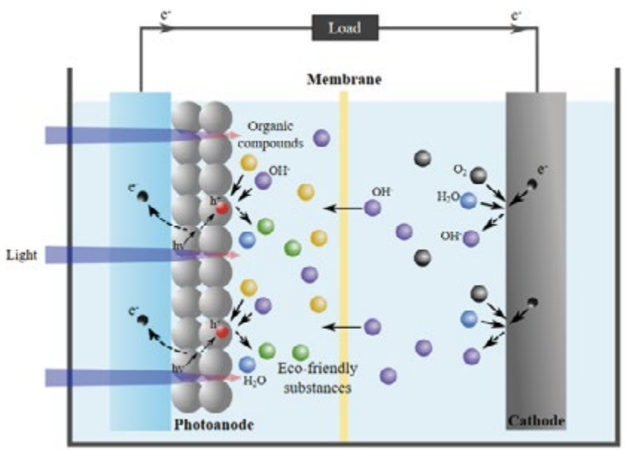


Fig. 1 Working principle of a typical photocatalytic fuel cell (PFC).

Transport phenomena in direct ethanol fuel cells for sustainable energy production:

Direct ethanol fuel cells (DEFC), which promise to be a clean and efficient energy production technology, have recently attracted worldwide attention, primarily because ethanol is a carbon-neutral, sustainable fuel and possesses many unique physicochemical properties including high energy density and ease of transportation, storage as well as handling. However, conventional DEFCs that use acid proton exchange membranes and precious metal catalysts result in rather low performance, primarily because it is difficult to oxidize ethanol in acid media. It has been recently demonstrated that when the acid electrolyte was changed to alkaline one, the cell performance could be substantially improved mainly due to the faster kinetics of both ethanol oxidation reaction and oxygen reduction reaction in alkaline media, even with cheaper materials, such as non-precious metals as electrocatalysts. The architecture design of alkaline DEFCs that purely relies on a hydroxide exchange membrane and ionomer to conduct ions exhibited extremely low performance, which is mainly attributed to the low conductivity of state-of-the-art membranes and corresponding ionomers. Recently, it has been demonstrated that, adding an alkali (e.g.: NaOH/KOH) to the fuel solution would much improve the fuel cell performance. Such an improvement can be attributed to the involvement of an alkali, which not only dramatically increases the ionic conductivity of hydroxide exchange membranes, but also enables the electrochemical kinetics of the ethanol oxidation reaction to be further enhanced. It should be noted that the presence of both metal ions and hydroxide ions in the fuel cell system creates an anion-cation co-existing system, thereby showing more complicated physicochemical processes, including mass transport, ion transport, electron transport, and electrochemical reactions. On the other hand, the DEFC has a complex multi-layered porous structure, in which the transport and electrochemical processes occur simultaneously. Our current research focuses on experimentally and numerically investigating the transport phenomena in alkaline DFFCs.

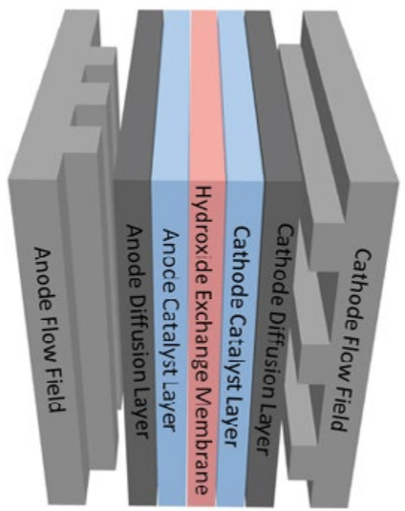


Fig. 2 A typical alkaline direct ethanol fuel cell.

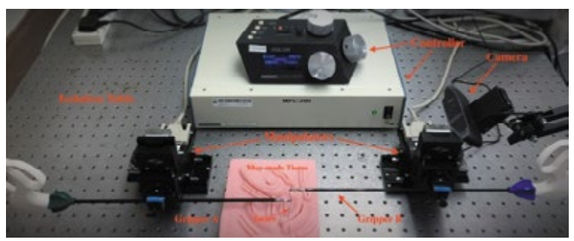
CHU Kar Hang, Henry (Dr)
Assistant Professor

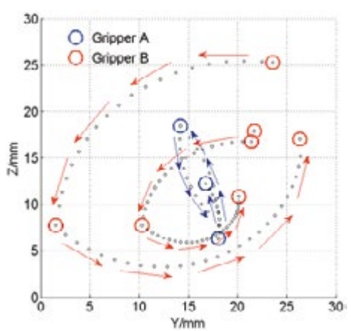
Robotic Surgical Knot Tying

Robot-assisted surgery has received increasing interest in the past few decades as it has potential to revolutionize the traditional surgery. Through the assistance of a dexterous robotic surgical system, surgeons can improve their accuracy and stability while eliminating hand tremor and involuntary movement during the surgical operation. To date, majority of these robotic systems are designed for tele-operation. When the scale of the surgical operation goes down to sub-millimeter or below, it may still pose a technical challenge for surgeons to be performed manually with high precision. With advances in vision and sensory feedback, automation can greatly reduce the difficulty and the surgical time.

Knot tying is a typical surgical operation to affix the suture to the soft tissue and the present research on robot-assisted knot tying mainly focuses at the macroscopic level through a stereo-vision, or a non-vision-based manner. In this research, several challenges associated to performing microscale knot tying automatically will be addressed. First, it is necessary to precisely evaluate the two grippers of the instruments from the microscopic images. In this context, 3D models of the suture and the two grippers are utilized to estimate the positions and orientations of the objects of interest so that the grippers can be positioned with respect to the suture for grasping. After alignment, the two arms are coordinated to construct multiple loops for knot tying. A dynamic loop winding approach is employed to minimize the required operation workspace for knot tying. The required three-dimensional trajectories for simultaneous dual-arm manipulation are generated through a path planning algorithm which can avoid collisions between the two grippers and suture breakage during the operation. Finally, an optimized control algorithm is developed to manipulate the two grippers to complete the knot operation and this algorithm can reduce the influence of the disturbances and measurement noise.

This research represents an important step in determining how visual information can be incorporated to enhance the overall precision and the quality of the knot-tying operation. Automation will greatly advance the field of minimally invasive surgery to assist surgeons to perform more delicate and complicated micro-surgical operations and cardiac surgery.



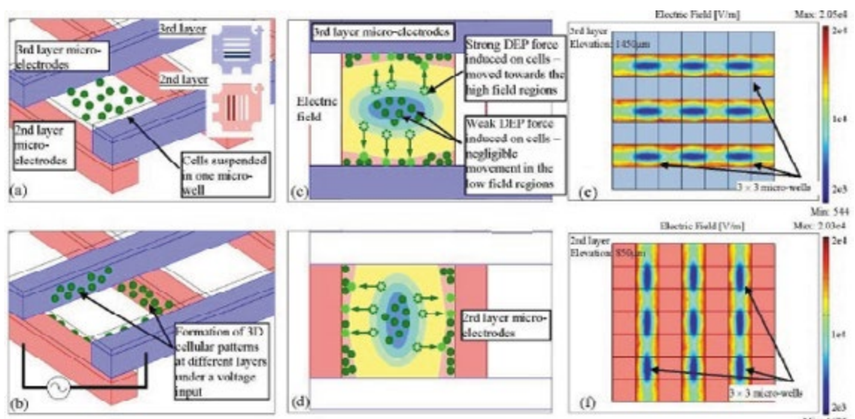


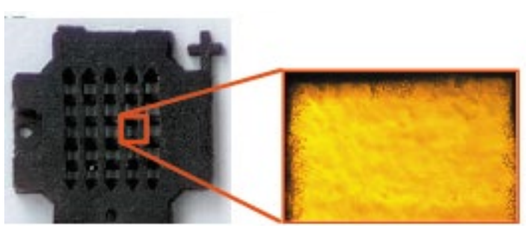
Dielectrophoresis Cell Patterning for Tissue Engineering

Manipulation of biological cells is a fundamental process in the areas of cellular biology for cell-based research. To manipulate cells suspending in a fluid medium, a simple and a non-invasive approach is to use electric fields for non-contact manipulation. Upon generating non-uniform electric fields through an electrode pair, dielectrophoretic forces are induced onto the cells and the cell movement is dependent on the gradients of the fields. Up until now, cell manipulation with this technique is restricted to planar or two-dimensional (2D) applications, and the cells are patterned or trapped either on the top or bottom layer of the electrode surfaces. If the cell manipulation technique in three-dimensional (3D) spatial environment has become available, the applications of cellular assays and tissue engineering can be expanded further to help advance healthcare of human people.

The production of artificial tissues from living cells has been regarded as a promising approach to remedy the shortage of human organs and tissues for transplantation. To construct tissues in vitro, engineered scaffolds are often utilized to provide a 3D template for cells to adhere and proliferate into functional tissues. In this research, the main goal is to develop innovative engineered scaffolds that incorporate dielectrophoresis to allow automation of 3D cell manipulation for tissue engineering applications. In order to make this leap forward and extend the current state-of-the-art beyond the 2D micro-scale environment, a novel electrode-integrated scaffold constituting multiple layers of bio-compatible materials is designed and fabricated. The unique multi-layer scaffold design can generate non-uniform fields for rapid formation of 3D cellular patterns automatically for subsequent culture. The patterning efficiency and the cell viability from the proposed technique are examined with different tests in order to ensure the quality of the tissues fabricated.

Findings from this project will generate insightful results for the utilization of dielectrophoresis for promoting cell seeding onto a scaffold and 3D cell culture techniques for tissue regeneration, and thereby providing guidelines on the development of artificial tissues and organs.



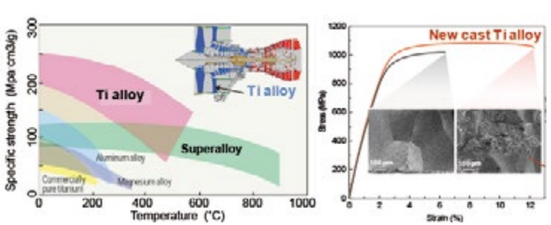


JIAO Zengbao (Dr)
Assistant Professor

ZB Jiao's research focuses on the development of advanced structural materials, including high-temperature and high-strength Ti alloys, ultrahigh-strength nanostructured steels, nanocrystalline alloys, and high-entropy alloys.

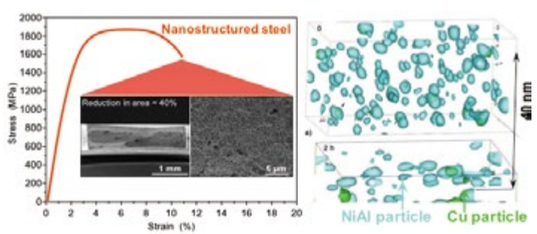
Development of high-temperature and high-strength Ti alloys

Titanium alloys have long been considered as promising structural materials for aerospace applications due to their low density, high strength, and excellent oxidation resistance. Nowadays, titanium alloys make up to ~15% of the structural weight of commercial aircraft and ~40% of military aircraft. Although significant efforts have been devoted to strengthening of titanium alloys, the scientific principles for alloy design of high-strength, high-ductility cast titanium alloys is still missing. In this project, we address the fundamental issues by investigating the metallurgical factors that govern the strength and ductility of cast titanium alloys, quantitatively characterizing the microstructures/microproperties at the nanoscale, and correlating the microstructures/microproperties with bulk mechanical properties.



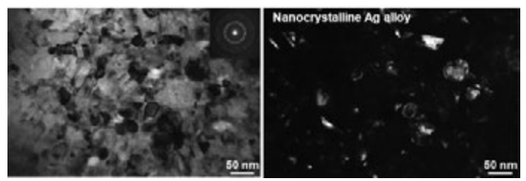
Development of ultrahigh-strength nanostructured steels

Advanced ultrahigh-strength steels are highly desirable for a wide range of engineering applications, such as aerospace, automotive, nuclear power, and defense industries. Among the various strengthening methods, nanoparticle strengthening has been proved to be one of the most effective approaches to enhance the strength of steels. In particular, the co-precipitation of multiple types of nanoparticles is very attractive, since it may lead to a superior overall properties. In this project, we systematically study the nucleation mechanism, evolution kinetics, and strengthening effects of a group of coherent nanoparticles, including BCC-Cu, B2-NiAl and Ni(Al,Mn), and L21-Ni2AlMn and Ni2AlTi nanoparticles, aiming at developing the next-generation ultrahigh-strength nanostructured steels for engineering applications.



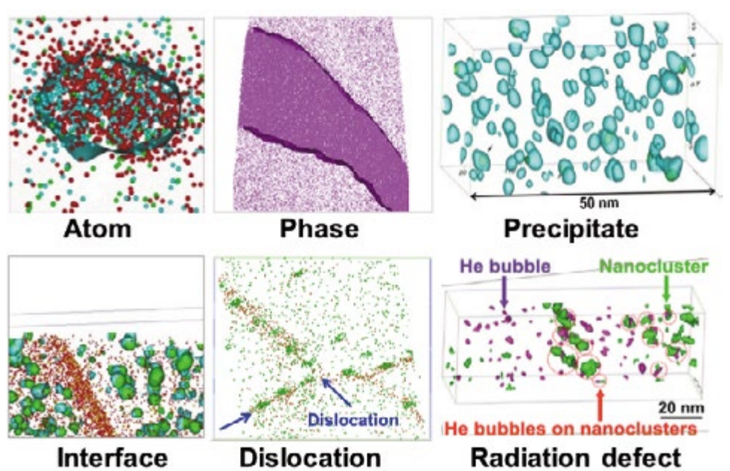
Design of stable nanocrystalline alloys

Nanocrystalline materials are desirable in a wide variety of applications. For example, nanocrystalline silver is an attractive material for electronic applications due to its excellent conductive properties. However, nanocrystalline pure silver suffers from nanostructure instability due to the high energy associated with the high fraction of grain boundaries. One way to suppress this structural instability is to alter the energy landscape of the material through chemistry. In this project, we examine the role of varying solute species and segregation profiles on the stability and mobility of silver grain boundaries at the nanocrystalline length scale, aiming at developing stable nanocrystalline silver alloys for electronic applications.



