Organised by:

THE HONG KONG POLYTECHNIC UNIVERSITY
香港理工大學

PolyU Academy for Interdisciplinary Research (PAIR)
香港理工大學高等研究院

RESEARCH INSTITUTE FOR SUSTAINABLE URBAN DEVELOPMENT
可持續城市發展研究院

RISUD ANNUAL INTERNATIONAL SYMPOSIUM (RAIS) 2023

Urban Sustainability through Innovative Technologies

6 – 7 July 2023

Sponsored by:

Ove Arup Foundation
Kwang-Hua Education Foundation

Contents

Preface

Welcome to this International Symposium organised by the Research Institute for Sustainable Urban Development (RISUD) of The Hong Kong Polytechnic University (PolyU).

The theme for this year's Symposium is "Urban Sustainability through Innovative Technologies". "Urban sustainability" is a broad and somewhat intangible concept. To turn concepts into actions, we must focus our constructive discussions on narrower topics so that concrete, fruitful outcomes can be achieved. The technical programme of this two-day Symposium comprises plenary sessions, as well as workshops on three frontier topics including:

(a) Air pollution and human health – which is crucial for guiding future developments in technology, urbanisation and regulations to minimise the negative impacts of air pollution.

(b) Large floating infrastructure – which has received increasing attention as an attractive solution to coastal cities for land creation and various applications including solar farms, wind farms, airports, bridges, etc.

(c) Urban carbon neutrality – which concerns how various urban systems including energy, buildings, transport, utilities, industry and agriculture, etc., can timely respond to the climate emergency via lower carbon emission and energy consumption.

These three topics are especially important in responding to the pressing needs of high-density urban cities like Hong Kong. Since rapid urban developments are most often characterised by more mobility, building constructions, economic activities, etc., and these usually come at a cost, such as air pollution and health risks, land shortage, and greenhouse gas emissions. To soften these trade-offs, we must explore innovative solutions to help us better manage air pollution, utilise land and space, and reduce carbon footprints.

On behalf of the RISUD, I would like to extend my sincere gratitude to all individuals and organisations who have contributed to the success of the Symposium. Many thanks to our two sponsors: Ove Arup Foundation and Kwang-Hua Education Foundation. I am also grateful to all speakers and participants for their contributions to the Symposium. Last but not least, I am indebted to all colleagues of the PolyU Academy for Interdisciplinary Research (PAIR) and RISUD offices and all student helpers for their administrative and secretarial support in coordinating the Symposium.

Prof. Xiangdong LI
Director of Research Institute for Sustainable Urban Development (RISUD)

Programme Rundown

Day 1 – Thursday, 6 July 2023

08:30 – 09:00	On-site Registration		
09:00 – 09:05	Opening Speech: Prof. Jin-Guang TENG President of The Hong Kong Polytechnic University, Hong Kong SAR		
09:05 – 09:10	Welcome Speech: Dr Andrew CHAN, BBS, JP Chairman of the RISUD International Advisory Committee Senior Consultant, Arup, Hong Kong SAR		
09:10 – 09:15	Welcome Speech: Prof. Xiangdong LI Director of Research Institute for Sustainable Urban Development, Hong Kong SAR		
09:15 – 09:20	Group Photo		
09:20 – 09:55	Plenary Speaker 1: *Topic: Hong Kong's Climate Action Plan and Innovations* Mr Kam Sing WONG, GBS, JP Former Secretary for the Environment, Hong Kong Special Administrative Region Government, Hong Kong SAR		
09:55 – 10:15	Coffee break		
10:15 – 10:50	Plenary Speaker 2: *Topic: Integrated Toxicological Analyzer (ITA) & Environmental Risk Assessment* Prof. Guibin JIANG Director of State Key Laboratory of Environmental Chemistry and Ecotoxicology, Chinese Academy of Sciences, China		
10:50 – 11:25	Plenary Speaker 3: *Topic: Clinical and Toxicological Studies on the Health Effects of Air Pollution and the Challenges Ahead* Prof. Frank KELLY Humphrey Battcock Chair of Community Health and Policy, School of Public Health, Imperial College London, UK		
11:25 – 12:00	Plenary Speaker 4: *Topic: Setting a Course for Carbon Neutrality* Prof. Siaw Kiang CHOU Emeritus Professor, College of Design and Engineering, National University of Singapore, Singapore		
12:15 – 14:00	Lunch		
14:00 – 18:00	Workshop 1: Air Pollution and Human Health Organiser: Prof. Xiangdong LI	Workshop 2: Large Floating Infrastructure Organiser: Prof. Xiao Lin ZHAO	Workshop 3: Urban Carbon Neutrality Organiser: Prof. Jerry YAN

Day 2 – Friday, 7 July 2023

08:30 – 09:00	On-site Registration		
09:00 – 12:00	Workshop 1: Air Pollution and Human Health Organiser: Prof. Xiangdong LI	Workshop 2: Large Floating Infrastructure Organiser: Prof. Xiao Lin ZHAO	Workshop 3: Urban Carbon Neutrality Organiser: Prof. Jerry YAN
12:10 – 12:45	Plenary Session 5: *Topic: Ideas on Large Floating Technology for Future Urban Development* Prof. Ming LIN Chief Scientist, China Communications Construction Co., Ltd., China		
12:45 – 12:50	Closing Remarks Prof. Christopher CHAO Vice President (Research and Innovation) of The Hong Kong Polytechnic University, Hong Kong SAR		

Workshop 1 : Air Pollution and Human Health

Organsier: Prof. Xiangdong LI

Day 1 – Thursday, 6 July 2023

14:00 – 14:30	Invited Keynote Talk: Causes for Recent Trend of Air Pollution in China *Prof. Shu TAO* *Peking University*
14:30 – 15:00	Invited Keynote Talk: Air Pollution and Daily Mortality: From PAPA to MCC Studies *Prof. Haidong KAN* *Fudan University*
15:00 – 15:20	Identification of Aryl Hydrocarbon Receptor Agonists from Real Environmental Samples Based on Effect-Directed Analysis *Prof. Guangbo QU* *Chinese Academy of Sciences*
15:20 – 15:40	"Smoke Detector" Science for Aerosol Exposure Health Effects *Prof. Maosheng YAO* *Peking University*
15:40 – 16:00	Mixed Metal Components Facilitate $PM_{2.5}$ to Induce CCR5-Mediated Neuroinflammation in Mouse Olfactory Bulb *Prof. Daqiang YIN* *Tongji University*
16:00 – 16:15	Coffee break
16:15 – 16:45	Invited Keynote Talk: Unravelling the Polyaromatic Continuum in Atmospheric Particles *Prof. Gan ZHANG* *Guangzhou Institute of Geochemistry*
16:45 – 17:05	Unravelling the Black Box between Air Pollution and Public Health for Transformative Air Quality Management *Prof. Xiangdong LI* *The Hong Kong Polytechnic University*
17:05 – 17:25	Gaseous Pollutants and Health: One Wind A Day Keeps the Doctor Away? *Dr Linwei TIAN* *The University of Hong Kong*
17:25 – 17:45	Photochemical Oxidation of Gasoline Vehicle Exhaust – Volatile Organic Compound Emissions and Secondary Organic Aerosol Formation *Prof. Kin Fai HO* *The Chinese University of Hong Kong*
17:45 – 18:05	Quasi-Experimental Methods for Air Pollution-Health Studies *Dr Guojun HE* *The University of Hong Kong*

Day 2 – Friday, 7 July 2023

09:00 – 09:20	Building Mechanistic Linkages between $PM_{2.5}$-Induced Oxidative Potential and Chemical Composition *Prof. Jianzhen YU* *The Hong Kong University of Science and Technology*
09:20 – 09:40	Cytotoxicity of Fine Particulate Matter in Different Locations in Hong Kong *Prof. Hai GUO* *The Hong Kong Polytechnic University*
09:40 – 10:00	What are Driving the Evolving Toxicity of Particulate Matter Generated from Residential Biomass Burning? *Dr Ling JIN* *The Hong Kong Polytechnic University*
10:00 – 10:20	Chronic Exposure of PM2.5 Induces Impairment in Mood and Working Memory in Association with Aberrant Adult-Born Neurons in the Hippocampus *Dr Sonata YAU* *The Hong Kong Polytechnic University*
10:20 – 10:40	Modelling COVID-19 Vaccine Breakthrough Infections in Highly Vaccinated Israel *Dr Daihai HE* *The Hong Kong Polytechnic University*
10:40 – 11:00	Coffee break
11:00 – 11:20	Pollutants and Vascular and Metabolic Dysfunction *Prof. Yu HUANG* *City University of Hong Kong*
11:20 – 11:40	Feel the Burn: Mental and Behavioral Responses to Air Pollution in China *Dr Tong LIU* *National University of Singapore*

Workshop 2 : Large Floating Infrastructure

Organiser: Prof. Xiao Lin ZHAO

Day 1 – Thursday, 6 July 2023

14:00 – 14:30	Invited Keynote Talk: Floating Infrastructure for Offshore Aquaculture Farms *Prof. Chien Ming WANG* *The University of Queensland*
14:30 – 15:00	Invited Keynote Talk: Upscaling Floating Structures Technology for Climate Resilient Urban Development to Address Land Scarcity *Ir Bart ROEFFEN* *Blue 21*
15:00 – 15:30	Advances in Research and Application of Deep-Water Floating Bridges *Prof. Bin CHENG* *Shanghai Jiao Tong University*
15:30 – 16:00	Possible Floating Structures in Kau Yi Chau Artificial Islands *Ir Raymond IP* *Civil Engineering and Development Department*
16:00 – 16:20	Coffee break
16:20 – 16:50	Invited Keynote Talk: Design and Construction of the Concrete Floating Pier in Golden Harbor, Incheon *Dr Kwanghoe JUNG* *HYUNDAI Engineering & Construction*
16:50 – 17:20	Green on Blue – Alternative Development Strategy via Pontoons in Hong Kong *Mr Rick LAM* *Architecture Commons*
17:20 – 17:40	Offshore Caisson Foundation in Sand: From Numerical Modelling to Macroelement Design Tool *Prof. Zhenyu YIN* *The Hong Kong Polytechnic University*
17:40 – 18:00	Main Environmental Issues Associated with Floating Structures *Prof. Hongbin LIU* *The Hong Kong University of Science and Technology*

Day 2 – Friday, 7 July 2023

09:00 – 09:30	Invited Keynote Talk: Examples of Floating Infrastructure in Japan - Yumemai Floating Bridge in Osaka and Floating Offshore Wind Turbine in Goto Islands *Prof. Tomoaki UTSUNOMIYA* *Kyushu University*
09:30 – 10:00	Light-weight High-Performance Concrete for Floating Structures *Ir Prof. Chi-sun POON* *The Hong Kong Polytechnic University*
10:00 – 10:30	Novel FRP Prestressed Concrete Assembled Floating Structure like Bamboo Raft *Prof. Peng FENG* *Tsinghua University*
10:30 – 10:50	Coffee break
10:50 – 11:20	Invited Keynote Talk: Trends of Application of Floating Structures in South-East Asia *Mr Anil THAPAR* *Paaras Marine Solutions Pte. Ltd*
11:20 – 11:40	Design and development of coiled FRP rope for offshore platform *Prof. Xin WANG* *Southeast University*
11:40 – 12:00	Developing Floating Structure Technology (FST) for Hong Kong's Sustainable Growth and Liveability *Prof. Xiao Lin ZHAO* *The Hong Kong Polytechnic University*

Workshop 3 : Urban Carbon Neutrality

Organiser: Prof. Jerry YAN

Day 1 – Thursday, 6 July 2023

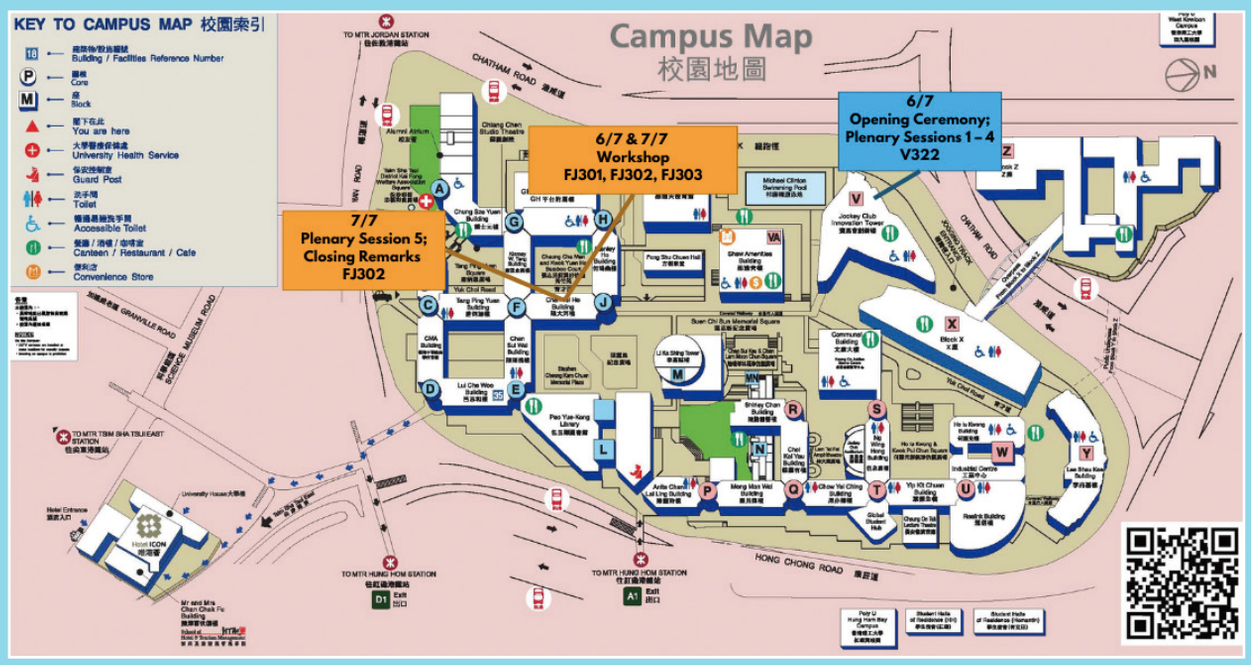
14:00 – 14:30	Invited Keynote Talk: Big Data and Climate Change: How Cities Can Become More Resilient and Efficient *Prof. Markus KRAFT* *Cambridge Centre for Advanced Research and Education*
14:30 – 15:00	Invited Keynote Talk: Autonomous Driving and the Challengers to Future City *Prof. Jianping WU* *Tsinghua University*
15:00 – 15:30	Coffee break
15:30 – 16:00	Harnessing the Power of Data Via Smart Systems Engineering Towards an Intelligent Carbon-Neutral Future *Dr Xiaonan WANG* *Tsinghua University*
16:00 – 16:30	Solar Reflectance Index (SRI) Based Functional Nanomaterial Solutions to Energy Smart Building Envelope *Prof. Lin LU* *The Hong Kong Polytechnic University*
16:30 – 17:00	Scientific Machine Learning in Smart Energy *Dr Yuntian CHEN* *Eastern Institute for Advanced Study*

Day 2 – Friday, 7 July 2023

09:00 – 09:30	Invited Keynote Talk: Incorporating Data Analytics into Urban Systems Design for Carbon Neutrality *Prof. Perry Pei-Ju YANG* *Georgia Institute of Technology*
09:30 – 10:00	Invited Keynote Talk: Deep Learning for Carbon Neutrality: AI Applications across Scales *Prof. Fengqi YOU* *Cornell University*
10:00 – 10:30	Coffee break
10:30 – 11:00	Invited Keynote Talk: Key Technologies and Applications for Smart Integrated Energy Systems *Prof. Yingru ZHAO* *Xiamen University*
11:00 – 11:30	Modular Metacognitive Digital Twin Technologies for Greener Cities & Cleaner Mobility *Dr Haoran ZHANG* *Peking University*
11:30 – 12:00	Secure Operation of a Low-Carbon Sustainable Urban Grid *Dr Siqi BU* *The Hong Kong Polytechnic University*

Symposium Venues

Date & Time	Event	Venue
6 July 2023; 09:00 – 12:00	Opening Ceremony; Plenary Sessions 1 – 4	V322, 3/F, Block V
6 July 2023; 14:00 – 18:00 7 July 2023; 09:00 – 12:00	Workshop 1: Air Pollution and Human Health	FJ301, 3/F, Core F
	Workshop 2: Large Floating Infrastructure	FJ302, 3/F, Core F
	Workshop 3: Urban Carbon Neutrality	FJ303, 3/F, Core F
7 July 2023; 12:00 – 12:45	Plenary Session 5; Closing Remarks	FJ302, 3/F, Core F



About RISUD

Research Institute for Sustainable Urban Development (RISUD)

The Research Institute for Sustainable Urban Development (RISUD) was established by The Hong Kong Polytechnic University (PolyU) to develop innovative solutions for sustainable high-density cities by capitalizing on the living laboratory of Hong Kong's urban environment and the multidisciplinary expertise of PolyU.

Vision

To be a world leader in the development and dissemination of innovative solutions for sustainable high-density urban development.

Mission

- To create innovative solutions to problems generated by high-density urban development through multi-disciplinary, collaborative research;
- To engage in knowledge transfer activities by collaborating with industry and government; and
- To make an impact on societal culture of urban sustainability through community engagement and services.

Plenary Sessions

Plenary Sessions 1 – 4

Date: 6 July 2023
Venue: V322, 3/F, Block V

Plenary Session 5

Date: 7 July 2023
Venue: FJ302, 3/F, Core F

Plenary Speaker 1

Mr Kam Sing WONG, GBS, JP

Former Secretary for the Environment
Hong Kong Special Administrative Region Government, Hong Kong SAR

Biography:

With the background as an architect, WONG served as the Secretary for the Environment, Hong Kong SAR Government, in 2012-2022. During his 10-year tenure as the Secretary for the Environment, WONG launched a number of policy blueprints on climate actions and energy, clean air, popularisation of electric vehicles, waste management, and biodiversity, leading Hong Kong towards carbon neutrality before 2050.

Prior to his tenure as the Secretary for the Environment, WONG contributed to various award-winning projects in sustainable architecture, from pioneering high-density public housing estate Verbena Heights in the early 1990s to Zero Carbon Building, the first of its kind in Hong Kong, in the early 2010s. WONG also volunteered in the sustainable bridge design and construction project 'A Bridge Too Far, A Dream Comes True' in Gansu Province in northwest China in the 2000s, and has become the Chairman of Wu Zhi Qiao (Bridge to China) Charitable Foundation since October 2022. In addition, he is currently Distinguished Department of Architecture Fellow at The University of Hong Kong, and Honorary Professor at Hong Kong Chu Hai college.

WONG was the Founder Chairman of the Environment and Sustainable Development Committee of the Hong Kong Institute of Architects, Chairman of the Professional Green Building Council and Vice Chairman of the Hong Kong Green Building Council (HKGBC). He has contributed to the promotion and research of the standards and guidelines for sustainable built environment applicable to the local high-density urban environment, including HKGBC's BEAM Plus, and Buildings Department's Sustainable Building Design Guidelines.

Topic:

Hong Kong's Climate Action Plan and Innovations
Date: 6 July 2023 Time: 09:20 – 09:55

Abstract:

To combat climate change and tackle various environmental challenges, Hong Kong's Climate Action Plan 2050 was launched in October 2021. The plan should be read in conjunction with other relevant environmental blueprints including Clean Air Plan for Hong Kong 2035, Hong Kong Roadmap on Popularisation of Electric Vehicles, and Waste Plan for Hong Kong 2035, which were also announced in 2021.

The highlight of the updated climate action plan is its target and roadmap to achieve carbon neutrality before 2050. The roadmap towards carbon neutrality embraces net-zero electricity generation, energy saving and green buildings, green transport and waste reduction. Moreover, the plan not only focuses on climate adaptation, resilience and mitigation strategies, but also integrates the urban solutions for better air quality and waste management etc.