Atomic characterization of advanced materials using 3D atom probe tomography

Atom Probe Tomography is a state-of-the-art analytical technique that allows for 3D elemental mapping with near atomic resolution and gives information on the topology of interfaces and local chemical gradients. Due to its outstanding spatial resolution and detection sensitivity it provides information essential for understanding structure-property relationships of complex materials and understanding atomic-scale critical phenomena of advanced materials. In this project, we use atom probe tomography, together with transmission electronic microscopy and computational simulations, to study the nanoscale precipitation, phase decomposition, and grain-boundary segregation of advanced structural materials, including high-entropy alloys, oxide-dispersion strengthened steels, and superalloys.



David NAVARRO-ALARCON (Dr)
Assistant Professor

Visual Deformation Servoing of Soft Objects

The robotic manipulation of rigid objects has been extensively studied for more than four decades now. On the other hand, the vision-based manipulation of deformable objects has many promising and economically important applications in growing fields such as medical and surgical robotics (e.g. manipulating soft tissues and organs), automated food processing (shaping compliant food materials), home and elderly care robotics (folding clothes and fabrics), manufacturing industry (positioning cables and flexible PCBs), to name a few applications.

To perform deformation control tasks in a closed-loop manner, a robotic system must measure the object's configuration, typically with a vision sensor, and use the feedback shape to plan a trajectory to actively deform the soft object into a desired shape. In a series of research articles [1]-[4], my team has recently coined the term "visual deformation servoing" to define these new types of sensor-based manipulation tasks. This new control paradim contrasts with the well-known standard visual servoing (i.e. à la Chaumette) in that the servo-loop is formulated in terms of the object's deformations and not in terms of the robot's pose.

Note that despite the great progress achieved during the past decade in soft robotics, the vision-based control of soft object deformations still remains an open research problem. The servo-control of soft deformations is currently one of the most challenging problems in dexterous robot manipulation and has puzzled for years many researchers who have proposed various interesting approaches, however, none has been able to thoroughly solve the issue. The main difficulties that hamper the implementation of these tasks are: (1) the real-time estimation of the deformation properties of an unknown soft object, (2) the characterisation of an infinite-dimensional soft body as a compact feedback signal, and (3) the coordination of the robot's input motion with the feedback shape measurements of the manipulated object.

A New Model-Free Soft Object Manipulation Approach

The objective of this RGC-funded project is to develop a new control framework for manipulating soft objects. Specifically, we aim to develop a new visual servoing method to automatically deform soft objects into desired contours by means of the active pushing/pulling motions of multiple manipulation points. Fig. 1 conceptually depicts the proposed model.

The main innovations of the method to be developed in this research project can be summarised as follows: First, we propose a new compact vectorial representation of the infinite-dimensional shape of the object that is based on Fourier coefficients and which is suitable for real-time computations and controller design; Second, the method uses a new Lyapunov-motivated adaptive algorithm that iteratively estimates the deformation properties (i.e. the quasi-static relation between the robots' motion and the shape vector) of an unknown soft object in real-time; Third, to manipulate the soft object into the desired configuration, the proposed method uses a new kinematic control law that computes the trajectories for the manipulators based on an explicit deformation error which conceptually represents the difference between the Fourier-constructed feedback shape vector and its constant target; Fourth, in contrast with most existing deformation servo-controllers in the literature, this new image-based approach can be used to manipulate soft objects without the need to use artificial fiducial markers or special texture on its surface.

Fig. 2 shows sample experimental results using the propose method. In this figure we can see how the vision-based algorithm automatically control robotic grippers such that a piece of phantom tissue is deformed into target configurations.

Founding Source
Project title: Fourier-Based Shape Control of Soft Objects with Multiple Active Manipulation Points and Online Model Estimation.
RGC General Research Fund, 2018–2021

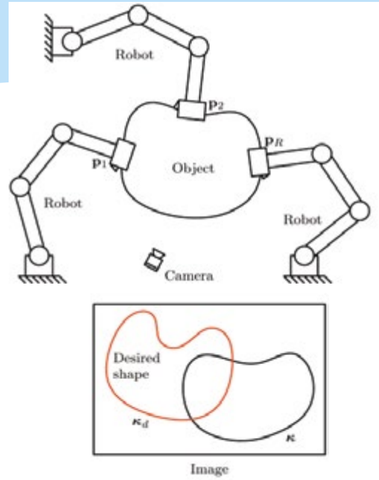


Fig. 1 Soft object manipulated by multiple robotic grippers.

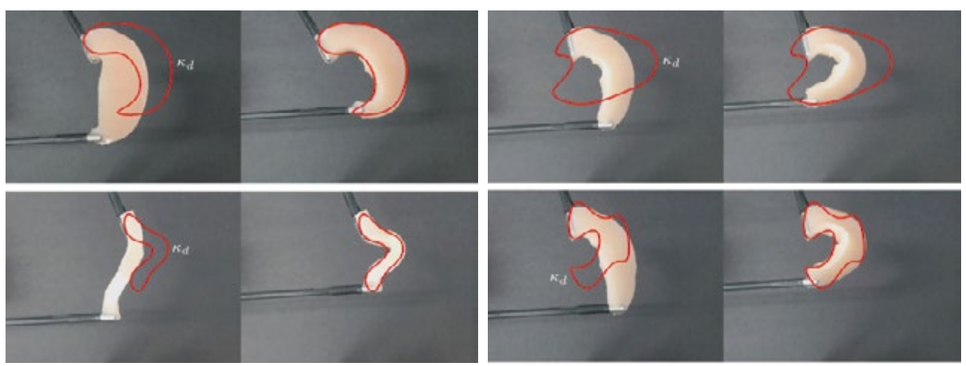


Fig. 2 Manipulation experiments of phantom tissues using real-time vision feedback

References
[1] D Navarro-Alarcon et al. “Model-free Visually Servoed Deformation Control of Elastic Objects by Robot Manipulators”. IEEE Transactions on Robotics, vol. 29, no. 6, pp. 1457–1468, 2013
[2] D Navarro-Alarcon et al. “On the Visual Deformation Servoing of Compliant Objects: Uncalibrated Control Methods and Experiments” International Journal of Robotics Research, vol. 33, no. 11, pp. 1462–1480, 2014
[3] D Navarro-Alarcon et al. “Automatic 3D Manipulation of Soft Objects by Robotic Arms with Adaptive Deformation Model”. IEEE Transactions on Robotics, vol. 32, no. 2, 429–441, 2016
[4] D Navarro-Alarcon et al. “Contour-Based Deformation Servoing: A New Algorithm to Actively Deform Soft Objects into Desired 2D Image Shapes”, IEEE Transactions on Robotics, 2017

RUAN Haihui (Dr)
Assistant Professor

Precision Glass Moulding for Optoelectronics

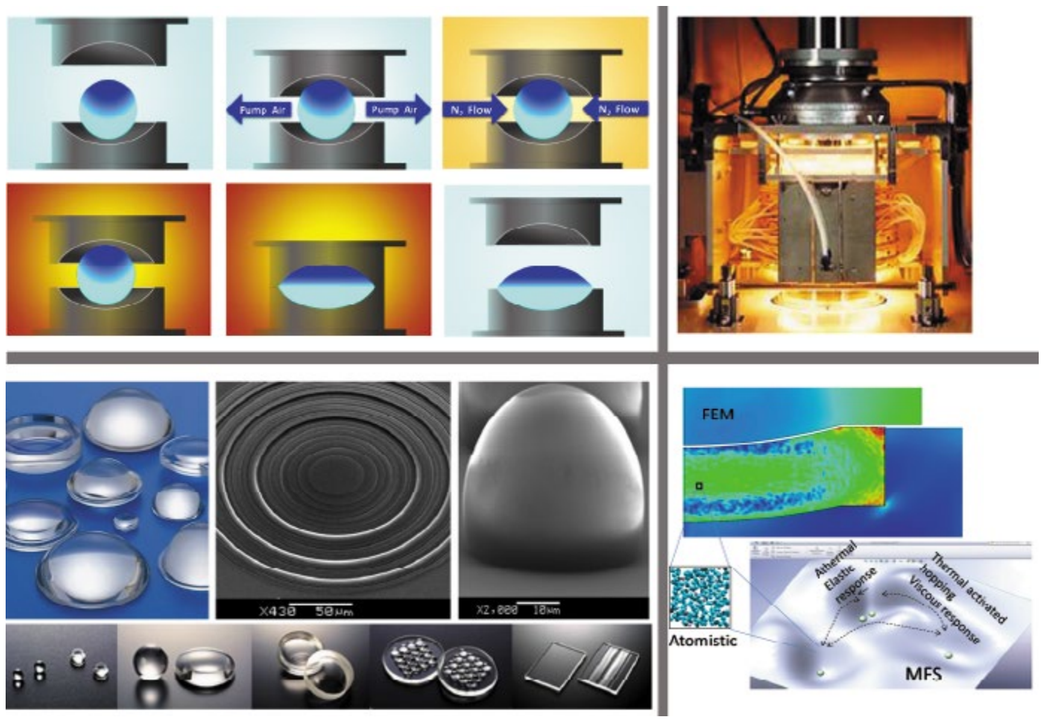
Our daily life has been significantly influenced by the advent of new glasses. For example, the glass transition temperature can be effectively reduced by adding metal-oxide into silica, which leads to window glass and optical lenses. The excellent combination of hardness and fracture toughness can be achieved by putting alkali into aluminosilicate (i.e. the Gorilla Glass), which has been widely used in computer or smartphone touchscreens. Glass gobs have been formed into not only windshields but also substrates for Thin-Film-Transistor Liquid-Crystal Displays (TFT-LCD) and for harvesting solar energy.

Glass manufacturing has an age-old tradition, which employs the transition from the hard solid at low temperature to the soft matter at high temperature. However, the same burn-and-shape process becomes difficult to implement when the high precision is called for in the current age with booming applications of optoelectronic devices. In theory, glass can be shaped into nanoscale without an apparent limit of minimum feature size, because an amorphous material has no internal length scale (e.g. unlike the gain size effect of a crystalline material). But in practice, the lack of knowhow makes precision glass moulding becomes extremely difficult and cost a lot of trail-and-error efforts. For example, precision glass moulding is of little use in precision optics, where the geometry and physical properties of an optical element must be highly precise. The production of high-quality lenses nowadays still depends on dedicated grinding/polishing systems. These processes are extremely expensive, and become even unviable when the optical components are of complex shapes and/or with small-scale surface features.

Can the low-cost thermoforming also be high-precision? Can it be more predictable and less trial-and-error? Thermoforming would be applicable for making most optical elements and be immediately scalable for mass production. However, the process design currently still depends on trial-and-error experimentations and skilful artisans, which in most cases are costly and formidable. To break the barrier from the grass root of the technology, we aim at establishing an accurate computational model of glass, which can predict the material behaviour in a thermal process and ascertain the physical properties of the final product.

The conceptual innovation in our research is to impart stochasticity in glass constitutive modelling since the heterogeneous and non-equilibrium nature of glassy state makes a definite description of material behaviour unviable. We work on the stochastic model of glass and novel experiments. The structural relaxation of glass is conventionally investigated using dilatometry or calorimetry. This project will use the impulse excitation (IE) technique to study the variation of elastic modulus. Elastic modulus reflects the curvature of the potential energy profile near a minimum. Its variation with temperature and time also manifests the change of atomic structures. In our recent experimental investigation of mouldable optical glass Schott P-BK7, it is found that the variation of volume expansion is non-linear and non-trivial at the low temperature regime, which can be well correlated to the variation of Young's modulus under the same heating rate. Therefore, we propose to simultaneously measure the changes of modulus and volume by integrating a specially designed dilatometer into the IE station. This unique setup will provide the unprecedentedly comprehensive characterisation of glass relaxation and lead to a more accurate glass model.

The success of this project can significantly advance the industry in exploiting glass transition for making high-quality and complex-shaped optical components. The developed theory will predict the property variations of a final product and allow reliable design of thermoforming process. The new areas/disciplines that can also benefit from this research will include, e.g. micro/nano mould manufacture for precision glass moulding, and the design and realisation of novel optical–electronic–biomedical–imaging systems.