The plan also highlights various challenges and opportunities in the context of Hong Kong. The key challenges include cost of decarbonisation, space constraint, demand for talent and technology breakthrough etc. At the same time, there are various new opportunities. For instance, Hong Kong will develop strategic growth areas into carbon-neutral communities. From the development of carbon-neutral communities to the journey towards carbon neutrality in Hong Kong, the role of innovative technologies is evidently important.

For our common future, the industry stakeholders and universities are encouraged to seize the opportunities and contribute to the making of a liveable, carbon-neutral urban environment in an integrated and innovative manner.

Plenary Speaker 2

Prof. Guibin JIANG

Director
State Key Laboratory of Environmental Chemistry and Ecotoxicology, Chinese Academy of Sciences, China

Biography:

Prof. Guibin JIANG, an Academician of Chinese Academy of Sciences and a Fellow of the Third World Academy of Sciences. He is currently Director of State Key Laboratory of ***Environmental Chemistry and Ecotoxicology***, Associate Editor of the journal of ***Environmental Science & Technology***, ACS, and the President of China Association for Instrumental Analysis.

Prof. JIANG is a leading scientist and pioneer in China in POPs and emerging pollutants studies. He has been the chief scientist of national 973 program on POPs, the principal investigators for National Key Technology R&D Program on POPs, the Major Program of National Natural Science Foundation (NSFC), and Innovation Research Group of NSFC. His work in the past 20 years has systematically exploited in a broad scientific spectrum of emerging pollutants from environmental chemistry to toxicology and health effect. His study on the emerging pollutants has made significant contributions to technically support the national implementation of the Stockholm Convention. He opened up a new research area in identifying new POPs in the environment and food. His team has discovered over 120 new POPs right now. These new pollutants he identified become the hot topics in POPs research worldwide, and has fostered the growth of a strong research team in our nation and enabled us to play an important role in the international POPs study.

Prof. JIANG has published more than 1100 articles in leading English journals. He is also the author or one of the coauthors of 21 scientific books.

Topic:

Integrated Toxicological Analyzer (ITA) & Environmental Risk Assessment
Date: 6 July 2023 Time: 10:15 – 10:50

Abstract:

The vast production and utilization of compounds have contributed to improving human welfare, yet they have also posed a significant threat to the ecological system and human health. In response to this challenge, risk assessment-based effect response is the perquisition to determine the emerging key toxicants. The Integrated Toxicological Analyzer (ITA) integrates several high-throughput techniques, performing high-coverage extraction, high-automation fractionation, high-sensitivity bioassays, high-resolution mass spectrometry analysis, and high-efficiency virtual filtering, enabling more efficient screening of causal toxic pollutants. The literature on EDA has expanded significantly, with numerous studies utilizing these techniques to identify causal toxicants.

The various high-automation fractionation strategies for the separation and preparation of sample extracts, High-sensitivity biological assays, classified into adverse outcome pathways, will be in-depth incorporated in ITA. The development of new bioassays based on can significantly enhance our understanding of the mechanisms underlying key toxicants. However, the toxicological screening scope is limited by utilizing only a few bioassays. To capture the effects of samples, multi-omics in ITA needs to be more widely implemented. To identify unknown pollutants, non-target analysis based on high-resolution mass spectrometry (HRMS) has been a significant advancement. In this regard, we will provide a comprehensive summary of the identified emerging contaminants to surmount the current challenges and enhance the risk assessment in environmental samples.

Plenary Speaker 3

Prof. Frank KELLY

Humphrey Battcock Chair of Community Health and Policy
School of Public Health, Imperial College London, UK

Biography:

Prof. KELLY holds the Humphrey Battcock Chair in Community Health and Policy at Imperial College London, where he is Director of the Environmental Research Group, Director of the NIHR Health Protection Research Unit on Environmental Exposures and Health and Deputy Director of the MRC-PHE Centre for Environment & Health.

Prof. KELLY leads a substantial research activity which spans all aspects of air pollution research from toxicology to science policy. He has led studies of the urban airshed within London including the impact of the introduction of London's Congestion Charging Zone and Low Emission Zone. He currently leads a study in West London, 'WellHome' which is investigating possible links between poor indoor air quality and respiratory health outcomes. Prof. KELLY is past Chairman of the British Association for Lung Research and COMEAP, the UK's Department of Health & Social Care Expert Committee on the Medical Effects of Air Pollutants. He provides policy support to the WHO on air pollution issues and he is a Member of the US Health Effects Institute Review Committee.

Topic:

Clinical and Toxicological Studies on the Health Effects of Air Pollution and the Challenges Ahead
Date: 6 July 2023 Time: 10:50 – 11:25

Abstract:

Air pollution is a worldwide problem and since air pollutants are expensive to control, a strong scientific understanding is required to underpin mitigation policies aimed at reducing the burden on public health. Much of the evidence concerning hazard identification and risk quantification related to air pollution comes from epidemiological studies. However, as urban air pollution is increasingly influenced in many localities by household biomass combustion (Lelieveld et al, ***Nature*** 2015;525:367–71), wildfires (Jaffe et al, ***Environ Sci Technol*** 2008;42:2812–8) and desert dust storms (Tamamura et al, ***Atmos Environ*** 2007;41:2580–93) an improved understanding of the mechanistic pathways evoked is required to infer causality. Taking each in turn, appropriate measures to protect populations will involve advocating smart cities and addressing economic and behavioural barriers to sustained adoption of clean stoves and fuels. Like all natural hazards, wildfires and dust storms are a feature of the landscape that cannot be removed. However, emission containment (land/fire management practices), exposure avoidance and identifying susceptible populations can be taken to prepare for air pollution episodes and ensure people are out of harm's way when conditions are life-threatening. Communities residing in areas affected by unhealthy concentrations of airborne particles will benefit from optimum communication via public awareness campaigns, designed to empower people to modify behaviour in a way that improves their health as well as the quality of the air they breathe.

Plenary Speaker 4

Prof. Siaw Kiang CHOU

Emeritus Professor
College of Design and Engineering, National University of Singapore, Singapore

Biography:

S.K. CHOU is Emeritus Professor at the National University of Singapore. Between 1998 and 2007, he served as Head of the NUS Department of Mechanical Engineering and Vice-Dean of the Faculty of Engineering. He was the Founding Executive Director of the NUS Energy Studies Institute from 2007 to 2017. He has had a sustained engagement with the ASEAN Committee on Science, Technology and Innovation, having twice co-authored its Plan of Action on S&T and chaired its advisory board. His experience in energy R&D covers energy performance of buildings, energy conversion for power and cooling, and energy management and policy. He is credited with designing the Envelope Thermal Transfer Value (ETTV) and the Residential Envelope Transmittance Value (RETV) energy standards used today in the Singapore Green Mark building certification scheme. He is a Fellow and President Emeritus of the Institution of Engineers, Singapore, and a Fellow of the Singapore Academy of Engineering. He is also a Fellow of the ASEAN Academy of Engineering and Technology, the ASEAN Federation of Engineering Organisations, the Energy Institute, UK, and the American Society of Heating, Refrigerating and Air-Conditioning Engineers. Besides being editor of the ***Applied Energy*** journal, he also sits on the editorial board of Advances in Applied Energy and chairs the International Advisory Panel of the Centre for Strategic Energy and Resources.

Topic:

Setting a Course for Carbon Neutrality
Date: 6 July 2023 Time: 11:25 – 12:00

Abstract:

Addressing the question of sustainability from the perspective of availability of natural resources, energy, and the environment, we discuss the potential strategic choices and the challenges in the context of urban development and economic viability and vibrancy. Using Singapore as a case study, we share the city's plan to achieve carbon neutrality by 2050.

Plenary Speaker 5

Prof. Ming LIN

Chief Scientist
China Communications Construction Co., Ltd., China

Academician
Chinese Academy of Engineering, China

Biography:

Prof. Ming LIN is a technology and management expert in bridge, tunnel and marine engineering. Currently, he is the Chief Scientist of China Communications Construction Co., Ltd., and an Academician of the Chinese Academy of Engineering. He has presided over the construction of a number of national key projects, such as the island and tunnel construction project of the Hong Kong-Zhuhai-Macao Bridge. In recent years, he has organized the researches and developments of a series of applied technologies such as the floating engineering on continental shelf, focusing on the key technologies for engineering design and construction.

Topic:

Ideas on Large Floating Technology for Future Urban Development
Date: 7 July 2023 Time: 12:10 – 12:45

Abstract:

The global population continues to grow, and the extreme weather and sea level rise caused by the greenhouse effect, the demands of food and energy, as well as the urban environmental problems, are becoming more and more significant. This report expounds the ideas of solving the future urban development problem through large floating engineering technology, and introduces some research advances in this topic, including the engineering technology research of floating tunnels, the conceptual design of a floating airport in Sanya, Hainan, and the "re-blue" plan of a coastal city, etc.

Workshop 1: Air Pollution and Human Healths

Session Chairs: Prof. Guibin JIANG (Day 1; 14:00 – 16:00)
Prof. Frank KELLY (Day 1; 16:00 – 18:00)
Prof. Shu TAO (Day 2)

Date & Time: 6 July 2023; 14:00 – 18:00
7 July 2023; 09:00 – 12:00

Venue: FJ301, 3/F, Core F

Invited Keynote

Prof. Shu TAO

Professor
College of Urban and Environmental Sciences, Peking University, China

Biography:

Prof. Shu TAO is a Chair Professor of Peking University and Southern University of Science and Technology. He is a Member of Chinese Academy of Science and a Member of National Steering Committee on Environmental Protection. He serves as Associate Editor of ***Environmental Science & Technology***. His current research interests include global emission inventories of various air pollutants, atmospheric transport and population exposure modelling, household air quality. He has more than 200 papers published in peer-reviewed international journals, with total citation over 22,000 and H-index (Web of Science) of 92.

Topic:

Causes for Recent Trend of Air Pollution in China
Date: 6 July 2023 Time: 14:00 – 14:30

Abstract:

The past decade has witnessed significant improvement in air quality in China. It is of interest to analyse the causes leading to the change. Here we use a few examples to uncover the effects of major drivers. We found that switch of residential energy mix driven by socioeconomic development has reduced emissions from this sector substantially. The process of residential emission reduction has been enhanced by recent government intervention significantly. Banning of beehive coke ovens is a good example to show effectiveness in pollution control by legal means. Also, changes in meteorological conditions lead to random variation in air pollution, which can be distinguished from contributions of emissions.