Research Achievements

Grants

Externally funded projects

Project Title : Creation of Rechargeable Electron-fuels for Stationary Power Supplies and Electric Vehicles (ME)
Investigators : L An
Source of Funding : RGC Theme-based Projects
Amount Sponsored : HKD 531,111

Project Title : Mass and Charge Transport Through the Porous Photoanode in Photocatalytic Fuel Cells for Simultaneous Wastewater Treatment and Electricity Generation
Investigators : L An
Source of Funding : Early Career Scheme
Amount Sponsored : HKD 820,000

Project Title : A Novel Bivariate Taylor Expansion Method of Moments (BTEMOMs) for Multi-Scale Agglomerate Synthesis in Turbulent Combustion Flows
Investigators : TL Chan and JZ Lin (Zhejiang University, China)
Source of Funding : RGC General Research Fund
Amount Sponsored : HKD 835,025

Project Title : Development of a Novel Bimodal Moment Method (BMM) Model Scheme for Solving Complex Aerosol-Related Problems
Investigators : TL Chan
Source of Funding : RGC General Research Fund
Amount Sponsored : HKD 622,000

Project Title : Development of a Novel Operator Splitting Framework for Solving Population Balance Equation on Aerosol Dynamics
Investigators : TL Chan and K Zhou (Wuhan University of Science and Technology, China)
Source of Funding : RGC General Research Fund
Amount Sponsored : HKD 579,126

Project Title : 多孔介质燃烧中气态及颗粒污染物生成与演化的实验及数值模拟研究
Investigators : TL Chan
Source of Funding : 面上项目
Amount Sponsored : RMB 788,000

Project Title : Fundamental Investigation of Magneli Phase Titanium Oxide Nanotube Arrays as Host of Sulfur for Cathode of High Performance Lithium-Sulfur Batteries
Investigators : GH Chen
Source of Funding : RGC General Research Fund
Amount Sponsored : HKD 200,502

Project Title : Oxidative Chemical Vapor Deposition of Conductive Polymers on Particle Materials as Cathodes for Lithium Ion Batteries
Investigators : GH Chen and K Lau (Drexel University, US)
Source of Funding : RGC General Research Fund
Amount Sponsored : HKD 637,584

Project Title : Preparation of High Performance Cathodes for Li-S Batteries and Their Property and Mechanism Study: Enhancement of Electron and Lithium Ion Transmission and Anchoring of Polysulfides
Investigators : GH Chen and YF Deng (South China University of Technology, China)
Source of Funding : RGC Joint Research Scheme
Amount Sponsored : HKD 1,124,880

Project Title : A Hierarchical Diagnosis Strategy and Integrity Monitoring Technique for Space Structures and Systems
Investigators : L Cheng, ZQ Su, YS Choy and XJ Jing
Source of Funding : Beijing Institute of Spacecraft Environment Engineering, China Academy of Space Technology
Amount Sponsored : HKD 4,832,280

Project Title : Acoustic Boundary Design Based on a Wavelet-Decomposed Galerkin Formulation
Investigators : L Cheng
Source of Funding : RGC General Research Fund
Amount Sponsored : HKD 762,183

Project Title : Nonlinear Third-Harmonic Shear-Horizontal Waves for Structural Health Monitoring Through Incipient Defect Detection
Investigators : L Cheng and JH Qiu (Nanjing University of Aeronautics and Astronautics, China)
Source of Funding : RGC General Research Fund
Amount Sponsored : HKD 579,126

Project Title : Research on Structural Wave Manipulation and its Engineering Applications
Investigators : L Cheng
Source of Funding : State Key Laboratories of Mechanics and Control of Mechanical Structure, NUAA, China
Amount Sponsored : RMB 200,000

Project Title : Simulation, Monitoring and Control of Vibroacoustic Coupled Systems
Investigators : L Cheng
Source of Funding : State Key Laboratories of Mechanics and Control of Mechanical Structure, NUAA, China
Amount Sponsored : RMB 200,000

Project Title : Structure-Borne Wave Manipulation Through Acoustic Black Hole for Vibration and Noise Control Applications
Investigators : L Cheng and JH Qiu (Nanjing University of Aeronautics & Astronautics, China)
Source of Funding : RGC General Research Fund
Amount Sponsored : HKD 594,874

Project Title : Vibrating Structures Coupled to Open/Close Acoustic Cavities with Application to Micro-perforated Panels
Investigators : L Cheng and JL Guyader (Institut National des Science Appliquees de Lyon, France)
Source of Funding : RGC General Research Fund
Amount Sponsored : HKD 525,000

Research Achievements

Grants

Project Title : Vibroacoustics of Structures with Space-Dependent Structural Inhomogeneity: Modelling and Physical Exploration
Investigators : L Cheng
Source of Funding : RGC General Research Fund
Amount Sponsored : HKD 488,345

Project Title : 基于声学黑洞效应（ABH）的波操纵及其工程应用中的力学问题研究
Investigators : L Cheng
Source of Funding : 面上项目
Amount Sponsored : RMB 1,000,000

Project Title : 由微元動力平衡擾動辨識結構損傷的理論與方法
Investigators : L Cheng, WO Wong, JL Guyader (Institut National des Science Appliquees de Lyon, France), S Zhang, C Mao and H Xu
Source of Funding : 面上项目
Amount Sponsored : RMB 820,000

Project Title : 面向载人航天器密封舱的噪音与振动控制理论方法及应用技术研究
Investigators : L Cheng, XJ Jing, YS Choy and ZQ Su
Source of Funding : China Academy of Space Agency (CAST)
Amount Sponsored : RMB 1,194,000

Project Title : Acoustic Behavior of Parallel-arranged Perforated Panel Absorber at High Sound Pressure Level
Investigators : YS Choy
Source of Funding : RGC General Research Fund
Amount Sponsored : HKD 525,000

Project Title : Online Sound Sources Identification for Space Vehicles
Investigators : YS Choy, L Cheng, ZQ Su, XJ Jing and SK Tang (BSE)
Source of Funding : Beijing Institute of Spacecraft Environment Engineering, China Academy of Space Technology
Amount Sponsored : HKD 600,000

Project Title : 帶背腔的薄膜結構用於管道風扇噪音控制的研究
Investigators : YS Choy, Y Liu, XN Wang and Q Xi
Source of Funding : 青年科学基金項目
Amount Sponsored : RMB 250,000

Project Title : 3D Fabrication of Vascularized Tissue Constructs Through a Combined Robotic and Dielectrophoretic Bio-Printing System
Investigators : KH Chu
Source of Funding : RGC Early Career Scheme
Amount Sponsored : HKD 732,164

Project Title : Development of Hybrid 3D Printing Technologies Aided by Reverse Engineering and Simulation Technologies for Making of Critical Spare Parts of Complex Systems
Investigators : MW Fu, ZB Jiao and C Ng
Source of Funding : Hong Kong Government (Electrical and Mechanical Services Department)
Amount Sponsored : HKD 350,000

Project Title : Development of Semi-solid Forming Technologies for Fabrication of Micro-scaled and Fine-pitched Parts for Semiconductor and Microelectronics Applications
Investigators : MW Fu
Source of Funding : Hong Kong Government (ITF)
Amount Sponsored : HKD 1,215,800

Project Title : Epistemological Investigation of the Scattering Deformation Behaviors and Phenomena and the Undesirable Geometries and Inaccurate Dimensions in Micro-Scaled Plastic Deformation
Investigators : MW Fu
Source of Funding : RGC General Research Fund
Amount Sponsored : HKD 579,126

Project Title : 不同尺度下塑性变形中断裂行为差异及断裂准则有效性研究
Investigators : MW Fu
Source of Funding : 面上项目
Amount Sponsored : RMB 752,000

Project Title : 不全冶金结合粉末原始边界的再结晶面棱隅形核的竞争机制研究
Investigators : MW Fu
Source of Funding : 面上项目
Amount Sponsored : RMB 162,000

Project Title : 钛合金薄板电致增塑机理及微细冲压成形工艺研究
Investigators : MW Fu
Source of Funding : 面上项目
Amount Sponsored : RMB 100,000

Project Title : 不同尺度下塑性变形中断裂行为差异及断裂准则有效性研究
Investigators : MW Fu
Source of Funding : 面上项目
Amount Sponsored : RMB 752,000

Project Title : 跨尺度构件形性协同塑性成形理论及技术基础研究
Investigators : MW Fu
Source of Funding : 重点项目
Amount Sponsored : RMB 3,000,000

Project Title : Effects of Deformation and Aging on the Microstructure and Mechanical Properties of Nanoscale Precipitation Strengthened Steels
Investigators : ZB Jiao, SQ Shi, L Fan and ZP Lu (University of Science & Technology Beijing)
Source of Funding : State Key Laboratory for Advanced Metals and Materials, U of Science and Technology Beijing, China
Amount Sponsored : HKD 82,999

Research Achievements

Grants

Project Title : 共格 / 非共格纳米相复合强化钢的析出机理和强化机制
Investigators : ZB Jiao
Source of Funding : 青年科学基金项目
Amount Sponsored : RMB 240,000

Project Title : Anti-Vibration Assistive Exoskeleton Technology for Manipulating Vibrating Tools
Investigators : XJ Jing and KH Chu
Source of Funding : Hong Kong Government (ITF)
Amount Sponsored : HKD 1,304,000

Project Title : Development of a Smart Localization Technique of Thermal Source
Investigators : XJ Jing
Source of Funding : Guangzhou Purple River Technology Limited
Amount Sponsored : HKD 239,700

Project Title : Feature Characterization and Fault Detection of Complex-structure Systems Based on Dynamic Response Signals & Initial Development of New Generation Vibration Isolation Technology in Aeronautic Engineering
Investigators : XJ Jing, L Cheng, WO Wong and RCK Leung
Source of Funding : Beijing Institute of Spacecraft Environment Engineering, China Academy of Space Technology
Amount Sponsored : HKD 1,200,000

Project Title : Modelling, Analysis & Design of Novel X-shaped Structures for Beneficial Nonlinear Stiffness and Damping Characteristics
Investigators : XJ Jing, A Robert (The University of Southampton) and R Vaidyanathan (Imperial College)
Source of Funding : RGC General Research Fund
Amount Sponsored : HKD 488,345

Project Title : Nonlinear Analysis and Design in the Frequency Domain: Theoretic Basis and Practical Methods
Investigators : XJ Jing and L Cheng
Source of Funding : RGC General Research Fund
Amount Sponsored : HKD 1,163,130

Project Title : Computational Science and Engineering for Product Innovation and Aeronautical System Design
Investigators : RCK Leung
Source of Funding : Charities & Foundation (Philip K. H. Wong Foundation)
Amount Sponsored : HKD 1,000,000

Project Title : Development of Advanced Close-Proximity (CPX) Technology with Suppressed Background Noise for Tyre/Road Noise Measurement in Hong Kong Traffic
Investigators : RCK Leung and WT Hung (CEE)
Source of Funding : Hong Kong Government (Environment and Conservation Fund)
Amount Sponsored : HKD 1,628,140

Project Title : Experimental and Numerical Studies of Innovative Acoustical Material Technology for Industrial and Urban Low-Frequency Noise Mitigation
Investigators : RCK Leung, WP Bi (Universite du Maine, Laboratoire d'Acoustique, France), Le D.A. (Universite du Maine, Laboratoire d'Acoustique, France) and Y. Auregan (Universite du Maine, Laboratoire d'Acoustique, France)
Source of Funding : RGC Joint Research Scheme (ANR/RGC Joint Research Scheme)
Amount Sponsored : HKD 3,240,000

Project Title : Novel Wave Functional Materials for Manipulating Light and Sound
Investigators : RCK Leung
Source of Funding : AoE Collaborated Project
Amount Sponsored : HKD 300,000

Project Title : Development of Next Generation Multi-layer Chitosan Nanofiber Filters for Medical/Environmental Use with Novel Filtration/Purification Technology
Investigators : WWF Leung and H Feng (Avalon Nano-Biotech (HK) Limited)
Source of Funding : Hong Kong Government (ITF)
Amount Sponsored : HKD 2,727,266

Project Title : High-Efficiency, Titanium-Graphene Composite Nanofiber Photocatalyst Integrated Into Flexible Surfaces or Wearables For Improving Air Purification
Investigators : WWF Leung
Source of Funding : RGC General Research Fund
Amount Sponsored : HKD 640,200

Project Title : High-performance all solution processing pervoskite-based solar cells with TiO_2 /CNT nanofiber scaffold
Investigators : WWF Leung
Source of Funding : Hong Kong Government (ITF)
Amount Sponsored : HKD 1,217,361

Project Title : Loading and Cleaning of A Nanofiber Depth Filter for Capturing Submicron Aerosols
Investigators : WWF Leung
Source of Funding : RGC General Research Fund
Amount Sponsored : HKD 725,000

Project Title : Effect of Vasomotion on Efficient Flow Delivery in Microvascular Network
Investigators : Y Liu and XY Luo (University of Glasgow, UK)
Source of Funding : RGC General Research Fund
Amount Sponsored : HKD 525,000

Project Title : A Sensor-Guided Robotic System for Automatic Manipulation of Laser, Radiofrequency, or related Instruments m Skin Rejuvenation Procedures
Investigators : D Navarro Alarcon
Source of Funding : Industry & Utilities (Rods Technology Company Limited)
Amount Sponsored : HKD 386,515

Research Achievements

Grants

Project Title : Fourier-Based Shape Control of Soft Objects with Multiple Active Manipulation Points and Online Model Estimation
Investigators : D Navarro Alarcon
Source of Funding : RGC General Research Fund
Amount Sponsored : HKD 640,200

Project Title : Human-to-Robot Skill Transfer for Soft Manipulation in Unstructured Human Environments
Investigators : D Navarro Alarcon
Source of Funding : RGC Joint Research Scheme (France/HK Joint Research Scheme)
Amount Sponsored : HKD 86,400

Project Title : Visuo-Tactile Learning of Mechanical Properties for Robotic Grasping of Inhomogeneous Objects
Investigators : D Navarro Alarcon
Source of Funding : RGC Joint Research Scheme (Germany/HK Joint Research Scheme)
Amount Sponsored : HKD 43,200

Project Title : Constitutive Modelling of Glass: New Experiments and New Models
Investigators : HH Ruan
Source of Funding : RGC Early Career Scheme
Amount Sponsored : HKD 921,290

Project Title : Development of A Phase Field Modeling Framework for Localized Corrosion Kinetics
Investigators : SQ Shi, SY Hu (Pacific Northwest National Laboratory, US) and JL Luo (University of Alberta, Canada)
Source of Funding : RGC General Research Fund
Amount Sponsored : HKD 550,000

Project Title : Investigation of the Evolution Kinetics of Porous Metals During Dealloying by Phase-field Method
Investigators : SQ Shi
Source of Funding : RGC General Research Fund
Amount Sponsored : HKD 640,200

Project Title : Study of Gas Bubble Behavior for High Burnup Nuclear Fuels Using the Phase Field Methodology
Investigators : SQ Shi, SY Hu (Pacific Northwest National Laboratory, US), YL Li (Pacific Northwest National Laboratory, US) and CH Woo (The City University of Hong Kong, HK)
Source of Funding : RGC General Research Fund
Amount Sponsored : HKD 579,126

Project Title : 核燃料内部气泡演化行为的相场研究
Investigators : SQ Shi
Source of Funding : 面上项目
Amount Sponsored : RMB 620,000

Project Title : A New Research Framework for Quantitative Characterization of Disorderedly Clustered Pitting-type Damage in Engineering Structures: A Bottleneck Breakthrough of Guided-wave-based Detection for Multitudinous Damage
Investigators : ZQ Su and P Fromme (University College London (UCL), University of London)
Source of Funding : RGC General Research Fund
Amount Sponsored : HKD 488,345

Project Title : An Innovative Smart Sensing Network Coating towards in-situ Acousto-ultrasonics-based Health Monitoring for Engineering Structures
Investigators : ZQ Su and LM Zhou
Source of Funding : Hong Kong Government (ITF)
Amount Sponsored : HKD 1,579,182

Project Title : In-situ Sensing and Characterization of Fatigue Damage Using Nonlinearity of Elastic Disturbance Perceived by a Coated CNT-graphene Hybrid Sensor Network
Investigators : ZQ Su, LM Zhou and WK Li
Source of Funding : RGC General Research Fund
Amount Sponsored : HKD 550,000

Project Title : Online Health Diagnosis and Integrity Monitoring for Space Vehicles based on Elastic Waves and Embeddable Sensor Networks
Investigators : ZQ Su, L Cheng, YS Choy and XJ Jing
Source of Funding : Beijing Institute of Spacecraft Environment Engineering, China Academy of Space Technology
Amount Sponsored : HKD 600,000

Project Title : Probabilistic Evaluation of Hypervelocity Impact-Induced Damage Based on Cumulative Energy Transfer in Nonlinear Acousto-Ultrasonic Waves: a Framework for Space Application-Oriented Structural Health Monitoring
Investigators : ZQ Su and QM Zhang (Beijing Institute of Technology , China)
Source of Funding : RGC General Research Fund
Amount Sponsored : HKD 1,007,680

Project Title : Structural Health Monitoring-oriented Quantitative Characterization of Fatigue Damage Using Nonlinearities of Acousto-ultrasonic Waves: Fundamental Investigation, Algorithm Development and Experimental Validation
Investigators : ZQ Su
Source of Funding : RGC General Research Fund
Amount Sponsored : HKD 525,000

Project Title : Trial : Online Health Diagnosis and Prognosis (Online-HD&P) for Train Structures Using a Large-scale Diagnostic Sensor Network
Investigators : ZQ Su and L Cheng
Source of Funding : Hong Kong Government (ITF)
Amount Sponsored : HKD 232,429

Project Title : 航空时变服役条件下复杂结构的损伤波动诊断
Investigators : ZQ Su
Source of Funding : 重点项目
Amount Sponsored : RMB 950,000

Research Achievements

Grants

Project Title : 基于"准 - 弥散"喷涂传感网络及超声非线性的疲劳损伤原位定量监测
Investigators : ZQ Su
Source of Funding : 面上项目
Amount Sponsored : RMB 650,000

Project Title : 損傷誘發彈性波非線性特征的研究及其在飛行器 FRP 材料健康監測中的應用
Investigators : ZQ Su and SF Yuan (Nanjing University of Aeronautics and Astronautics, China)
Source of Funding : 機械結構力學及控制國家重點實驗室開放課題項目
Amount Sponsored : RMB 200,000

Project Title : On Physical Mechanism and Fluidic Control of Floppy Iris Syndrome During Cataract Surgery
Investigators : H Tang, KK Ramaesh (GTennent Institute of Ophthalmology, UK), PS Stewart (University of Glasgow, UK) and XY Luo (School of Mathematics & Statistics, UK)
Source of Funding : RGC General Research Fund
Amount Sponsored : HKD 820,776

Project Title : A Unique Multipurpose Transonic-to-Hypersonic Ludwieg Tube Facility for Study of the High-Speed Aerodynamics
Investigators : CY Wen, L Cheng, RCK Leung, P Zhang, CH Cheng (ISE), LX Huang (The University of Hong Kong, HK), HH Qiu (The Hong Kong University of Science and Technology, HK) and K Xu (The Hong Kong University of Science and Technology, HK)
Source of Funding : RGC Collaborative Research Fund
Amount Sponsored : HKD 4,500,000

Project Title : Application of Dielectric Barrier Discharge Plasma Actuators on a Highly Swept Delta Wing
Investigators : CY Wen
Source of Funding : RGC General Research Fund
Amount Sponsored : HKD 670,500

Project Title : Development of a wind-field simulation platform to assess installation sites of wind turbines in highly urbanized areas of Hong Kong
Investigators : CY Wen
Source of Funding : Hong Kong Government (Environment and Conservation Fund)
Amount Sponsored : HKD 1,062,660

Project Title : Experimental Investigation on Flow Instabilities of a Miscible Magnetic Droplet in a Hele–Shaw Cell
Investigators : CY Wen
Source of Funding : RGC General Research Fund
Amount Sponsored : HKD 550,000

Project Title : Investigation on Aerodynamic Breakup of a Liquid Droplet Behind a Shock Wave
Investigators : CY Wen
Source of Funding : RGC General Research Fund
Amount Sponsored : HKD 810,776

Project Title : The Application of Dielectric Barrier Discharge Plasma Actuators on Active Flow Control around a Bluff Body
Investigators : CY Wen
Source of Funding : Non – Hong Kong (Office of Naval Research)
Amount Sponsored : HKD 557,420

Project Title : The Design, Manufacture, Analysis and Control of Vertical Take-Off and Landing (VTOL) Unmmaned Aerial Vehicles (UAVs)
Investigators : CY Wen and SJ Shen (HKUST)
Source of Funding : Innovation and Technology Fund ITF Funding: HK$4,551,200
DJI Innovations Technology Co., Ltd. Sponsorship: $1,000,000
Amount Sponsored : Amount of funding to allocated to PolyU: $2,033,750

Project Title : 液态燃料爆轰波形成之数值模拟研究
Investigators : CY Wen
Source of Funding : 爆炸科学与技术国家重点实验室 (北京理工大学) 开放基金项目
Amount Sponsored : RMB 100,000

Project Title : 存在粒度分布的铝粉 - 空气两相爆轰波的数值模拟研究
Investigators : CY Wen
Source of Funding : 国家重点实验室开放基金
Amount Sponsored : RMB 100,000

Project Title : 汇聚激波诱导可燃界面的 Richtmyer-Meshkov 不稳定性研究
Investigators : CY Wen
Source of Funding : 面上项目
Amount Sponsored : RMB 620,000

Project Title : 声学超表面对高超声速边界层转捩的抑制机理与应用
Investigators : CY Wen
Source of Funding : 面上项目
Amount Sponsored : RMB 200,000

Project Title : Infrasonic Vibration Suppression Using Viscoelastic Dynamic Absorber
Investigators : WO Wong
Source of Funding : RGC General Research Fund
Amount Sponsored : HKD 758,225

Project Title : Investigation of the Lithiation Process in Constrained Anode Materials for High-Performance Lithium Ion Batteries
Investigators : HM Yao and HT Wang (Zhejiang University, China)
Source of Funding : RGC General Research Fund
Amount Sponsored : HKD 835,025

Research Achievements

Grants

Project Title : Investigation on the Mechanics of Adhesion between Tubeworm (Hydroides elegans) and Substrata
Investigators : HM Yao and V Thiyagarajan (The University of Hong Kong, HK)
Source of Funding : RGC General Research Fund
Amount Sponsored : HKD 762,183

Project Title : Mechanics of Morphological Optimization of Current Collectors in Li-ion Batteries for Enhanced Adhesion with Si-based Electrode Materials
Investigators : HM Yao and LM Zhou
Source of Funding : RGC General Research Fund
Amount Sponsored : HKD 861,450

Project Title : 多級生物黏附結構的實驗研究和仿製
Investigators : HM Yao, LL Hu (Sun Yat-sen University, China), XG Lei (Sun Yat-sen University, China), SY Liu (Sun Yat-sen University, China) and Q Ye (Sun Yat-sen University, China)
Source of Funding : 面上項目
Amount Sponsored : RMB 450,000

Project Title : 硅基锂电池负极材料的仿生梯度化设计与制备
Investigators : HM Yao
Source of Funding : 面上项目
Amount Sponsored : RMB 640,000

Project Title : Ab Initio Chemical Kinetics for Key Reactions in Biodiesel Combustion
Investigators : P Zhang
Source of Funding : RGC Early Career Scheme
Amount Sponsored : HKD 814,000

Project Title : Dynamics of Binary Droplet Collision under Elevated Gas Pressures
Investigators : P Zhang
Source of Funding : RGC General Research Fund
Amount Sponsored : HKD 550,000

Project Title : Experimental and Numerical Investigation on the Collision of Binary Droplets of Shear-Thinning Fluids in Atmospheric Air
Investigators : P Zhang
Source of Funding : RGC General Research Fund
Amount Sponsored : HKD 1,015,442

Project Title : Theoretical Chemical Kinetics for Pyrolysis and Oxidation of Large Biodiesel Molecules
Investigators : P Zhang, CK Law (Tsinghua University, China) and XQ You (Tsinghua University, China)
Source of Funding : RGC Joint Research Scheme
Amount Sponsored : HKD 400,000

Project Title : 高压环境下喷雾过程液滴碰撞模型的研究
Investigators : P Zhang
Source of Funding : 国家重点实验室开放基金
Amount Sponsored : RMB 100,000

Project Title : 大分子直链烷烃高精度从头算燃烧反应动力学的研究
Investigators : P Zhang
Source of Funding : 重大研究计划项目
Amount Sponsored : RMB 600,000

Project Title : Investigations on the Formability and Mechanical Properties of Nano-Glasses by a Simulation Approach Combining Ab Initio Molecular Dynamics and Phase-Field Modeling
Investigators : GP Zheng
Source of Funding : RGC General Research Fund
Amount Sponsored : HKD 810,776

Project Title : Airworthiness Compliance Analysis and Verification Study on Structural Health Monitoring System
Investigators : LM Zhou, ZQ Su and FX Zou (AAE)
Source of Funding : Beijing Aeronautical Science and Technology Research Institute of COMAC
Amount Sponsored : HKD 2,970,000

Project Title : Design of Passive Unidirectional Acoustic Metamaterials
Investigators : J Zhu
Source of Funding : RGC Early Career Scheme
Amount Sponsored : HKD 631,290

Project Title : 基于超构表面的突破衍射极限的声波聚焦和成像
Investigators : J Zhu
Source of Funding : 面上项目
Amount Sponsored : RMB 620,000

Research Achievements

Grants

Projects funded by Central Research Grant

Project Title : Flow and Transport Phenomena through Hierarchical Porous Electrodes in Vanadium Redox Flow Batteries for Large-scale Energy Storage
Investigators : L An
Amount Sponsored : HKD 150,000

Project Title : Transport Phenomena in Alkaline Direct Ethanol Fuel Cells
Investigators : L An
Amount Sponsored : HKD 200,000

Project Title : Understanding charge transport phenomena in photoelectrochemical storage cells for solar energy storage
Investigators : L An and H Tang
Amount Sponsored : HKD 642,421

Project Title : Experimental and Numerical Studies on the Gaseous and Particulate pollutants in Porous Media Combustion
Investigators : TL Chan
Amount Sponsored : HKD 105,782

Project Title : Modeling of Particle Flow
Investigators : TL Chan and JZ Lin (Zhejiang University, China)
Amount Sponsored : HKD 150,000

Project Title : The New Generation of High Capacity Batteries for Energy Storage
Investigators : GH Chen
Amount Sponsored : HKD 5,025,000

Project Title : Detection and Monitoring of Fatigue Cracks in Axles of High-speed Train Bogies Based on Nonlinear Acousto-Ultrasonic Waves and De-centralized Sensing
Investigators : L Cheng, ZQ Su and YQ Ni (CEE)
Amount Sponsored : HKD 322,802

Project Title : Modelling, Manipulation and Control of Structural and Acoustic Waves
Investigators : L Cheng
Amount Sponsored : HKD 315,000

Project Title : On Propagation Characteristics of Three-dimensional Elastic Waves Guided by Thick-walled Hollow Cylinder and Application to Detection of Damage in Train Axle
Investigators : L Cheng
Amount Sponsored : HKD 50,000

Project Title : Research on Mechanics Problems in the Manipulation and Exploration of Acoustic Black Hole (ABH) Effect
Investigators : L Cheng
Amount Sponsored : HKD 233,000

Project Title : Structural and Acoustic Waves: Manipulation, Control and Monitoring
Investigators : L Cheng
Amount Sponsored : HKD 315,000

Project Title : Study on the Structural Damage Detection Method Based on Perturbed Local Equilibrium
Investigators : L Cheng
Amount Sponsored : HKD 206,558

Project Title : Thermo-Acoustic Oscillations: Mechanism Exploration and Control Based on Delay Differential Equation Theories Under a Fully-coupled Modelling Framework
Investigators : L Cheng
Amount Sponsored : HKD 642,421

Project Title : Vibration Control and Structural Health Monitoring for High Speed Train Applications
Investigators : L Cheng
Amount Sponsored : HKD 500,000

Project Title : Influence of Biofuels (Biodiesel and Alcohol Blended Fuels) on the Emissions of a Diesel Engine with Emphasis on Particulate Emissions
Investigators : CS Cheung and Z Ning (The City University of Hong Kong)
Amount Sponsored : HKD 150,000

Project Title : Influence of Biofuels on the Particulate Emissions of a Diesel Engine
Investigators : CS Cheung and Z Ning (The City University of Hong Kong)
Amount Sponsored : HKD 227,000

Project Title : Spray, Combustion and Emission Characteristics of Pentanol/biodiesel Blends
Investigators : CS Cheung and ZH Huang (Xi'an Jiaotong University, China)
Amount Sponsored : HKD 168,000

Project Title : Broadband Flow Through Silencer with Model Actuation on Light Panel
Investigators : YS Choy
Amount Sponsored : HKD 150,000

Project Title : Broadband Sound Insulation Panel Embedding with an Array of Tubular Cavities Covered by Membranes in Random Alignment
Investigators : YS Choy
Amount Sponsored : HKD 198,215

Project Title : Fan Noise Suppression by Light Microperforated Panel with Non-uniform Grazing Shear Flow
Investigators : YS Choy
Amount Sponsored : HKD 189,000

Research Achievements

Grants

Project Title : Noise Reduction of Ducted-fan Product by Using Composite Materials
Investigators : YS Choy
Amount Sponsored : HKD 315,000

Project Title : Panel Silencing Device for Environmental Noise Control
Investigators : YS Choy
Amount Sponsored : HKD 189,000

Project Title : Automated Vision-based Micro-surgical Task Execution through a Robotic Multi-arm Micromanipulation System
Investigators : KH Chu
Amount Sponsored : HKD 200,000

Project Title : Development of a 3D Model-based Approach for Automated Surgical Knot Tying
Investigators : KH Chu
Amount Sponsored : HKD 189,000

Project Title : Experimental and Theoretical Study of the Friction and Adhesion in the Micro Hot Embossing of Polymers
Investigators : MW Fu and XM Lai (Shanghai Jiao Tong University)
Amount Sponsored : HKD 180,600