Invited Keynote

Prof. Haidong KAN

Professor
School of Public Health, Fudan University, China

Biography:

Prof. Haidong KAN is a Professor of Environmental Health Science in Fudan University, China. He is Associate Editor of the journal ***Environmental Health Perspectives***. His research investigates how ambient air pollution and global climate change affect human health.

Topic:

Air Pollution and Daily Mortality: From PAPA to MCC Studies
Date: 6 July 2023 Time: 14:30 – 15:00

Abstract:

The speaker will give an overview on the health effects of air pollution on mortality during the past decades, and discuss the challenges and future research directions. The Public Health and Air Pollution in Asia (PAPA) study and Multi-Country, Multi-City (MCC) study will be extensively discussed.

Speaker

Prof. Guangbo QU

Professor
Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences, China

Biography:

Prof. Guangbo QU is at the State Key Laboratory of Environmental Chemistry and Ecotoxicology, Research Center for Eco-Environmental Sciences (RCEES), Chinese Academy of Sciences (CAS). He obtained his PhD in Environmental Science at RCEES, CAS, in 2011. His major research interests are the evaluation of the biological effects of emerging pollutants based on effect-directed analysis, as well as their molecular mechanisms. Combining high-throughput toxicological assays and non-targeting high-resolution mass spectrometry, he also developed an integrated toxicology analysis system. This strategy allows for the identification of key toxicants responsible for the measured toxicological potency in extracts from real environmental samples in an automatic highly efficient manner.

Topic:

Identification of Aryl Hydrocarbon Receptor Agonists from Real Environmental Samples Based on Effect-Directed Analysis
Date: 6 July 2023 Time: 15:00 – 15:20

Abstract:

Combining the advances of biological assay, fractionation with chromatography, and mass spectrum analysis, effect-directed has been widely applied for identifying key toxicants in environmental samples. In this study, samples from contaminated regions have been extracted with accelerated solvent extraction. Aryl hydrocarbon receptor (AhR) agonic potency in the extracts was measured with a cell-based genetic reporter assay that utilizes the luciferase reporter gene. The positive samples with high potency were then fractionated using an established fractionation method.

The key toxicants in active fractions have been identified using gas or liquid chromatography coupled with high-resolution mass spectrometry (Q Extractive). Trace Finder (v 5.0, Thermo Scientific, USA) was used for data acquisition and processing. We have identified the above thirty AhR agonists in the positive fractions. The major contributor to AhR activity in these sediment samples was petroleum product combustion and biomass combustion. Fractions were collected for unknown AhR agonist chemical identification. The contributions of potent AhR agonists to adverse outcomes have been discussed. More fractionation methods are required to seek the source of measured toxicity induced by the extracts from real environmental samples.

Speaker

Prof. Maosheng YAO

Professor
College of Urban and Environmental Sciences, Peking University, China

Biography:

Maosheng YAO is a Boya Distinguished Professor at Peking University. Prof. YAO obtained his PhD from Rutgers University in 2006, and completed a postdoc training at Yale University. He is a PI for the Innovative Research Group Grant of the National Science Foundation of China (NSFC). His research mainly focuses on bioaerosol and health effects of air particulate matter. Particularly, Prof. YAO made important contributions to SARS-CoV-2 aerosol transmission, global particular matter toxicity analysis and real-time monitoring aerosol exposure health effects. Prof. YAO is a winner of NSFC Distinguished Young Scholar Grant, Kenneth T. Whitby, and Marian Smoluchowski Awards for his outstanding research contributions to aerosol science. His work was also recognized by the second prize of the National Technical Invention Award, the Special Gold Award from the 44th Geneva International Invention Exhibition, and an award of "Top 10 Scientific and Technological Advances in Environmental and Ecological Fields in China". He was also awarded the Excellence in Research Award by the J Aerosol Sci (JASER Award). Prof. YAO chaired two Xiangshan Science Conferences on bioaerosol and ARG frontiers. Prof. YAO serves as the Executive Vice President of the Indoor and Environmental Health Branch of the Chinese Society For Environmental Sciences.

Topic:

"Smoke Detector" Science for Aerosol Exposure Health Effects
Date: 6 July 2023 Time: 15:20 – 15:40

Abstract:

Aerosol exposure represents a significant health threat to human health. It is often difficult to detect and feel when it is harming the health. Traditional approach involves sampling, offline component and toxicity analysis studies, failing to provide a timely protection to the health. Toward this problem, in our laboratory we have discovered that living system on cell, animal and human levels would emit a distinctive profile of volatile organic components (VOC) upon specific aerosol pollutant exposure within a very short of time period. Together with machine learning, we were able to distinguish between different aerosol exposures. For example, SARS-CoV-2 exposure also resulted in different profile of VOCs, including elevated isopropanol and decreased acetone levels. Using PMs from various cities, we have shown that cells also emit different profiles of VOCs upon the exposure, thus implying different health effects. Further, using a rat together with an array of breath-borne biomarker sensors we were able to real-time monitor health effects of air pollution, including those hazy days. Development of "Smoke Detector" for aerosol exposure health effects would enable humans to be able to real-time "see and feel" the aerosol harm, and thus holds a great promise in revolutionizing the studies and the instrumentation for environmental aerosol and health.

Speaker

Prof. Daqiang YIN

Professor
College of Environmental Science and Engineering, Tongji University, China

Biography:

Prof. Daqiang YIN, Professor of College of Environmental Science and Engineering, Tongji University, P. R. China. Director of Key Laboratory of Yangtze River Water Environment, Ministry of Education. Lead of Program of Environmental Toxicology and Health. Associate Editor of ***Science of the Total Environment***, and ***Archives of Environmental Contamination and Toxicology***. His research is focused on the effects and the mechanisms of action of pollutants or toxic chemicals, and to estimate the hazard of aquatic ecosystem and human exposed to toxic chemicals in water. More than 300 research papers in English have been published. He is Lead Scientist of Tai Hu Drinking Water of National Mega Water Program.

Topic:

Mixed Metal Components Facilitate $PM_{2.5}$ to Induce CCR5-Mediated Neuroinflammation in Mouse Olfactory Bulb

Date: 6 July 2023 Time: 15:40 – 16:00

Abstract:

Particulate matters, especially $PM_{2.5}$, can invade the central nervous system (CNS) via the olfactory pathway to induce neurotoxicity. Olfactory bulb (OB) is the key component integrating immunoprotection and olfaction processing in the pathway and is necessarily involved in the relevant health outcomes. Here we show that microglial CCR5 is the target of environmentally relevant $PM_{2.5}$ in OB to trigger neuroinflammation and then neural injuries. Mechanistically, $PM_{2.5}$-induced CCR5 upregulation results in the M1-dominant paradigm of microglial activation, which subsequently activates TLR4-NF-κB neuroinflammation signalling and induces Alzheimer's-like pathologies (e.g., Aβdeposition and disruption of the blood-brain barrier). Although the biosynthesis of Aβ is not affected by $PM_{2.5}$, the clearance process is significantly delayed, which can be the possible reason for the Aβ deposition. Furthermore, we specifically highlight that manganese and lead on $PM_{2.5}$ are the main contributors to the CCR5 activation in synergy with aluminium. Our results uncover the causes of $PM_{2.5}$-induced neuroinflammation and identify the principal neurotoxic components, which can provide new insight into efficiently diminishing the adverse health effects of $PM_{2.5}$.

Invited Keynote

Prof. Gan ZHANG

Director
The State Kay Laboratory of Organic Geochemistry, Guangzhou Institute of Geochemistry, Chinese Academy of Sciences, China

Biography:

Prof. ZHANG obtained his BSc (1987) and MSc (1990) from Nanjing University, and PhD (1995) from Chinese Academy of Sciences. He serves as the Director of the State Kay Laboratory of Organic Geochemistry (SKLOG). He leads a research group working in the areas of organic pollution and organic geochemistry, in particular on persistent organic pollutants (POPs), and polyaromatic organic matters (POM) including black carbon. He leads the Accelerated Mass Spectrometer Facility (GIG-CAMS) dedicated to environmental radiocarbon (^{14}C) analysis. He has published more than 500 research papers in peer-reviewed journals, with a total citation of >24,000 times and an ***h*** index of 78 (Publons/WoS). Prof. ZHANG's current research interests include: (i) fate of persistent organic pollutants (POPs) in regional environment; (ii) development of radiocarbon analysis techniques and its application in environmental sciences; and (iii) environmental pollution and health risk.

Topic:

Unravelling the Polyaromatic Continuum in Atmospheric Particles
Date: 6 July 2023 Time: 16:15 – 16:45

Abstract:

Polyaromatic organic matters (POMs) exist in ambient aerosol as a continuum spanning from small polycyclic aromatic compounds (PACs) to black carbon (BC), and appears in from water soluble, organic-solvent soluble to insoluble fractions. Numerous studies revealed that POMs are key contributors to both the light absorption and toxicity of atmospheric fine particles. A single measurement of priority polycyclic aromatic hydrocarbons (EPA-PAHs) could not afford the quantification of PACs in different chemical fractions of air particle. We adapted the BPCA (benzene polycarboxylic acid) method to address this problem. POMs are oxidized and broken down to individual benzene rings substituted with 2-6 carboxylic groups, depending on the extent of vicinal carbon atoms (i.e., BPCAs), in nitric acid under high temperature and pressure. The BPCAs are then quantified and translated to the POM concentration. We further developed compound-specific isotope analysis/radiocarbon analysis (CSIA/CSRA) methods for tracking the sources of POMs in different chemical fractions. It was found that, in the SRM1649b reference standard, the EPA-PAHs account for only less than 1% of low-polarity PACs quantified by BPCA method, and the abundance of low- and high-polarity PACs was comparable. Source apportionment of POMs using CSRA of BPCAs showed varied contributions of fossil and contemporary sources among bulk aerosols and water-soluble, methanol-soluble fractions of ambient aerosols from a megacity of southern China. The BPCA-based method is shown to be a useful tool for unravelling the POM continuum in air particles.