Project Title : Hetergenous Recrystallization Mechanisms Incorporating the Grain Boundary, Edge and Junction of the Previous Particle Boundaries (PPBs)
Investigators : MW Fu
Amount Sponsored : HKD 18,424

Project Title : Investigation of Thermal Assisted Microforming of Bio-compatible Ti-alloys
Investigators : MW Fu
Amount Sponsored : HKD 98,600

Project Title : Investigation of Undesirable Geometries and Inaccurate Dimensons of Microformed Parts and Development of Their Avoidance Methods
Investigators : MW Fu
Amount Sponsored : HKD 150,000

Project Title : Modelling and Control of Springback in Warm Bending of Titanium Tubular Materials
Investigators : MW Fu and H Li (Northwestern Polytechnical University)
Amount Sponsored : HKD 180,600

Project Title : Numerical Evaluation of Damage and Failure Behaviours of Carbon Fiber Reinforced Metal Matrix Composites
Investigators : MW Fu and HH Ruan
Amount Sponsored : HKD 695,400

Project Title : Plastic Deformation Based Processing of Advanced Materials
Investigators : MW Fu
Amount Sponsored : HKD 315,000

Project Title : Rationales and Principles for Superplastic Development of Micro Scale Tubular Parts of Mg-Li Alloy for Biomedical Applications
Investigators : MW Fu
Amount Sponsored : HKD 189,000

Project Title : Research on Advanced Processing of Engineering Materials
Investigators : MW Fu
Amount Sponsored : HKD 315,000

Project Title : Research on Different Fracture Behavior and the Validity of Fracture Criteria in Multi-scale Plastic Deformation Process
Investigators : MW Fu
Amount Sponsored : HKD 192,788

Project Title : Shape Memory Performance and Micro-mechanics of 3D Printed Structures Made of Shape Memory Alloys for Bio-medical Applications
Investigators : MW Fu, SQ Shi, XS Yang (ISE) and Y Yang (The City University of Hong Kong)
Amount Sponsored : HKD 400,000

Project Title : Size Effect Based Micro-mechanics and Its Affected Behaviors and Phenomena in Micro-manufacturing and Micro-product Service
Investigators : MW Fu and SQ Shi
Amount Sponsored : HKDD 500,000

Project Title : Size Effect Phenomena and Gradient Effect in the Micromechanics of Micro-scaled Plastic Deformation
Investigators : MW Fu
Amount Sponsored : HKD 200,000

Project Title : Design of High-strength and High-ductility Titanium Alloys for Aerospace Applications
Investigators : ZB Jiao
Amount Sponsored : HKD 200,000

Project Title : Solute Segregation and Precipitation Mechanism in Nanoparticle-strengthened High-entropy Alloys
Investigators : ZB Jiao
Amount Sponsored : HKD 200,000

Project Title : Strengthening of High-entropy Alloys by Nanoscale Coherent Precipitates
Investigators : ZB Jiao
Amount Sponsored : HKD 50,000

Project Title : Employing Bio-Inspired Structure Nonlinearity in Passive Vibration Isolation: Theory, Methods, and Applications
Investigators : XJ Jing
Amount Sponsored : HKD 189,000

Research Achievements

Grants

Project Title : High-Performance Vibration Isolation by Employing Bio-Inspired Structure Nonlinearity
Investigators : XJ Jing
Amount Sponsored : HKD 189,000

Project Title : Nonlinear Dynamics and Control with Innovative Applications (Mechanical Systems or Robots)
Investigators : XJ Jing
Amount Sponsored : HKD 315,000

Project Title : Nonlinear Dynamics, Vibration, and/or Control, and Applications
Investigators : XJ Jing
Amount Sponsored : HKD 315,000

Project Title : Nonlinear Energy Harvesting Systems: Theory, Methods and Applications in Railway Systems
Investigators : XJ Jing
Amount Sponsored : HKD 500,000

Project Title : Robotic Technology for Underwater Infrastructure Inspection
Investigators : XJ Jing, WL Lai (LSGI), QX Wang (COMP) and Y Xia (CEE)
Amount Sponsored : HKD 1,000,000

Project Title 利用非线性特性实现振动隔离和控制的方法研究
Investigators XJ Jing
Amount Sponsored HKD 204,039

Project Title : Thermal, Explosion, Burning and Emission Characteristics of an Array of Premixed Flame Jets Burning Liquefied Petroleum Gas Enriched with Hydrogen
Investigators : CW Leung, P Zhang and ZH Huang (Xi'an Jiaotong University, China)
Amount Sponsored : HKD 150,000

Project Title : Thermal, Explosion, Burning and Emission Characteristics of Premixed Flame Jets Array Burning Liquefied Petroleum Gas Enriched with Hydrogen
Investigators : CW Leung, P Zhang and ZH Huang (Xi'an Jiaotong University, China)
Amount Sponsored : HKD 189,000

Project Title : A Study of the Effects of Aeroacoustic-Structural Interaction on Airfoil Trailing Edge Noise
Investigators : RCK Leung
Amount Sponsored : HKD 189,000

Project Title : A Study of the Mechanisms of Thermoacoustic Oscillations in Gas Turbine Combustion Chamber Installed with Bluff Flame Holder
Investigators : RCK Leung and M Zhu (Tsinghua University, China)
Amount Sponsored : HKD 168,000

Project Title : Aeroacoustics of High-lift Airfoil with Trapped Vortex Cavity
Investigators : RCK Leung
Amount Sponsored : HKD 156,500

Project Title : Exploration of Tunable Fluid-structure Interaction for Development Advanced Aeronautical Noise Mitigation Technology
Investigators : RCK Leung
Amount Sponsored : HKD 315,000

Project Title : Low Dimensional Modeling of Duct Aeroacoustics with Multiple Side-Branches
Investigators : RCK Leung
Amount Sponsored : HKD 150,000

Project Title : New Acoustic Source Localization Methodology in Realistic Reverberant Sound Fields Using Optimal Broadband Beamformer Design
Investigators : RCK Leung and KFC Yiu (AMA)
Amount Sponsored : HKD 146,278

Project Title : Numerical Modeling of Aeroacoustic Generation by Flow Duct Side-Branches at Various Separations
Investigators : RCK Leung
Amount Sponsored : HKD 150,000

Project Title : Charge Transport in Perovskite Solar Cell
Investigators : WWF Leung
Amount Sponsored : HKD 189,000

Project Title : Numerical Modelling of Continuous Deposition of Nanoparticles in a Nanofiber Filter and Conversion of the Deposited Particles by Photocatalysis
Investigators : WWF Leung
Amount Sponsored : HKD 150,000

Project Title : Solid-State Dye Sensitized Solar Cells with High Conversion Efficiency using Electrospun TiO_2 Nanofiber Photoanode
Investigators : WWF Leung
Amount Sponsored : HKD 150,000

Project Title : Solid-State Solar Cells with High Conversion Efficiency using Electrospun TiO_2 Nanofiber Photoanode
Investigators : WWF Leung
Amount Sponsored : HKD 150,000

Project Title : Effect of Arteriovenous Shunts and Vessel Leakiness on Flowmotion in Normal and Tumor Vasculature
Investigators : Y Liu and BM Fu (City College New York, USA)
Amount Sponsored : HKD 189,000

Project Title : Effect of Red Blood Cell on Tumor Cell Adhesion -- Dissipative Particle Dynamics Study
Investigators : Y Liu
Amount Sponsored : HKD 50,000

Research Achievements

Grants

Project Title : Numerical Model Development for Prediction of Silt Sediment of Yellow River at Delta Based on LIDAR Morphological Database
Investigators : Y Liu, XL Ding (LSGI) and ZL Li (LSGI)
Amount Sponsored : HKD 130,350

Project Title : Adaptive Visuo-Motor Models for Robotic Welding in Uncertain Construction Environments
Investigators : D Navarro Alarcon
Amount Sponsored : HKD 314,600

Project Title : Development of Robotic Technologies for Natural Human-Robot Interactions
Investigators : D Navarro Alarcon and KH Chu
Amount Sponsored : HKD 450,000

Project Title : Perceptual and Cognitive Methods for Intelligent Robot Behaviour
Investigators : D Navarro Alarcon
Amount Sponsored : HKD 200,000

Project Title : An Investigation of Dynamic Behavior of Metallic Glasses Using Mini SHPB System
Investigators : HH Ruan
Amount Sponsored : HKD 189,000

Project Title : Impact Induced Structural Vibration and Energy Conversion -- a Conceptual Investigation on Kinetic Energy Harvesting in Low-speed Impact
Investigators : HH Ruan
Amount Sponsored : HKD 189,000

Project Title : The Mechanism of Electroplasticity and Its Application for Emerging High-performance Alloys
Investigators : HH Ruan
Amount Sponsored : HKD 200,000

Project Title : Towards Predictable Thermoforming of Glass - from Microscropic Understanding to Constitutive Modeling
Investigators : HH Ruan
Amount Sponsored : HKD 200,000

Project Title : Towards the Unique Miniaturized Optical Split Hopkinson Pressure Bar Apparatus - A Conceptual Investigation on Measuring Ultrahigh Strain Rate Using Optical Methods
Investigators : HH Ruan
Amount Sponsored : HKD 200,000

Project Title : Development of A Phase Field Modeling Framework for Corrosion Kinetics
Investigators : SQ Shi
Amount Sponsored : HKD 150,000

Project Title : Formation and Fracture of Zirconium Hydrides under Temperature Transient and Gradient
Investigators : SQ Shi
Amount Sponsored : HKD 201,520

Project Title : Study of Advanced Structural and/or Functional Materials
Investigators : SQ Shi
Amount Sponsored : HKD 315,000

Project Title : Study of Gas Bubble Behavior in Nuclear Fuels Using Phase Field Method
Investigators : SQ Shi
Amount Sponsored : HKD 147,027

Project Title : Study of Intragranular Gas Bubble Behavior for High Burnup Nuclear Fuels Using Phase Field Methodology
Investigators : SQ Shi, SY Hu (Pacific Northwest National Lab, US) and YT Li (Pacific Northwest National Lab, US)
Amount Sponsored : HKD 189,000

Project Title : Study of Phase Stability of Low Dimensional High Entropy Alloys
Investigators : SQ Shi and ZB Jiao
Amount Sponsored : HKD 700,000

Project Title : An Insight into Shock Wave Propagation under Hypervelocity Impact (>4 km/s) and Its Application to Characterizing Orbital Debris-induced Damage in Space Structures
Investigators : ZQ Su
Amount Sponsored : HKD 189,000

Project Title : Development of Large-scale Smart Sensing Networks for Health Monitoring of Train and Railway Structures: From Fundamental Research to Real-world Engineering Application
Investigators : ZQ Su
Amount Sponsored : HKD 500,000

Project Title : Elastic-wave-based Characterization of Damage in Complex Aircraft Structures under Time-varying Service Conditions
Investigators : ZQ Su
Amount Sponsored : HKD 225,283

Project Title : Quantitative Characterization of Multiple Fatigue Cracks for Structural Integrity Monitoring (SIM) Using Nonlinear Acousto-ultrasonics and Active Sensor Networks
Investigators : ZQ Su, L Cheng and LM Zhou
Amount Sponsored : HKD 150,000

Project Title : Quantitative Damage Evaluation Using Nonlinear Vibro-Acoustics
Investigators : ZQ Su
Amount Sponsored : HKD 315,000

Project Title : 結構疲勞裂紋的非線性波動特征及其概率診斷與監測
Investigators : ZQ Su
Amount Sponsored : HKD 201,520

Research Achievements

Grants

Project Title : Closed-loop Active Flow Control Using Machine Learning
Investigators : H Tang
Amount Sponsored : HKD 189,000

Project Title : Development of a GPU-based Numberical Framework for Fluid-structure Interaction Problems
Investigators : H Tang
Amount Sponsored : HKD 100,000

Project Title : Enhancement of Flapping-wing MAV Aerodynamic Performance Using Active Flow Control
Investigators : H Tang
Amount Sponsored : HKD 189,000

Project Title : On Energy Harvesting from Open Channel Water Flows Using Self-sustained Oscillating Hydrofoils
Investigators : H Tang
Amount Sponsored : HKD 200,000

Project Title : Study of magnetic hyperthermia based cancer treatment using a holistic simulation framework
Investigators : H Tang, S Kenjeres (Delft University of Technology) and K Vafai (University of California, Riverside)
Amount Sponsored : HKD 654,921

Project Title : Control Techniques for Supersonic / Hypersonic Boundary Layer Transition
Investigators : CY Wen
Amount Sponsored : HKD 48,200

Project Title : Experimental and Numerical Investigation on the Interfacial Instability Induced by Rippled Shock Waves
Investigators : CY Wen and XS Luo (University of Science and Technology of China)
Amount Sponsored : HKD 180,600

Project Title : Experimental and Numerical Study on the Effects of Dynamic Characteristics of Converging Shock Waves on Induced Richtmyer-Meshkov Instability
Investigators : CY Wen and XS Luo (University of Science and Technology of China, China)
Amount Sponsored : HKD 168,212

Project Title : Investigation and Optimization of Porous Coatings on the Stabilization of Hypersonic Boundary-Layer Flows
Investigators : CY Wen, L Cheng and R Zhao (Beijing Institute of Technology)
Amount Sponsored : HKD 642,421

Project Title : Investigation on Aerodynamic Breakup of a Liquid Droplet behind a Shock Wave
Investigators : CY Wen
Amount Sponsored : HKD 189,000

Project Title : Investigation on Reactive Richtmyer-Meshkov Instability in Convergent Geometry
Investigators : CY Wen
Amount Sponsored : HKD 70,513

Project Title : Theoretical and Numerical Study on Vibrational Nonequilibrium Effect on Hydrogen Detonation
Investigators : CY Wen
Amount Sponsored : HKD 189,000

Project Title : 液态燃料在高速气流中的雾化、蒸发和燃烧
Investigators : CY Wen
Amount Sponsored : HKD 228,820

Project Title : Complex Power Flow Control in Vibrating Plates with Dynamic Vibration Absorbers
Investigators : WO Wong
Amount Sponsored : HKD 150,000