Speaker

Prof. Xiangdong LI

Director of Research Institute for Sustainable Urban Development
Dean of Faculty of Construction and Environment
Chair Professor of Environmental Science and Technology
Ko Jan Ming Professor in Sustainable Urban Development
The Hong Kong Polytechnic University, Hong Kong SAR

Biography:

Prof. LI's major research interests include regional environmental pollution, urban environment, and remediation of contaminated soils. His recent research projects have mainly focused on environmental changes in the fast-developing regions. Prof. LI's research team has been engaged in the study of trace metals and organic pollutants in atmospheric particles, soils, sediments, and biological samples, including their impacts on human health and ecological systems. He has been the principal investigator of numerous research projects funded by RGC, NSFC, and the UGC Area of Excellence Scheme. He has published more than 250 papers, mostly in leading international journals. His current research topics are focused on the environmental behaviours and health implications of $PM_{2.5}$ and antimicrobial resistance in air environments. Prof. LI was awarded the Clair C. Patterson Medal (Innovative Breakthrough in Environmental Biogeochemistry in the last decade) from the Geochemical Society (GS) in 2022. This Award is presented annually for an innovative breakthrough in environmental geochemistry of fundamental significance within the last decade, particularly in service to society, including research in the fields of regional contamination, urban air $PM_{2.5}$ pollution, and the origin and dissemination of antimicrobial resistance. Prof. LI is an elected Fellow of the Hong Kong Academy of Engineering Sciences (HKAES), a Geochemistry Fellow of the Geochemical Society (GS) and the European Association of Geochemistry (EAG). He is Deputy Editor of ***ACS Environmental Au***, and an Associate Editor of ***Environmental Science and Technology (ES&T)***.

Topic:

Unravelling the Black Box between Air Pollution and Public Health for Transformative Air Quality Management
Date: 6 July 2023 Time: 16:45 – 17:05

Abstract:

Dominated by fine particulate matter ($PM_{2.5}$), air pollution is the world's greatest environmental health risk factor in both developed and developing economies. Each year, outdoor $PM_{2.5}$ pollution causes millions of premature deaths worldwide and costs the global economy US$225 billion in lost labour income. Many regulatory bodies, including the Hong Kong Environmental Protection Department, benchmark against the guideline values of the World Health Organization (WHO) (e.g., mass concentration of $PM_{2.5}$, $\mu g\ m^{-3}$) to protect public health. However, evidence is mounting on the unequal health effects at equal mass concentrations of $PM_{2.5}$. This is primarily because $PM_{2.5}$ is a cocktail of components from a mix of sources. Not all components and sources are equally important in toxicity contribution to the combined impact of what people breathe in different parts of the world. Controlling the sources of health-relevant but not necessarily mass-dominating fractions of $PM_{2.5}$ would be a more effective option than managing the entire $PM_{2.5}$ mass. Identifying the toxic components and their associated sources responsible for $PM_{2.5}$ health effects represents a major scientific challenge prior to the making of policy. Owing to 21st century advancements in toxicology and molecular epidemiology, it is hoped that this long-standing puzzle can be resolved by a high-throughput ***in vitro*** effect-directed analysis and ***in silico*** mixture-toxicity predictions along with optimal ***in vivo*** and epidemiological validations. We will introduce our study design and report the progresses so far in the first year.

Speaker

Dr Linwei TIAN

Associate Professor
School of Public Health, The University of Hong Kong, Hong Kong SAR

Biography:

Dr Linwei TIAN is an epidemiologist studying environmental causes of the lung cancer epidemic in Xuan Wei, China and lately the endemicity of oesophageal cancer in a few regions of mainland China. He also makes use of the high-quality environmental and health data in Hong Kong. He is trying to examine the earlier ambiguity and enhance causal inference of the environment-health associations by contrasting the traditional time series regression models with the recent methods of causal discovery from time series data.

Topic:

Gaseous Pollutants and Health: One Wind A Day Keeps the Doctor Away?
Date: 6 July 2023 Time: 17:05 – 17:25

Abstract:

The current air quality standards set upper bounds for air pollutant concentrations to protect public health. Can we envision some future air quality standards set also lower bounds to ensure minimal requirements of certain gaseous compounds in the air for public health benefits? It sounds a silly question, but research is warranted. Being a well-known toxicant at high level, exogenous carbon monoxide (CO) has been proved of its beneficial anti-inflammatory effects at low concentrations and therefore therapeutic applications in critical care medicine. Sulphur dioxide (SO_2) is probably another gasotransmitter in the body for its physiological functions such as maintaining normal vascular tone and blood pressure whereas the potential health effect of extremely low ambient SO_2 is uncertain. Ambient ozone (O_3) increases the risk of COPD exacerbation but it may decrease the risk of influenza. Daily time series data from Hong Kong and USA are analysed by a combination of three distinct methods for better triangulation of causal evidence on three pairs of relationships: CO effect on sepsis ("blood poisoning"), SO_2 effect on ischemic stroke, and O_3 effect on influenza. Preliminary findings are to be presented.

Speaker

Prof. Kin Fai HO

Associate Professor, Earth System Science Programme,
Head of Graduate Division, JC School of Public Health and Primary Care
The Chinese University of Hong Kong, Hong Kong SAR

Biography:

Prof. Kin Fai HO's research focuses on developing exposure assessment techniques and modifying chemical/ toxicological characterization methods to quantify the personal exposure and health impacts of air pollution. These techniques concentrate on bridging the gap from air pollution sources to health.

His recent studies aim to reduce uncertainties throughout the entire source-to-health effects paradigm. His research outputs include peer-reviewed articles in reputable journals and demonstrate a proven track record in the adverse health effects of different emission sources in Hong Kong and mainland China. In addition, his work has clarified the characteristics and health impacts of volatile organic compounds (VOCs), carbonyls, and polycyclic aromatic hydrocarbons (PAHs) in the region. Prof. HO's research findings have crucial implications for the development of related control strategies targeted to minimize the adverse health effects of air pollution in the regions.

Topic:

Photochemical Oxidation Of Gasoline Vehicle Exhaust – Volatile Organic Compound Emissions And Secondary Organic Aerosol Formation
Date: 6 July 2023 Time: 17:25 – 17:45

Abstract:

The emissions before and after atmospheric oxidation from gasoline vehicles were characterized under different driving conditions. The organic aerosol mass concentrations showed substantial increase (~ 7.6-10.8 times) after ageing process, implying that vehicular emissions were an important source of aged organic aerosol. The total quantified organic species mass concentrations in aged samples ranged from 77.7 to 480.5 ng m^{-3} under different test conditions. The emission factors of VOCs were higher under idling condition compared to the other driving modes for all selected vehicles. High VOCs emissions could potentially lead to high aged organic compounds formation inside the Potential Aerosol Mass (PAM) reactor under idling condition. The vehicle with latest year of manufacture in Euro 5 standard could pose lower primary emissions of organic substances. High aged/fresh emission ratios (A/F) (> 20) of phthalic acid, 2,3-dihydroxy-4-oxopentanoic acid, selected dicarboxylic acids and motor emission (ME) markers were secondary produced through aging processes, suggesting possible formation products from the photooxidation reaction of VOC precursors, e.g. naphthalene and toluene. In most cases, the bioreactivity induced by the aged PM samples is significantly higher than the fresh samples, which suggested that the aged organic compounds from oxidation of gasoline exhaust can play an important role in PM-induced oxidative stress and inflammation in Hong Kong. The stepwise regression analysis suggested that n-alkane and alkenoic acid are major contributors to the increase in lactate dehydrogenase (LDH) levels in the fresh samples, polycyclic aromatic hydrocarbons (PAHs) and monocarboxylic acid are for the aged samples.

Speaker

Dr Guojun HE

Associate Professor in Economics and Management & Strategy, HKU Business School
Director of ESG Research Institute
Associate Director of Institute of China Economy
The University of Hong Kong, Hong Kong SAR

Biography:

Dr Guojun HE is an economist working on environmental, development, and governance issues. Currently, he is an Associate Professor in Economics and Management & Strategy at The University of Hong Kong (HKU). He serves as the Director of HKU's ESG Research Institute and the associate director of HKU's Institute of China Economy. He holds a concurrent appointment at the Energy Policy Institute of the University of Chicago (EPIC) and leads research activities of its China center (EPIC-China). He is a Co-Editor of ***Journal of Environmental Economics*** and ***Management and China Economic Review***.

Topic:

Quasi-Experimental Methods for Air Pollution-Health Studies
Date: 6 July 2023 Time: 17:45 – 18:05

Abstract:

which are drawn intensely from the economics literature. It starts by discussing various confounding factors that are commonly seen in associational studies, then gives examples of how quasi-experimental designs can address these issues. Several widely-used quasi-experimental inference methods are reviewed, with a particular focus on empirical findings from China. The paper concludes by discussing how quasi-experimental designs can help isolate the impact of PM toxicity on population health, which essentially requires researchers to hold PM concentrations constant and vary the degrees of toxicity.

Speaker

Prof. Jianzhen YU

Chair Professor, Department of Chemistry Division of Environment and Sustainability
Director of Atmospheric Research Center
The Hong Kong University of Science and Technology, Hong Kong SAR

Biography:

Prof. YU is an atmospheric chemist at The Hong Kong University of Science and Technology (HKUST). Her main research interests are the development of analytical methods for airborne organic compounds, and chemical characterization of ambient aerosols for source apportionment and health effects studies. Analytical techniques she and her group have developed have been adopted and used in many laboratories in the field of atmospheric chemical measurements. Her laboratory is a frequent provider for the analytical work for the $PM_{2.5}$ monitoring network in Hong Kong set up by the Hong Kong Environmental Protection Department.

Topic:

Building Mechanistic Linkages between $PM_{2.5}$-Induced Oxidative Potential and Chemical Composition
Date: 7 July 2023 Time: 09:00 – 09:20

Abstract:

Inhaled ambient fine particulate matter ($PM_{2.5}$) contains transition metals (TMs) that possess excellent catalytic properties and can contribute to the formation of multiple reactive oxidative species (ROS) in human lung lining fluid. These ROS include $\cdot O_2$, H_2O_2, and $\cdot OH$. Additionally, ambient organics, particularly humic-like substances (HULIS), can complex with TM ions as ligands, facilitating electron transfer in TM-induced ROS generation. This leads to an increase in the adverse oxidative potential (OP) to the human body. Several studies have measured the OP of ambient or lab-prepared samples using different assays and generated equations between OP and chemical concentration using multiple regression models. However, these equations could not explain the catalytic effects of TMs and organics in OP formation processes as they are purely empirical and no underlying chemical reaction mechanisms were proposed.