Project Title : Cross-Modal Vibration Energy Method for Dynamic Force Identification
Investigators : WO Wong
Amount Sponsored : HKD 150,000

Project Title : Biomimetic Design and Manufacture of Gradient Silicon-based Anode Materials for Lithium-ion Batteries
Investigators : HM Yao
Amount Sponsored : HKD 72,787

Project Title : Biomimetic Study on the Reaction Chambers of Bombardier Beetles for Aeronautical Applications: Thermal Resistance and Pulsed Jet Propulsion
Investigators : HM Yao and P Zhang
Amount Sponsored : HKD 157,350

Project Title : Optimizing Heterogeneity in Si-based Nanocomposite Anode Materials for Higher Electrochemical Performance
Investigators : HM Yao
Amount Sponsored : HKD 189,000

Project Title : Structural Optimization of Hierarchical Porous Anode for High Performance Microbial Fuel Cell
Investigators : HM Yao and SL Chen (Jiangxi Normal University, China)
Amount Sponsored : HKD 189,000

Project Title : Active Noise Control in Acoustic Wave Guides (AWGs)
Investigators : J Yuan
Amount Sponsored : HKD 150,000

Project Title : Computational Study on Slotted Swirl Combustor for Application in Gas Turbine Engines
Investigators : P Zhang
Amount Sponsored : HKD 200,000

Research Achievements

Grants

Project Title : Dynamics of Unequal-size Droplet Collision
Investigators : P Zhang
Amount Sponsored : HKD 450,000

Project Title : Experimental Study and Large Eddy Simulation of Slotted Swirler Combustor Fueled with Natural Gas/ Synthesis Gas Mixtures
Investigators : P Zhang and Y Yang (Peking University, China)
Amount Sponsored : HKD 242,550

Project Title : High-level Ab Initio Chemical Kinetics of Combustion of Large Molecule Straight-chain Alkanes
Investigators : P Zhang
Amount Sponsored : HKD 142,284

Project Title : Hypergolic Ignition Induced by Propellant Droplet Collision
Investigators : P Zhang
Amount Sponsored : HKD 378,000

Project Title : Spray Impingement Modelling and Simulation based on Accurate Description of Droplet Impact Dynamics
Investigators : P Zhang and CL Tang (Xi'an Jiaotong University)
Amount Sponsored : HKD 180,600

Project Title : Atomic-scale Experimental and Simulation Investigations on the Deformation Twinning in Nanostructured Titanium
Investigators : GP Zheng
Amount Sponsored : HKD 150,000

Project Title : Experimental Investigation and ab initio Simulation on the Pizoelectricity and Pyroelectricity of Graphene-ferroelectrics Heterostructures
Investigators : GP Zheng
Amount Sponsored : HKD 200,000

Project Title : First-principles Calculations and Experimental Verification of Ferroelectrics in Two-dimensional Materials
Investigators : GP Zheng
Amount Sponsored : HKD 189,000

Project Title : Frenkel-Kontorova model based simulation on the deformation mechanisms in nanostructured high-entropy alloys
Investigators : GP Zheng
Amount Sponsored : HKD 642,421

Project Title : Investigations on the Mechanical Properties of Bulk Amorphous Alloys with Nano-sized Microstructures
Investigators : GP Zheng
Amount Sponsored : HKD 315,000

Project Title : Multi-scale Simulation on the Deformation Mechanisms of Disordered Alloys
Investigators : GP Zheng
Amount Sponsored : HKD 315,000

Project Title : Multiscale Simulation Studies on the Processing and Mechanical Behaviors of Ultrafine and Nano-size Grained Magnesium Alloys
Investigators : GP Zheng
Amount Sponsored : HKD 189,000

Project Title : The Pyroelectric Properties and Electro-caloric Effect of Graphene Oxide-copolymer Multi-layer Structures
Investigators : GP Zheng and HH Ruan
Amount Sponsored : HKD 695,400

Project Title : Advanced Composites and Functional Structures
Investigators : LM Zhou and L Ye (Sydney University, Australia)
Amount Sponsored : HKD 824,000

Project Title : All Solid State Quantum-dot-sensitized Solar Cells Based on Solution Processed Inorganic Semiconductors (G-YBDG)
Investigators : LM Zhou
Amount Sponsored : HKD 300,000

Project Title : Bi-functional Metal Organic Framework-derived Porous Electrospun Nanofiber Materials for Lithium-sulfur Batteries
Investigators : LM Zhou and HM Yao
Amount Sponsored : HKD 700,000

Project Title : Design and Performance Study on Micro-mesoporous Three-dimensional Framework Materials for Lithium-sulfur Batteries with High Energy Density
Investigators : LM Zhou and HM Yao
Amount Sponsored : HKD 700,000

Project Title : Development of Nanocomposite Materials for Energy Storages
Investigators : LM Zhou
Amount Sponsored : HKD 315,000

Project Title : Graphene Strengthened Silicon Nanocomposite Anodes for Lithium Ion Batteries
Investigators : LM Zhou, HT Huang (AP), HM Yao, JK Kim (Hong Kong University of Science and Technology, HK), SQ Shi and CY Tang (ISE)
Amount Sponsored : HKD 400,000

Project Title : Optimal Si-nanoparticle-based Nanocomposite Structure with Long-term Stability for Li-ion Batteries
Investigators : LM Zhou
Amount Sponsored : HKD 210,620.29

Research Achievements

Grants

Project Title	:	Size- and temperature-dependent phase transition in NASICON-type material on Li+- and Na+-(de)intercalation
Investigators	:	LM Zhou and SQ Shi
Amount Sponsored	:	HKD 642,421
Project Title	:	Broadband Sub-diffraction-limit Acoustic Wave Focusing with Two-dimensional Acoustic Rainbow Trapping Metamaterials
Investigators	:	J Zhu
Amount Sponsored	:	HKD 189,000
Project Title	:	Hypersonic Turbulent Boundary Layer Transition Delay with Acoustic Metasurface
Investigators	:	J Zhu
Amount Sponsored	:	HKD 189,000
Project Title	:	Investigation on broadband transition delay and stability control of hypersonic turbulent boundary layer via gradient-index acoustic metasurface
Investigators	:	J Zhu
Amount Sponsored	:	HKD 642,421
Project Title	:	Sub-diffraction-limit Sound Focusing and Imaging with Acoustic Metasurface
Investigators	:	J Zhu
Amount Sponsored	:	HKD 70,513
Project Title	:	Thin Layer Elastic Material Characterization Using Ultrasonic Bessel Transducer
Investigators	:	J Zhu
Amount Sponsored	:	HKD 200,000
Project Title	:	Two Dimensional Acoustic Rainbow Trapping Metamaterials
Investigators	:	J Zhu
Amount Sponsored	:	HKD 100,000
Project Title	:	Two-dimensional Acoustic Metamaterial for Turbulent Boundary Layer Transition Delay of Hypersonic Vehicles
Investigators	:	J Zhu, L Cheng and CY Wen
Amount Sponsored	:	HKD 200,000

Research Achievement

Awards

Year	Staff	Awards
2018/19	Prof. SU Zhongqing	Faculty of Engineering Research Grant Achievement Award 2017/18
2018/19	Prof. WEN Chih-yung	Faculty of Engineering Research Grant Achievement Award 2017/18 Faculty of Engineering Outstanding Award in Teaching (Individual) 2017/18
2018/19	Dr JING Xingjian	Faculty of Engineering Merit Award in Research and Scholarly Activities (Individual) 2017/18
2017/18	Prof. CHENG Li	Faculty of Engineering Research Grant Achievement Award 2016/17 Faculty Award in Research and Scholarly Activities – Merit Award (Individual) 2016/17
2017/18	Prof. LEUNG Chun Wah	Faculty of Engineering Outstanding Award in Services (Individual) 2016/17
2017/18	Prof. SHI San-Qiang	Faculty of Engineering Research Grant Achievement Award 2016/17
2017/18	Prof. SU Zhongqing	Gold Award, The 46th International Exhibition of Inventions of Geneva, Geneva, Switzerland
2017/18	Dr JING Xingjian	The European Association for Structural Dynamics (EASD) Senior Research Award, The European Association for Structural Dynamics First Prize of Construction Safety, CIC Construction Innovation Award 2017, The Construction Industry Council
2016/17	Prof. CHAN Tat Leung	Faculty of Engineering Research Grant Achievement Award 2015/16, The Hong Kong Polytechnic University
2016/17	Prof. CHEUNG Chun Shun	Multi-departmental Participation Award, PTeC's Outstanding Professional Services Awards 2016, The Hong Kong Polytechnic University
2016/17	Prof. LEUNG Woon Fong Wallace	Gold Award with the Congratulations of Jury, The 45th International Exhibition of Inventions of Geneva, Geneva, Switzerland PolyU Distinguished Knowledge Transfer Award 2017 – Research Excellent Merit Award, The Hong Kong Polytechnic University
2016/17	Prof. WEN Chih-yung	Gold Award with the Congratulations of Jury, The 45th International Exhibition of Inventions of Geneva, Geneva, Switzerland
2016/17	Dr JING Xingjian	The 2016 Andrew P. Sage Best Transactions Paper Award, The Institute of Electrical and Electronics Engineers (IEEE) Systems, Man, and Cybernetics Society TechConnect Global Innovation Awards 2017, TechConnect
2016/17	Dr NG Chun	Multi-departmental Participation Award, PTeC's Outstanding Professional Services Awards 2016, The Hong Kong Polytechnic University
2015/16	Prof. CHENG Li	Faculty of Engineering Research Grant Achievement Award 2014/15, The Hong Kong Polytechnic University
2015/16	Prof. LEUNG Woon Fong Wallace	Technology Transfer Award, PTeC's Outstanding Professional Services Awards 2015

Research Achievement

Awards

Year	Staff	Awards
2015/16	Prof. SU Zhongqing	2015 Natural Science Award (2nd Class) for Higher Education Outstanding Scientific Research Output (國家教育局 2015 年度高等學校科學研究優秀成果獎), The Ministry of Education, China Faculty of Engineering Research Grant Achievement Award 2014/15, The Hong Kong Polytechnic University
2015/16	Prof. WEN Chih-yung	Faculty of Engineering Research Grant Achievement Award 2014/15, The Hong Kong Polytechnic University
2015/16	Dr JING Xingjian	First Class Research Award of Natural Science of Liaoning Province 2015, Natural Science Research Award Committee of Liaoning Province
2015/16	Dr YAO Haimin	Faculty of Engineering Merit Award (Individual) 2014/15 in Research and Scholarly Activities, The Hong Kong Polytechnic University Faculty of Engineering Research Grant Achievement Award 2014/15, The Hong Kong Polytechnic University
2015/16	Dr ZHANG Peng	Faculty of Engineering Research Grant Achievement Award 2014/15, The Hong Kong Polytechnic University
2014/15	Prof. LAU Kin Tak Alan	Award for Outstanding Contribution to Education, 2014 Global Learn Tech Congress & Awards, Mumbai
2014/15	Prof. LEUNG Woon Fong Wallace	The Frank Tiller Award 2015, The American Filtration & Separations Society (AFS), US
2014/15	Dr CHOY Yat Sze	Faculty of Engineering Research Grant Achievement Award 2013/14, The Hong Kong Polytechnic University
2014/15	Dr SU Zhongqing	1st Place of The Dragon-STAR Innovation Award 2015, European Union, Brussel
2013/14	Prof. LAU Kin Tak Alan	UGC Teaching Award 2013, University Grants Committee
2013/14	Prof. LEUNG Woon Fong Wallace	Special Award and Gold Medal, The 42th International Exhibition of Inventions Geneva 2014, Romania Ministry of National Education
2013/14	Prof. WEN Chih-yung	國家級科技項目獎 , The Appreciation of Research Achievement, The Committee of Science and Technology Innovation of Shenzhen (深圳市科技創新委員會)
2013/14	Dr JING Xingjian	Most Active New Consultant, PTeC's Annual Outstanding Professional Services Awards 2013 國家級科技項目獎 , The Appreciation of Research Achievement, The Committee of Science and Technology Innovation of Shenzhen (深圳市科技創新委員會)
2013/14	Dr SU Zhongqing	國家級科技項目獎 , The Appreciation of Research Achievement, The Committee of Science and Technology Innovation of Shenzhen (深圳市科技創新委員會)
2013/14	Dr ZHANG Peng	市級科技項目獎 , The Appreciation of Research Achievement, The Committee of Science and Technology Innovation of Shenzhen (深圳市科技創新委員會)
2013/14	Dr ZHENG Guang-Ping	市級科技項目獎 , The Appreciation of Research Achievement, The Committee of Science and Technology Innovation of Shenzhen (深圳市科技創新委員會)

Scholarly Activities

Conferences / Symposiums

2018-12-17 to 18	The Hong Kong Symposium of Batteries
2018-12-1 to 3	The 8th East Asia Mechanical and Aerospace Engineering Workshop, Hong Kong
2018-11-12 to 15	The 7th Asia-Pacific Workshop on Structural Health Monitoring, Hong Kong
2017-11-13 to 15	The 17th Asia Pacific Vibration Conference, Nanjing, China
2017-08-27 to 30	The 46th International Congress and Exposition on Noise Control Engineering, Hong Kong
2017-08-23 to 27	The 17th Congress of Asian Pacific Confederation of Chemical Engineering
2017-06-21 to 23	International Symposium on Advanced Boiler Technology and Workshop, Hong Kong
2016-12-4 to 7	The Third International Conference on Metallic Materials and Processing, Hong Kong
2014-10-24 to 25	The 4th East Asia Mechanical and Aerospace Engineering Workshop
2013-10-15	Hong Kong Electronic Industry Summit on Latest Acoustic Technology and Product Design
2013-09-16	Young Leadership Conference
2013-07-10 to 12	The 4th International Conference on Smart Materials and Nanotechnology in Engineering
2012-09-7 to 9	The 1st International Education Forum on Aeronautical and Astronautical Engineering

Academic Seminars

2019-01-17	Seminar - How many parameters do we really need to predict the acoustical properties of porous media accurately? by Prof. Kirill V Horoshenkov
2018-12-04	Seminar - Flash-boiling Spray Behavior and Combustion in Spark-Ignition Direct-Injection Engine by Professor David L.S. Hung
2018-12-03	Seminar - Warfighter Protection and Structural Health Monitoring by Prof. Ken Loh
2018-11-26	Seminar - Nonlinear and time-variant behaviour for structural damage detection - recent developments by Prof. Wieslaw J. Staszewski
2018-11-01	Seminar - Nanostructured Materials for Energy Applications by Prof. Qiang XU