We assessed the OP of lab-prepared TM samples under different conditions using the ascorbic acid (AA) assay and the glutathione (GSH) assay. By analysing the OP dependence on TM concentration, we proposed a TM-AA/TM-GSH complex as the major intermediate and a quasi-Michaelis-Menten mechanism to quantitatively explain the nonlinear dose-response in TM-induced AA/GSH depletion. Our proposed reaction mechanisms also provide a clear understanding of the $\cdot OH$ formation in the AA assay. We also observed a synergistic effect between metals and ambient HULIS. Our work proposes a detailed chemical mechanism for TM-catalysed OP formation, which quantitatively links TM concentration and OP. This provides valuable information and reference for OP calculation and modelling based on the chemical composition of ambient $PM_{2.5}$.

Speaker

Prof. Hai GUO

Professor
Department of Civil and Environmental Engineering,
The Hong Kong Polytechnic University, Hong Kong SAR

Biography:

Prof. Hai GUO completed his PhD study in Australia. He is currently a Professor in The Hong Kong Polytechnic University (PolyU). Prof. GUO's research interests include atmospheric chemistry, organic aerosols and their precursors, ozone pollution, bioaerosol transmission and indoor chemistry. He is among the first to have developed a photochemical trajectory model and a photochemical box model to understand atmospheric ozone formation in Asia. He is also the first person in Hong Kong to establish a world-class laboratory instrument system to analyse trace volatile organic compounds (VOCs). He has developed offline and semi-online samplers for measuring ambient acidic ultrafine particles. Prof. GUO is an investigator of more than 70 research projects. He has published about 180 papers, with an h-index of 57 on Google scholar and 52 on Scopus. He has been ranked the World's Top 2% Highly Cited Scientist in Meteorology and Atmospheric Sciences in 2020-2022. Prof. GUO is a VOC Expert Group Member of the World Meteorological Organization – Global Atmosphere Watch. Furthermore, Prof. GUO is Associate Editor of ***Science of the Total Environment***, and Editor of ***Aerosol and Air Quality Research***. Prof. GUO has won many prizes including a second prize of natural science issued by China's Ministry of Education, first prize of science and technology in Guangdong province, golden medal, and a special merit award at the 71st International Trade Fair for Ideas, Inventions & New Products in Germany, and eight-time Dean awards for outstanding research and publication at PolyU. Prof. GUO has given keynotes and invited speeches in a number of international conferences and been a Member of Scientific Advisor Committee in many conferences.

Topic:

Cytotoxicity of Fine Particulate Matter in Different Locations in Hong Kong
Date: 7 July 2023 Time: 09:20 – 09:40

Abstract:

Fine particulate matter ($PM_{2.5}$) has been identified as a major air pollutant with irreversible impacts on humans. In this study, the chemical and toxicological characteristics of $PM_{2.5}$ in residential and rural background environments were investigated. Sampling was performed in an apartment, at a mountainous site (Tai Mo Shan, TMS) and a coastal background site (Hok Tsui, HT), respectively. $PM_{2.5}$ collected on quartz fibre filters were weighed and extracted, followed by organic compound analysis and in vitro cellular testing. Toxicity of $PM_{2.5}$ in the apartment and at the rural background environments was evaluated by tumour necrosis factor-alpha (TNF-a) and interleukin 6 (IL-6), monocyte chemoattractant protein-1 (MCP-1), malondialdehyde (MDA), 8-hydroxy-2'-deoxyguanosine (8-OHdG) and lactic dehydrogenase (LDH). In the residential environment, IL-6, MCP-1, and MDA levels were comparable among general household activities, intensive cooking, and smoking. Concentrations of phthalates, methyl palmitate, Flexol 4GO, Flexol 3GO and 2-Pentadecanone, 6,10,14-trimethyl which were all plasticizers generated from residential background emissions, were found to have strong positive correlation ($p < 0.05$, $r = 0.79 - 0.93$) with the biomarker MDA, indicating that attention should be paid to health risks of accumulation effects of toxic background plasticizers. At the two rural background sites, DNA adduct 8-OHdG concentrations of $PM_{2.5}$ were found to be significantly higher than control levels ($p < 0.0001$). $PM_{2.5}$ collected on days influenced by the northeast continental airmass at HT and TMS showed higher levels of 8-OHdG than the eastern coastal air. The 8-OHdG levels in marine air were comparable to control group and about half the levels of air from the northeast continent and the eastern coast. No strong correlations were found between biomarkers and measured organic compounds at the rural background sites. C5 compounds in TMS samples presented a moderate positive correlation with 8-OHdG concentration ($p < 0.05$, $r = 0.49$). The findings indicate that the cytotoxicity of $PM_{2.5}$ in different microenvironments is unequal.

Speaker

Dr Ling JIN

Assistant Professor
Department of Civil and Environmental Engineering and Department of Health Technology and Informatics, The Hong Kong Polytechnic University, Hong Kong SAR

Biography:

Dr Ling JIN is an Assistant Professor at Department of Civil and Environmental Engineering and Department of Health Technology and Informatics of The Hong Kong Polytechnic University. He works keenly in the interdisciplinary research fields across environmental chemistry, toxicology, and microbiology, and anchors chemical-microbial mixture toxicity in a number of pressing environmental health issues, such as air pollution and human health, environmental transmission of pathogens and antimicrobial resistance, and marine pollution and wildlife health.

Topic:

What are Driving the Evolving Toxicity of Particulate Matter Generated from Residential Biomass Burning?
Date: 7 July 2023 Time: 09:40 – 10:00

Abstract:

Residential biomass burning releases substantial amounts of pollutants, such as polycyclic aromatic hydrocarbons (PAHs) and black carbon (BC), posing significant health risks in rural areas of China and other countries alike. Current stove improvements focusing on thermal efficiency do not necessarily lead to reduced health risks. A better understanding of toxicity-contributing pollutants and their formation mechanisms is urgently needed. We conducted laboratory combustion experiments using three biomass types under different temperatures. Particulate matter (PM) samples were collected for chemical and toxicity characterizations. Toxic potency per unit mass of PM increased from 400°C, peaked at 600°C, and then decreased at 800°C. PAH concentrations in PM also increased with temperature, peaking at 800°C, which means that PAHs alone could not explain the declining toxic potency of PM at high temperatures. Non-target screening revealed primary biomass pyrolysis products dominated the organic emissions from low-temperature combustion (400°C) and heterocyclic aromatic compounds were intensely emitted during medium-temperature combustion (600°C). As the temperature increased, the aromatic compounds aggregated and transformed into more stable PAHs. The decrease in heterocyclic aromatic compounds may be a key reason for reduced PM toxicity at high temperatures (800°C). Further research is necessary to identify toxic components underlying the evolving PM toxicity during combustion. The full outcomes of the study will inform effective strategies for reducing harmful emissions from residential biomass burning.

Speaker

Dr Sonata YAU

Associate Professor
Department of Rehabilitation Sciences, The Hong Kong Polytechnic University, Hong Kong SAR

Adjunct Associate Professor
Division of Medical Science, University of Victoria (British Columbia), Canada

Biography:

Dr Sonata YAU, is currently working as an Associate Professor in the Department of Rehabilitation Sciences at The Hong Kong Polytechnic University (PolyU). She is also an Adjunct Associate Professor in Division of Medical Science, University of Victoria (British Columbia), Canada. She obtained her bachelor's degree in biochemistry at HKUST in 2005, followed by a PhD degree in neuroscience at LKS Faculty of Medicine, The University of Hong Kong (HKU) in 2009. Before joining PolyU as an Assistant Professor in 2016, she obtained her postdoctoral training with research fellowships funded by HKU and Canadian Institute of Health Research in Canada, respectively. She was a short-term visiting scholar in School of Medicine at Yale University and a visiting scholar at Stanford University. Her research is centred in identifying environmental risk factors (e.g. air pollutant) for neurodevelopmental disorders, and functional roles of hippocampal structural plasticity and synaptic plasticity in learning and memory, as well as mood regulation. She also investigates molecular mechanisms and blood biomarkers of physical exercise-promoted brain plasticity by using different disease animal models, including depression, diabetes, and autism. She has extensive experience in examining cellular and system changes of brain plasticity following exercise interventions in animals. Since 2016, she has obtained four external grants from Hong Kong Research Council and two grants from the National Natural Science Foundation of China, and other open grants from mainland China and Hong Kong. She has published over 60 research articles and reviews, and 4 book chapters with H index 26 (May 2023) and serves as guest editors and reviewers for many internal peer-review journals.

Topic:

Chronic Exposure of $PM_{2.5}$ Induces Impairment in Mood and Working Memory in Association with Aberrant Adult-Born Neurons in the Hippocampus
Date: 7 July 2023 Time: 10:00 – 10:20

Abstract:

Air pollution poses a significant threat to human health as 90% of the global population breathes polluted air, according to a report by the World Health Organization (WHO). This has resulted in the deaths of 7 million people worldwide per year due to exposure to pollutants such as Nox, SO_2, O_3, particulate matter (PM), and organic metals, with particulate matter being of particular concern. The small size of $PM_{2.5}$ particles allows them to penetrate the respiratory tract, leading to inflammation, oxidative stress, and harmful effects on the nervous system. The effects of $PM_{2.5}$ on respiratory and cardiovascular health are known, including breathing difficulties, chest tightness, coughing, and cardiovascular mortality and morbidity. However, less is known about the detrimental effects of air pollution on cognitive functioning and mental health. Our research focuses on the hippocampus as its continuous development of new neurons the dentate gyrus (DG) of the hippocampus, a key brain region that regulates mood regulation, and learning and memory. We exposed adult mice with either (A) artificial lung fluid as control group or (B) $PM_{2.5}$ exposure as treatment group with intratracheal instillation of $PM_{2.5}$ at the dosage of 2.5 μg/ul every other 3 days continuously for three weeks. Our pilot data showed that $PM_{2.5}$ treatment increased immobility time and decreased total time spent in the center of the open field, suggesting an increase in depression-like and anxiety-like behaviour. $PM_{2.5}$ treatment also decreased exploration index to novel object in a working memory test, indicating memory impairment. Quantification of doublecortin (adult born immature neuron) and Ki 67 (proliferating cells) positive cells in the DG using immunostaining showed a decreasing trend in number of positive cells in the $PM_{2.5}$ treatment group when compared to the control group, indicating that exposure to $PM_{2.5}$ may result in a decrease in adult neurogenesis. The pilot data has suggested that decrease in adult neurogenesis could be linked to $PM_{2.5}$-induced mood and memory impairment.