2018-10-29 Seminar - Underwater acoustic and the application of the hydrophone to assess the impact to marine mammals

2018-10-29 Seminar - From Spray Cooling to Droplet Impacting and Droplet Train Impingement by Prof. Fei DUAN

2018-10-26 Seminar - Image Processing and Machine Vision to Measurement, Motion Control and Automation quantification by Prof. Chieh-Li Chen

2018-10-25 Seminar - Improvements in Perovskite solar cells by Prof. Wallace Woon-Fong LEUNG

2018-09-04 Seminar - From Membrane- to Plate-Type Acoustic Metamaterials: Towards Large-Scale Noise Control Applications by Prof. Heow Pueh LEE

2018-08-23 Seminar - Development of a Collaborative Surgical Robot Assistant for Laparoscopic Hysterectomy by Tiffany Hiu Man YIP

2018-08-22 Seminar - Dynamic and flexible thermodynamic power cycles for efficient waste heat recovery by Dr Yu Zhibin

2018-08-15 Seminar - Exploring microperforated panel designs for duct noise control by Dr. Cheng Yang

2018-08-07 Seminar - Boundary Layer Transition Talk Series “Basic Issues of Laminar Flow Control for High-Speed Boundary-Layer Flows” by Professor Alexander V. Fedorov

2018-07-19 Seminar - Time-Domain Simulation of Acoustic Propagation in Complex Environments by Dr. Zhongquan Charlie Zheng

2018-07-11 Seminar - Overcome the strength-ductility trade-off in steels by a novel short-range ordering strengthening concept by Dr. Wenwen Song

2018-07-04 Seminar - Energy Shaping of Mechanical Systems via PID Control by Dr. José Guadalupe Romero

2018-06-28 Seminar - Recent Progress in Fundamental Study of Supersonic Combustion by Professor Fengquan Zhong

2018-06-27 Seminar - Nanowires Devices for Emerging Energy Storage by Professor Liqiang Mai

2018-06-20 Seminar - Computational Fluid Dynamics Application in Biomimetic and Marine Renewable Technology by Dr. Qing Xiao

2018-05-28 Seminar - Conceptual Study on Traffic Management of Multiple-Drone Operations in Urban Environments by Dr. Low, Kin Huat

2018-04-20 Seminar - From Generalised Analysis to Application Realisation of Cable-Driven Robots by Dr. Darwin Lau

2018-04-17 Seminar - Process Engineering Evolution and Innovations – Food, Society and Future by Professor Xiao Dong Chen

2018-03-20 Seminar - Nature-inspired innovations for engineering novel mechanical systems by Dr. Zuankai Wang

2018-03-13 Seminar - Human dental tissues - Nature's hierarchically structured materials by Professor Alexander M. Korsunsky

2018-03-05 Seminar - Nanofiber Photocatalyst in Purifying Air and Water by Prof. Wallace Woon-Fong LEUNG

2018-02-13 Seminar - Advances in Nanofiber Filtration of Nano-aerosols by Prof. Wallace Woon-Fong LEUNG

2018-02-08 Seminar - Traditional Chinese medicine describes the transduction pathways of signaling molecules 黃帝內經描述了信號分子的傳遞過程 by Dr. Yang LIU

2018-01-22 Seminar - ADVANCED NANOSTRUCTURED FABRICS FOR LOW BURDEN PROTECTION by Dr. Yen Bach Truong

2018-01-08 Seminar - Artificial muscles for MEMS, soft robotics, tunable optics & acoustics by Dr. Lau Gih-Keong

2018-01-04 Seminar - Flow over shallow dimple arrays by Professor B.C. Khoo

2017-12-11 Seminar - Dynamics of Super-Scale Modularized Floating Airport by Prof. Daolin Xu

2017-12-08 Seminar - Manufacturing of large components for the aviation using laser additive manufacturing by Prof. Xin Lin

2017-12-08 Seminar - Droplet Dispersion in a “Box of Turbulence” by Prof. Huan Lian

2017-12-07 Seminar - Metallic glasses: From fundamental research to application exploration by Prof. Gang Wang

2017-12-05 Seminar - Development of Advanced Flow Diagnostic Techniques to Study Complex Thermal/Fluid Phenomena by Professor Hui Hu

2017-11-29 Seminar - Alloy Design by Dislocation Engineering by Dr. Mingxin Huang

2017-10-09 Seminar - Aerodynamic Testing at Duplicating Hypersonic Flight Conditions with Hyper-Dragon by Prof. Zonglin Jiang

2017-10-03 Seminar - Acoustics and Vibrations from the Université de Technologie de Compiègne by Dr. Jean-Daniel Chazot

2017-09-28 Seminar - Multi-Objective Robust Optimization for a Centrifugal Impeller with Operational Flexibility and Discretized Interval Uncertainty by Dr. Yu-Tai Lee

2017-08-31 Seminar - Sound Quality Design for Industry Now and Future by Dr. Koji Ishida

2017-08-25 Seminar - Progress of the discrete unified gas kinetic scheme for multiscale transport process by Prof. Zhaoli Guo

2017-08-24 Seminar - The Propulsion of Flying and Swimming Animals by Prof. Yongliang Yu

2017-08-22 Seminar - Assessment of Wind Power Generation in Dense Urban Area by Prof. An-Shik Yang

2017-08-18 Seminar - Hybrid Nanostructures as Electrode Materials for Metal-Ion Batteries by Prof. Zaiping Guo

2017-08-08 A Joint HKSTAM/PolyU ME Distinguished Seminar - Topological Toughening of graphene and other 2D materials by Prof. Huajian Gao

2017-08-02 Seminar - Ligament formation mechanism and breakup threshold for the Faraday instability by Dr. Yikai Li

2017-07-03 A Joint HKSTAM/PolyU ME Distinguished Seminar - Hypersonic Research in the High Enthalpy Shock Tunnel Göttingen by Prof. K. Hannemann

2017-06-30 Seminar - Challenges and Future Opportunities in Insect-inspired Flight Systems: from Biomechanics to Biomimetics by Professor Hao Liu

2017-06-27 Seminar - A Publisher’s Guide to Writing and Publishing Scientific Manuscripts by Gaëlle Hull

2017-06-23 Seminar - Physical Review X, and Q&A by Dr. Yiming Xu

2017-06-21 Seminar - Biofunctionalization of Metallic Biomaterials by Professor Ke Yang

2017-05-31 Seminar - Elastoplastic Damage Micromechanics for Continuous Fiber Reinforced Ductile Matrix Composites with Progressive Fiber Breakage by Professor J. Woody Ju

2017-05-25 Distinguished Seminar - Brief Introduction to Materials Informatics by Professor Tong-Yi Zhang

2017-05-18 Seminar - Telenav, navigation from Silicon Valley by Dr. Y.C. Chao

2017-05-10 Seminar - Inspection and monitoring of bond line defects in composite structures using ultrasonic feature guided wave by Professor Zheng Fan

2017-05-09 Seminar - Efficient Modeling Strategies for Linear and Nonlinear Ultrasonic Guided Waves in Structural Health Monitoring by Professor Yanfeng Shen

2017-05-05 Seminar - Inverse Design: Thermal Management and Control by Professor George Huang

2017-04-26 Seminar - Reaction Mechanism of Fuel-rich Combustion of Large Hydrocarbons by Dr. Xiaoqing You

2017-04-25 Seminar - Complex hydride solid-state electrolytes for Li, Na and Mg batteries by Dr. Ruben-Simon Kühnel

2017-04-11 A Joint HKSTAM/PolyU ME Distinguished Seminar - Fuel Options for Next Generation Chemical Propulsion by Prof. Chung K. Law

2017-03-17 Seminar - Research Technology Development – from laboratory to industrial application by Prof. Bill Zhao

2017-02-17 Seminar - Construction and evolution of vortex-surface fields in transitional flows by Dr. Yue Yang

2017-02-08 Seminar - Pressure Correction Method for Fluid-Particle Interaction and Two-Phase Flow Problems by Prof. San-Yih Lin

2017-01-24 Seminar - Metal Additive Manufacturing (3D Printing): CFD Analysis and Design of Powder-Fed Laser Cladding by Prof. Hsin-Luen Tsai

2017-01-24 Seminar - Purification of single-walled carbon nanotubes using thermocapillary flow by Prof. Jizhou Song

2017-01-17 Seminar - Energy gradient theory for flow instability and turbulent transition by Prof. Hua-Shu Dou

2017-01-09 Distinguished Seminar - Introduction to MIT Department of Mechanical Engineering And Using Nanostructures to Tailor Thermal Radiation by Prof. Gang Chen

2017-01-05 Distinguished Seminar - Advanced Energy Storage systems for enabling electrification of vehicles by Dr. Khalil Amine

2016-12-19 Seminar - Ultrasonic Guided Waves: "Promising Alternatives for Advanced Structural Health Management/NDE" by Prof. Younho Cho

2016-11-25 Seminar - Numerical modeling of high-speed non-equilibrium gas flows by Prof. Yevgeniy A. Bondar

2016-11-18 Seminar - Microstructure based material sensitive design by Dr. Yan Li

2016-10-25 Seminar - Roles of Applied Research Centre in Supporting Technology Innovation in the Construction Industries in Hong Kong by Dr. SHAM Man Lung, Ivan

2016-10-03 Seminar - Advances in Spray Atomization and Turbulence Theories by Prof. T.-W. Lee

2016-09-19 Seminar - Interfaces, adhesion, and the attachment of tendon to bone by Prof. Guy M. Genin

2016-09-07 Seminar - How are living things seen from dynamics and fluid mechanics? by Prof. Takayuki SAITO

2016-08-30 Seminar - Nonlinear Wave Scattering at the Interface of a Granular Dimer Chain and a Flexible Continuum by Prof. D. Michael MCFARLAND

2016-08-03 Seminar - Modeling and Simulation of Milling Processes by Prof. Avi Levy

2016-07-22 Seminar - Magnetic-Assisted Rapid Aptamer Selection (MARAS) & New Biomedical Application Horizon of Aptamer by Prof. C.Y. Hong

2016-06-27 Seminar - Towards Fusion of Vision with Robot Motion by Prof. Yunhui Liu

2016-05-27 Seminar - Functional nanomaterials for energy conversion and storage by Prof Qiang Xu

2016-05-12 RISUD Distinguished Lecture - A New Approach for Design and Testing of Composite Materials

2016-04-19 Seminar - Opportunities and Challenges of Structural Health Monitoring (SHM) for Civil Aircraft Application by Dr. Limin Gao

2016-04-18 Seminar - Numerical Simulation of Broadband Noise for Aeroengines by Prof Xin Zhang

2016-03-30 Seminar - High-speed imaging for impact testing by Prof Han Zhao

2016-03-23 Seminar - Smart Structures for Space Exploration by Dr Hongyu Yu

2016-03-18 Knowledge Transfer Talk “Non-ferrous Metals in Construction Industry and their Production Prospect in HK”

2016-03-17 Seminar - Design with Constructal Theory: Recent Advances by Prof. Sylvie Lorente

2016-03-15 Seminar - Mechanical Microscopy at the Oxford MBLEM lab by Professor Alexander M. Korsunsky

2016-02-26 Seminar - Influence of relative humidity on the structure and electrochemical performance of LiFeSO4F electrodes for Li-ion batteries by Prof. Guohua CHEN

2016-02-25 Seminar - The Fast Spectral Method for the Boltzmann and Enskog Equations by Dr Lei Wu

2016-02-19 Seminar - Time-resolved Measurements and Mode Decomposition of Separated Flows and Wakes by Prof Yingzheng Liu

2016-01-22 Seminar - Damage-Tolerance in Multi-Element Metallic Alloys by Prof. Robert Ritchie

2016-01-21 Seminar - Modelling Residual Stresses in Heart and Arteries by Professor Xiaoyu Luo

2016-01-20 Seminar - Hypersonic Talk Series“Oblique shock reflection of a shock wave from an axis of symmetry” by Professor Hans G. Hornung

2016-01-08 Seminar - Tailoring Nanostructures for Energy Conversion Devices by Prof. Jia Zhu

2016-01-06 Seminar - Manipulating Tissue Using Magnetic Retraction in Minimal Access Surgery by Dr Yu-Sheng Lin

2015-12-18 Seminar - Improving combustion engines (and other systems) through automatic construction of detailed chemical kinetic models Preferred by Dr Richard West

2015-12-18 Seminar - Infrastructure Innovations in Australia using Composites by Professor Thiru Aravinthan

2015-12-15 Seminar - A new device for crossing chronic total occlusions by Professor Martin Brouillette

2015-11-20 Seminar - Nonlinear Ultrasonic Guided Waves for Early Detection of Material Degradation by Prof. Cliff J. Lissenden

2015-10-28 Seminar - Noise Research at the University of Southampton by Dr. David Angland

2015-10-26 Seminar - Tyre/Road Noise and Vibration: Understanding Their Interaction and Contribution to Vehicle Noise and Fuel Consumption by Prof. Ines Lopez-Arteaga

2015-10-20 Seminar - Ultrasonic Guided Dispersion Extraction and Its Application In the Long Bone evaluation by Dr. Kailiang XU

2015-10-19 Seminar - System Modeling and Control Strategy Development for a Series Hydraulic Hybrid Vehicle by Prof. Chih-Keng Chen

2015-10-16 Seminar - Assessment of cerebral aneurysms and other vascular diseases using a fully circulative by Prof. George Huang

2015-10-14 Seminar - Life and Evolution, as Physics by Prof. Adrian Bejan

2015-10-13 Seminar - A tunable duct silencer using dielectric elastomer actuators by Dr. Lu Zhenbo

2015-09-30 Seminar - Some Aspects of Multiphase Flow Research by Prof Raymond Lau

2015-09-02 Seminar - Micro-Meso Swirling Combustion Chambers: concepts, projects and future developments by Dr. Angelo Minotti