Speaker

Dr Daihai HE

Associate Professor
Department of Applied Mathematics, The Hong Kong Polytechnic University, Hong Kong SAR

Biography:

Dr HE's research interests are infectious disease modelling and statistical analysis of medical data. His modelling of yellow fever in Angola Africa won the second place in the 2018 International Society for Disease Surveillance's Best Scientific Contribution Paper; He has several highly cited papers on the study of COVID-19.

Topic:

Modelling COVID-19 Vaccine Breakthrough Infections in Highly Vaccinated Israel
Date: 7 July 2023 Time: 10:20 – 10:40

Abstract:

In August 2021, a major wave of the SARS-CoV-2 Delta variant erupted in the highly vaccinated population of Israel. The transmission advantage of the Delta variant enabled it to replace the Alpha variant in approximately two months. The outbreak led to an unexpectedly large proportion of breakthrough infections (BTI)–a phenomenon that received worldwide attention. Most of the Israeli population, especially those aged 60+, received their second dose of the vaccination four months before the invasion of the Delta variant. Hence, either the vaccine induced immunity dropped significantly or the Delta variant possesses immunity escaping abilities, or both. In this work, we model data obtained from the Israeli Ministry of Health, to help understand the epidemiological factors involved in the outbreak. We propose a mathematical model that captures a multitude of factors, including age structure, the time varying vaccine efficacy, time varying transmission rate, BTIs, reduced susceptibility and infectivity of vaccinated individuals, protection duration of the vaccine induced immunity, and the vaccine distribution. We fitted our model to COVID-19 cases among the vaccinated and unvaccinated, for <60 and 60+ age groups, and quantified the transmission rate, the vaccine efficacy over time and the impact of the third dose booster vaccine. We estimated that approximately 4.03 million infective cases (95%CI 3.19, 4.86) were prevented by vaccination overall, and 1.22 million infective cases (95%CI 0.89, 1.62) averted by the booster.

Speaker

Prof. Yu HUANG

Head of Department of Biomedical Sciences
Chair Professor of Biomedical Sciences and Vascular Biology
Jeanie Hu Professorship in Biomedical Sciences
City University of Hong Kong, Hong Kong SAR

Biography:

Yu Huang is currently the Chair Professor of Biomedical Sciences and Vascular Biology, Jeanie Hu Professor of Biomedical Sciences at City University of Hong Kong. He obtained his BSc from Fudan University Shanghai Medical College and PhD from University of Cambridge. He was past President of Asian Society for Vascular Biology and past Vice-President for Chinese Society for Vascular Medicine. He is currently the Vice-President for both Chinese Association for Physiological Sciences and Chinese Section of International Society for Heart Research. He is the Fellow of International Society for Heart Research, and received inaugural Hong Kong Research Grants Council - Senior Research Fellow Award. The research focus of Huang's team is to elucidate cellular and molecular events in initiation and progression of endothelial cell dysfunction in hypertension, obesity, and diabetes, to uncover novel biomarkers for vascular pathogenesis, and to develop venues to reverse vascular dysfunction in animal models of cardio-metabolic disorders. He has co-authored 482 peer-reviewed publications in SCI-indexed journals including ***Nature, Science, Cell Metabolism, Circulation Research, European Heart Journal, PNAS, Diabetes, Hypertension, Cardiovascular Research, ATVB, Stroke, Kidney International*** with >32200 Google scholar citations (h-index of 93).

Topic:

Pollutants and Vascular and Metabolic Dysfunction
Date: 7 July 2023 Time: 11:00 – 11:20

Abstract:

Healthy vascular endothelium is the critical player in maintaining vascular homeostasis through releasing several vaso-protective substances called endothelium-derived relaxing factors (EDRFs) such as nitric oxide. By contrast, loss of EDRFs in diseased endothelial cells unmasks the vaso-harmful impact of endothelium-derived contracting factors (EDCFs) such as vaso-constrictive prostanopids. Such disrupted balance between EDRFs and EDCFs in endothelium is referred to endothelial dysfunction, an important initial pathological event that triggers pathogenesis of vascular diseases in hypertension and diabetes. Increased production of reactive oxygen species (ROS) or raised oxidative stress in the vascular wall is probably the key factor to inactivate nitric oxide within endothelial cells. Understanding and targeting the sources of ROS is effective to increase the bioavailability of endothelium-derived nitric oxide, thus improving endothelial function in cardio-metabolic diseases. Air pollutants increase oxidative stress in blood vessels and impair endothelial function, which may account for the pathogenic involvement of air pollutants in cardiovascular and metabolic diseases.

Speaker

Dr Tong LIU

Assistant Professor
Lee Kuan Yew School of Public Policy, National University of Singapore, Singapore

Biography:

Tong Liu is an Assistant Professor at the Lee Kuan Yew School of Public Policy at the National University of Singapore. His research focuses on the causes and consequences of environmental, development, and health issues in developing and developed economies with an interdisciplinary perspective from economics and science to facilitate sustainable development. The topics include human capital accumulation, information provision, technology, regulation, and inequality. Previously, he was a Research Assistant Professor at The Hong Kong University of Science and Technology (HKUST) and a Postdoctoral Fellow at Stanford University.

Topic:

Feel the Burn: Mental And Behavioral Responses To Air Pollution In China
Date: 7 July 2023 Time: 11:20 – 11:40

Abstract:

This paper examines the causal impacts of air pollution from agricultural straw burning on mental health measured by Center for Epidemiologic Studies Depression Scale (CES-D) in China in 2013 and 2015. Summer straw burning primarily elevates particulate matter (PM) concentrations in Chinese cities, which makes urban non-farmers more depressed. Conditional on individual fixed effects and weather conditions, if the number of straw fires detected by satellite increases by 10 points or 1 standard deviation (SD) in a prefecture, the mental health status of urban non-farmers will be worsened by 1.28 units (0.25 SD) or 0.17 units (0.03 SD). A 10 $\mu g/m^3$ or 1-SD increase in PM_{10} will impair mental health by 0.27 units (0.05 SD) or 0.73 units (0.14 SD). A back-of-the-envelope calculation shows that the monetary mental health losses due to straw burning can be as large as 2.6 billion USD in urban China. In contrast, rural farmers feel happier when there are more straw fires, especially local fires, revealing the agricultural gains from straw burning for the farmers. In response to straw burning, Chinese citizens adopt avoidance behaviours, such as searching and purchasing anti-haze masks and air filters in autumn but not in summer. This study is among the first to document a causal impact of air pollution on mental health, highlighting the urgency of restraining straw burning in China and other agrarian regions worldwide. The evidence further helps explain the failure of the command-and-control regulations which ban straw burning but neglect the potential losses to the farmers, calling for incentive-based policies such as subsidizing straw recycling to improve the welfare of both rural and urban residents.

Workshop 2: Large Floating Infrastructure

Session Chairs: Prof. Xiao Lin ZHAO (Day 1)
Prof. Xiaoli DING (Day 2)

Date & Time: 6 July 2023; 14:00 – 18:00
7 July 2023; 09:00 – 12:00

Venue: FJ302, 3/F, Core F

Invited Keynote

Prof. Chien Ming WANG

Transport and Main Roads (TMR) Chair Professor of Structural Engineering
School of Civil Engineering, The University of Queensland, Australia

Biography:

Prof. C.M. WANG is Professor in Structural Engineering, The University of Queensland. He is a Fellow of the Australian Academy of Technology and Engineering, and a Fellow of Academy of Engineering Singapore. His research interests are in the areas of structural stability, vibration, optimization, and Mega-Floats. He has published over 490 journal papers and co-authored 10 books such as ***Very Large Floating Structures, Shear Deformable Beams*** and ***Plates and Exact Solutions for Buckling of Structural Members***. He is an Editor-in-Chief of the ***International Journal of Structural Stability and Dynamics*** and an Editorial Board Member in several journals including ***Engineering Structures, International Journal of Applied Mechanics***, and ***Structures***. Currently, he is the Leader of the Offshore Engineering Program of the Blue Economy Cooperative Research Centre that conducts research projects that combine seafood, renewable energy and offshore engineering, underpinned by a $70 million cash investment from the Australian Government and $259 million from industry partners over a 10-year period. He is a Council Member of the Society of Floating Solutions Singapore and the Chairman of East Asia Pacific Conference on Structural Engineering and Construction steering committee. He has won many awards that include the 2019 Nishino Medal, 2019 JN Reddy medal, IStructE Singapore Structural Awards, Keith Eaton Award, Lewis Kent Award, IES Prestigious Engineering Achievement Award, and the Grand Prize of the Next Generation Container Port Challenge. He was the consultant and advisor on many structural and floating projects that include the world's largest floating performance stage at Marina Bay, multi-purpose floating structures research project funded by the Land and Liveability National Innovation Committee and JTC Corporation, and HDB project on floating wetlands. He is currently conducting research on the next generation offshore fish pens and seaweed cultivation platforms.

Topic:

Floating Infrastructure for Offshore Aquaculture Farms
Date: 6 July 2023 Time: 14:00 – 14:30

Abstract:

This talk is concerned with advances in research and developments on floating infrastructure for offshore aquaculture farms. Most marine aquaculture currently takes place in nearshore sheltered waters for easy access from the shore and protection from strong waves and currents. So, aquaculture farm operators can keep their infrastructure, operations and maintenance costs relatively low as well as to minimize the risk of damage to their farms during storms. However, nearshore aquaculture has to compete with other coastal activities such as shipping, fishing, tourism, conservation and recreation. To deal with the limited and contested nearshore space issue, aquaculture operators worldwide are planning to move their farms to more exposed or offshore sites. Moreover, these spacious sites provide better water quality and lower temperature which are important to the health of aquatic animals such as fish; and the strong waves and currents help to disperse waste, reduce biofouling, and avoid coastal ecosystem degradation often seen in nearshore aquaculture farms. In the talk, we first discuss the challenges encountered in offshore fish and seaweed farms. This is followed by a summary of recent advances and research needs in developing floating infrastructure (platforms, fish pens, mooring line systems) for offshore fish farming and seaweed cultivation.