2015-07-23 Seminar - On the interaction between mechanics and chemistry: two case studies by Prof. Pradeep R. Guduru

2015-07-17 Seminar - Experimental and Numerical Investigation of the Aerodynamic Control with Synthetic Jets at Low Reynolds number by Prof. Pierre E. Sullivan

2015-07-16 ASME Fellow Public Lecture “Technology and Sustainability”

2015-07-10 Seminar - Nonlocal modeling in computational mechanics By Dr. Adam Martowicz

2015-06-29 Seminar - Simulation of Low Reynolds Number Flows By Dr. Jörg Schlüter

2015-06-02 Knowledge Transfer Talk “Polymers and Lightweight Composites for Engineering Applications”

2015-05-21 Seminar - Recent Advances in Condensation Heat Transfer By Prof. Ping Cheng

2015-05-11 Seminar - CANDU Fuel: Design Improvement Initiatives By Dr. Paul K. Chan

2015-05-06 Distinguished Scholar Seminar - The surface eigenstress model and size-dependent Young’s modulus and ultimate tensile strength* By Prof. Tong-Yi ZHANG

2015-03-23 Seminar - Advancing combustion as a transdisciplinary thermal science & Engineering the leader: A Princeton/ personal perspective By Prof. Chung K. Law

2015-03-16 Seminar - Development and Performance Characterization of Cobalt-Based Superalloys By Dr. R. Liu

2015-03-12 Seminar on Airport Runway Design and Operation

2015-03-10 Seminar - Nanoindentation: Fundamental Mechanics and Practical Experience By Dr. Haimin Yao

2015-01-23 Seminar - Bio-inspired mechanical system: from animal locomotion to the cardiovascular system By Dr. Hao Liu

2015-01-22 講座 - 科普報告：神奇萬能的衝擊波 - 由張德良教授主講

2014-12-11 講座 - 壓電復合結構中彈性波傳播特性分析及其在高性能聲波器件中的應用研究 - 由金峰教授主講

2014-12-10 Seminar - Model Developments and Validation studies on Polymer Electrolyte Membrane Fuel Cells By Dr. Liang Hao

2014-12-08 講座 - 西安交通大學的輕質多孔材料與結構多功能一體化設計及應用基礎研究進展 - 由金峰教授主講

2014-12-02 Seminar - Mesoscale Simulations of Boiling Heat Transfer Phenomena: A New Approach for Phase-Change Heat Transfer Research By Prof. Ping Cheng

2014-11-27 Seminar - Optimized Unstructured and Structured Finite Volume Simulations using GPU and Phi Coprocessors using Dual Layer Parallelization By Dr. Matthew Ross SMITH

2014-10-28	Seminar - Study on optimal parameters estimation and cell performance of a proton exchange membrane Fuel by flow modification By Professor WU Horng Wen
2014-10-24	The 4th East Asia Mechanical And Aerospace Engineering Workshop
2014-10-14	Seminar - Flexible Energy-Efficient Manufacturing By Prof. Jian Cao
2014-09-29	Seminar - Starting and Design of Axisymmetric Scramjet Intakes for Hypersonic Airbreathing Propulsion By Dr. Hideaki Ogawa
2014-09-12	Seminar - Prediction of Dynamics and Thermal Fields using Immersed Boundary Method with Moving Embedded Object By Dr. Chao-An Lin
2014-09-05	Seminar - Metal forming related research at Nottingham By Dr. Hengan Ou
2014-09-05	Seminar - Recent research progress in conventional spinning at University of Sheffield By Dr. Hui Long
2014-08-11	Knowledge Transfer Talk “Lightweight Advanced Composites for Engineering Industry”
2014-07-10	Seminar - "What is a Fluid and how do we model them?" By Prof. K R. Rajagopal
2014-06-24	Seminar - Nanomechanics and nano-manufacturing research at The University of Queensland
2014-05-15	Seminar - Damage Mechanics, Material Modelling and Forming Limit Diagram of sheet metals by Dr. Chi L. Chow
2014-05-12	Seminar - Base Isolation using nonlinear mode localization and modal LQG control by Dr. Yumei Wang
2014-04-22	Seminar - MEMS and Microfluidics Research at HKUST by Dr. Yi-Kuen Lee
2014-04-07	Seminar - Multifunctional composites containing ferromagnetic microwires by Professor Hua-Xin Peng
2014-04-02	Seminar - Modeling the solidification, growth and properties of multiferroic polycrystalline materials by Prof. Ken Elder
2014-03-27	Seminar - Mechanics of Soft Materials-Large Deformation Kinetics of Hydrogels and Predicting Mechanical and Physical Properties of Silica Aerogels using Molecular Dynamics Simulations and Analytical Approach by Prof. Zishun Liu
2014-03-24	Seminar - Micromechanical Behavior of Super Duplex Stainless Steels by Dr. Ru Lin Peng
2014-02-26	Seminar - Cyclic Deformation Response and Fatigue Crack Initiation of Polycrystalline OFHC Copper Under Pure Compression Fatigue Condition by Dr. Zhirui Wang
2014-01-27	Seminar - New Approaches to Surface Engineering and Grain Refinement of Metals, and the Future of Metal Research by Professor Mingxing Zhang
2014-01-21	Seminar - In-situ TEM study on the carbon coating for lithium ion battery application by Prof. Hongtao WANG
2013-12-13	Seminar - Complexity on droplet evaporation by Dr. Fei Duan
2013-12-06	Seminar - Introduction to Energy Research Institute at NTU by Prof. Siew Hwa CHAN
2013-10-14	Seminar - Nanoscale Heat Transfer and Energy Conversion by Prof. Gang Chen
2013-10-11	Seminar - Dynamics-based Damage Identification of Composite Structures by Dr. Pizhong Qiao
2013-10-08	Seminar - Development and Performance Evaluation of Electromagnetictype Shock Wave Generator for Lipolysis by Dr. Shen-Min Liang
2013-10-03	Seminar - Synthetic Jet – Its Modeling, Testing, and Application in Active Flow Control by Dr. Hui TANG
2013-10-02	Seminar - Numerical simulation of acoustic waves in air and poroelastic media using the partition of unity finite element method by Dr. Jean-Daniel Chazot
2013-09-26	Seminar - Electrospinning Nanofibres/Nanocomposites: An Alternative Material Fabrication by Dr. Yu Dong
2013-08-21	Seminar - Draw Resistance of Cigarette and Effect of Non-isothermal Condition on Heterogeneous Flow in porous Media Pressure by Su Zhongdi and Yan Weiwei
2013-07-26	Seminar - The Progress in Shock Dynamics by Dr. Chun Wang
2013-07-26	Seminar - Ground-based Study on Hypervelocity Flows by Dr. Zongmin Hu
2013-07-23	Seminar - How cells respond to their mechanical environment: from substrate to nucleus by Dr. Julie Ying Hui JI
2013-07-23	Seminar - Biomechanical Measurement and Modeling of Sound Transmission in Normal, Diseased, Implanted Ears by Dr. Rong Zhu GAN
2013-07-22	Seminar - Ultrasonic and Electromagnetic Waves for NDE and SHM by Prof. Tribikram Kundu
2013-07-18	Seminar - DNS and Data Assimilation of compressible jets and shear layers by Prof. Jörn Sesterhenn
2013-06-10	Seminar - How to prepare a high quality NFSC proposal? by Dr. Libo Yuan
2013-06-07	Seminar - Sustainable composites for commercial aviation and building infrastructure sectors by Prof. Debes Bhattacharyya
2013-05-24	Seminar - Modeling and Path-Tracking Control for a Riderless-Bicycle System by Prof. Chih-Keng Chen
2013-05-24	Seminar - Drag reduction with suction and pulsed blowing actuator by Dr. Avrahame Seifert
2013-05-20	2nd Symposium on Fluid-Structure-Sound Interactions and Control
2013-05-07	Seminar - Sound Visualization by Prof. Yang-Hann Kim
2013-04-10	Seminar - Symposium on the Penn State Center for Acoustics and Vibration, along with recent work on the vibroacoustics of sandwich panels by Dr. Stephen A. Hambric
2013-04-09	Seminar - Probing Size-Dependent Mechanical Properties of Metallic Nanomaterials and Biological Structures by In Situ Nanomechanical Characterization by Dr. Yang Lu
2013-03-25	Seminar “Modern Advanced Composites Technologies for Aircraft Design”
2013-03-14	Seminar - Probing Mechanical Principles of Cell-Matrix Interaction by Dr. Jin Qian
2013-02-27	Public Lecture - Future of Aerospace Education and Research by Prof. Vigor Yang
2013-02-20	Seminar - Applications of high-speed imaging for compressible flows by Dr. Stuart Laurence
2013-01-29	Seminar - Research and Development in the Aerospace Engineering Division, MAE, NTU, Singapore by Dr. Simon C. M. YU
2013-01-11	Seminar - Bayesian Inference in Acoustical Applications by Dr. Ning Xiang
2012-12-19	Distinguished Scholar Seminar “Nanomechanics of Engineering and Biological Systems”

Fellowships

Prof. CHAN Tat Leung
- Fellow of American Society of Mechanical Engineers (FASME)
- Fellow of The Hong Kong Institution of Engineers (FHKIE)
- Fellow of The Institution of Mechanical Engineers (FIMechE)
- Fellow of Society of Automotive Engineers International (FSAE)

Prof. CHENG Li
- Fellow of Acoustical Society of America (FASA)
- Fellow of Acoustical Society of China (FASC)
- Fellow of The Hong Kong Institute of Acoustics (FHKIOA)
- Fellow of The Hong Kong Institution of Engineers (FHKIE)
- Fellow of The Institution of Mechanical Engineers (FIMechE)

Prof. LEUNG Woon Fong Wallace
- Fellow of Hong Kong Academy of Engineering Sciences (FHKAES)
- Fellow of American Society of Mechanical Engineers (FASME)
- Fellow of American Institute of Chemical Engineers (FAICHE)
- Fellow of The Hong Kong Institution of Engineers (FHKIE)
- Fellow of American Filtration & Separations Society (FAFS)

Prof. LEUNG Chun Wah *(retired in 2018)*
- Fellow of The Hong Kong Institution of Engineers (FHKIE)
- Fellow of Institute of Marine Engineering (FIMarEST)
- Fellow of The Institution of Mechanical Engineers (FIMechE)

Prof. SHI Sanqiang
- Fellow of The Hong Kong Institution of Engineers (FHKIE)

Prof. SU Zhongqing
- Fellow of The Hong Kong Institution of Engineers (FHKIE)

Prof. WEN Chih-Yung
- Associate Fellow of The American Institute of Aeronautics and Astronautics (AFAIAA)
- Fellow of The Hong Kong Institution of Engineers (FHKIE)

Journal Editorships

Prof. CHAN Tat Leung
- Editor: Aerosol and Air Quality Research, Taiwan Association for Aerosol Research
- Editor-in-Chief: The Hong Kong Institution of Engineers Transactions, HKIE / Taylor & Francis
- Editorial Advisory Board Member: Flow, Turbulence and Combustion, Springer

Prof. CHEN Guohua
- Editor, Separation and Purification Technology, Elsevier
- Associate Editor, Chinese Journal of Chemical Engineering, Elsevier
- Subject Editor, Process Safety and Environmental Protection - Official Journal of the European Federation of Chemical Engineering: Part B, Elsevier

Prof. CHENG Li
- Deputy Editor-in-Chief and Receiving Editor, Journal of Sound and Vibration, Elsevier
- Associate Editor: The Journal of the Acoustical Society of America, IOP publishing
- Associate Editor: Structural Health Monitoring, An international Journal. SAGE Ltd. Science
- Editorial Board Member: International Journal of Applied Mechanics, Imperial College Press
- Editorial Board Member: Advances in Aircraft and Spacecraft Science, An International Journal. Techno Press
- Editorial Board Member: International Journal of Mechanics and Solids
- Editorial Board Member: Vibration, MDPI, Switzerland
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- Editorial Board Member: Advances in manufacturing, Springer
- Editorial Board member: Chinese Journal of Mechanical Engineering-Chinese, Springer
- Editorial Board member: International Journal of Lightweight Materials and Manufacture, Ke Ai
- Editorial Board member: International Journal of Computer Aided Engineering and Technology, Inderscience Publishers

Prof. LEUNG Woon Fong Wallace
- Editorial Board Member: Journal of Separation and Purification Technology, Elsevier

Journal Editorships

Prof. SHI Sanqiang
- Associate Editor: Science of Advanced Materials, American Scientific Publishers
- Associate Editor: Journal of Nanoscience and Nanotechnology, American Scientific Publishers
- Associate Editor: Journal of Computational and Theoretical Nanoscience, American Scientific Publishers
- Editorial Board Member: International Journal of Minerals, Metallurgy and Materials, Elsevier

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- Editor-in-Chief: Ultrasonics, Elsevier
- Subject Editor: Journal of Sound and Vibration, Elsevier
- Associate Editor: Structural Health Monitoring: An International Journal, SAGE
- Associate Editor, ASME Journal of Nondestructive Evaluation, Diagnostics and Prognostics of Engineering Systems, ASME
- Associate Editor: Structural Engineering and Mechanics: An International Journal, Techno-Press
- Associate Editor: Coupled Systems Mechanics, Techno-Press
- Associate Editor: Structural Monitoring and Maintenance: An International Journal, Techno-Press
- Editorial Board Member: Aerospace

Prof. WEN Chih-Yung
- Associate Editor: The American Institute of Aeronautics and Astronautics (AIAA) Journal, SCI
- Editor: Shock Waves - An International Journal on Shock Waves, Detonations and Explosions

Prof. ZHOU Limin
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Dr JING Xingjian
- Associate Editor & Editorial Board Member: Mechanical Systems and Signal Processing, Elsevier
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- Associate Editor in Chief: Journal of Technical Acoustics
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Dr WONG Wai On
- Associate Editor: The Hong Kong Institution of Engineers (HKIE) Transactions
- Editorial Board Member: The Scientific World Journal, Hindawi Publishing Corporation
- Editorial Board Member: ISRN Mechanical Engineering, Hindawi Publishing Corporation
- Editorial Board Member: The International Journal of Mechanical Systems Engineering, American V-King Scientific Publishing

Recent Publications

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Published in March 2019

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