Invited Keynote

Ir Bart ROEFFEN

Co-Founder
Blue 21, The Netherlands

Biography:

Bart ROEFFEN is architect and Co-Founder/CTO at Blue21, a global leader in floating structures technology from the Netherlands. He has been working on the topic of floating cities since 2007. Bart ROEFFEN was the main architect of the Floating Pavilion Rotterdam, a building which has become an international icon of climate adaptation. Last year the building was mentioned in the 2022 IPCC report as an example of transformative climate adaptation. As Chief Technology Officer at Blue21, Bart is inventor on two patents of innovative floating structures (one of which is pending), and he was one of the two main developers of HydroMEC+, the world's first 3D simulation software toolkit for maritime analysis and engineering of floating architecture projects.

Topic:

Upscaling Floating Structures Technology for Climate Resilient Urban Development to Address Land Scarcity
Date: 6 July 2023 Time: 14:30 – 15:00

Abstract:

The potential of floating structures to provide climate resilient living space has recently been acknowledged by the United Nations and IPCC. Rapid urbanization, rising food demand, land degradation and increasing biofuel demand are putting pressure on available land, while coastal areas are under increasing threat by sea level rise. Floating structures provide a climate-proof solution that is more sustainable than traditional land reclamation. These structures consist of a buoyant foundation (substructure) which can support infrastructure, public space and buildings (superstructures). The technical feasibility of small-scale floating structures has been demonstrated in projects all over the world, supporting various functions such as housing, recreation, and energy production. However, in order to address societal challenges, this technology requires scaling up. What is needed to apply this proven technology at a much larger scale are: (1) technical and design innovations (including urban design, platform connections, manufacturing methods, wave and motion control), (2) integrated research (including governance, technical, social and ecological studies), (3) changes in government policy (e.g. spatial planning, building codes), (4) investments and financing and (5) social and political acceptance of large scale floating structures. These insights are needed to move from 'proof-of-concept' to 'proof-of-scale'.

Drawing on more than 15 years of experience and by presenting floating construction projects and R&D projects, Bart ROEFFEN, CTO at Blue21, will illustrate the aspects above with a focus on the required technical and design innovations for the upscaling of floating structures, which is a promising technology to address land scarcity in a climate resilient way in Hong Kong.

Speaker

Prof. Bin CHENG

Professor
Department of Civil Engineering, Shanghai Jiao Tong University, China

Biography:

Prof. Bin CHENG, Professor at the Department of Civil Engineering, Shanghai Jiao Tong University, received his BEng degree from Shanghai Jiao Tong University, MEng and PhD degrees from Tongji University. His research interests cover deep-water floating bridge and high-performance steel bridge. Prof. CHENG was the PI of one National Key R&D Program project and four National Natural Science Foundation projects. He has published more than one hundred scientific journal papers, including 45 SCI indexed papers as the first or corresponding author, and was granted 17 invention patents. The research achievements were awarded as the First Prize of Shanghai Science and Technology Progress Award (Ranked first, 2022) and the First Prize of Science and Technology Award of China Highway and Transportation Society (Ranked first, 2021). He also received Chang Jiang Scholars Program (Young Scholar) and Shanghai Academic Research Leader, Shanghai Youth May Fourth Medal, and Innovation Talent Award of China Steel Construction Society.

Topic:

Advances in Research and Application of Deep-Water Floating Bridges
Date: 6 July 2023 Time: 15:00 – 15:30

Abstract:

The deep-water floating bridge is a kind of bridge structure which bears the dead weight and live loads with buoyancy. It has obvious advantages in the construction environments of wide and deep water, as well as weak foundation. In this report, the history of floating bridges is first reviewed, and the structural systems of floating bridges are summarized. Furthermore, the researches and applications of deep-water floating bridges are introduced by focusing on the structural dynamic response, field monitoring, floating deep-water foundation, as well as the vibration and fatigue of anchor cable. The future research directions of the deep-water floating bridge are also recommended.

Speaker

Ir Raymond IP

Deputy Head of Sustainable Lantau Office
Civil Engineering and Development Department, Hong Kong Special Administrative Region Government, Hong Kong SAR

Biography:

Mr Raymond IP is a chartered civil engineer who is currently the Deputy Head of Sustainable Lantau Office (Works) of Civil Engineering and Development Department (CEDD). After graduating from The University of Hong Kong in 1998, Ir IP joined the Government as a Civil Engineering Graduate. Since then, he has gained 25 years of practical experience of managing engineering projects in different departments and bureau. Over the years, he was actively involved in various large-scale infrastructure projects including Penny's Bay Development, Liantang/Heung Yuen Wai Boundary Control Point and Enhancing Land Supply Strategy. He also obtained a master's degree in Maritime Engineering from The University of Liverpool in 2009. In 2018, Mr IP assumed the post of Chief Engineer in Drainage Services Department to take charge of district administration and maintenance of drainage assets. After re-joining CEDD in 2020, Mr IP steers his branch to spearhead various major projects including Kau Yi Chau Artificial Islands, Road P1 and Sunny Bay Reclamation, oversee the infrastructure works under the Tung Chung New Town Extension, and undertake the local improvement works in Tai O.

Topic:

Possible Floating Structures in Kau Yi Chau Artificial Islands
Date: 6 July 2023 Time: 15:30 – 16:00

Abstract:

Kau Yi Chau Artificial Islands (KYCAI) will provide about 1 000 hectares of land for meeting part of the medium to long-term land requirement in Hong Kong. It is located at a strategic position within the expanded Harbour Metropolis, providing an ideal opportunity to plan a new set of transport infrastructures with a view to improving Hong Kong's overall transportation network.

The KYCAI comprises three islands, which forms a Y-shaped channel separating the islands. The Y-shaped channel can effectively cope with the impact of reclamation on water quality and ecology by maintaining sufficient water flow velocity in the nearby waters.

To minimise the disturbance of seabed and the associated ecological impact, floating structures would be actively explored in the course of design development. A pilot trial of floating structure is being implemented at Tung Chung East reclamation area in collaboration with The Hong Kong Polytechnic University, which will pave the way for its possible applications in the future KYCAI.

Invited Keynote

Dr Kwanghoe JUNG

Professional Engineer and Chief Researcher
HYUNDAI Engineering & Construction, Korea

Biography:

Dr JUNG is a Professional Engineer and Chief Researcher in HYUNDAI Engineering and Construction who has over 20 years design and construction experience on the distinguished structure such as a steel-concrete hybrid bridge, an offshore platform for CCS (Carbon Capture Storage), a specific prestressed system for nuclear power plant and LNG tank as well as a large concrete floating structure.

In 2012, he received his Ph.D from the School of Civil and Environmental Engineering in Yonsei University with his thesis "Structural Safety and Serviceability Evaluation for the New Connection System of Hybrid Truss bridges". Also, from 2016 to 2020, he was a project leader of collaborative research projects with NTU in Singapore and Queensland University in Australia, regarding to the simulation and hydraulic test as well as the design and construction method for a large concrete floating structure.

Since 2020, he has been in charge of the smart construction group leader in HDEC which has a goal to enhance the construction efficiency and safety using digital technologies such as ICT, AI, Robotics etc. and HIOS (HYUDAI IoT Safety System), AI safety prediction system, digital site management system and site patrol system by SPOT were already developed and applied in the real construction site.

Topic:

Design and Construction of the Concrete Floating Pier in Golden Harbor, Incheon
Date: 6 July 2023 Time: 16:20 – 16:50

Abstract:

There are two 200m long floating piers for berthing car ferries in Golden harbor, Incheon, South Korea. Each floating pier has almost same dimensions but these piers are made of steel and concrete, respectively. This paper focus on the design and construction of a concrete floating pier. In the design, it was proposed as an alternative instead of a steel floating pier having two inner moorings and separated three parts (L: 66mx3ea). So it was composed of only one structure (L: 200m) without inner mooring dolphins, not only to maximize the use of top-side space but also to minimize the number of mooring dolphins. In the construction, the modular construction method fabricating concrete segments on land and assembling them as modules on the seawater was applied instead of the conventional method using a big floating dock not only to increase the construction efficiency but also to enhance the concrete quality of modules. More detail considerations of this design and construction are explained in this paper.

Speaker

Mr Rick LAM

Co-Founder and Director
Architecture Commons, Hong Kong SAR

Biography:

Mr Rick LAM is the Co-Founder and Director of Architecture Commons. He received his bachelor degree from HKU and his graduate degree from Harvard. He has extensive work experience in Hong Kong, Tokyo, Boston, and New York on projects that span every scale. In the past several years in Hong Kong, Rick has been working with the government, non-profits, NGOs and the private sector tackling a mixture of deep-rooted social issues, from alienated youth, elderly care, environment, to health and education – most notably the Former Fanling Magistracy Revitalization, Taipo Youth Hostel, and Stanley Outdoor Training Centre that have won awards from the American Institute of Architects. Rick is a recipient of the 40-under-40 Award, and also a studio instructor in the Masters Architecture Programme in The Chinese University of Hong Kong.

Topic:

Green on Blue – Alternative Development Strategy via Pontoons in Hong Kong
Date: 6 July 2023 Time: 16:50 – 17:20

Abstract:

The city of Hong Kong throughout history owes much of her development and prosperity to the surrounding bodies of water. From the macroscopic relationship with the Pacific Ocean to the strategic position at the mouth of the Pearl River Delta / Greater Bay Area, water continues to sustain our region in terms of food, economy, and climate conditioning. We have entered the era where sustainability should be the foremost concern of development, and given the ecological and economic burden imposed by landfill, alternative strategies such as pontoon should be considered to lower the impact to our coastlines and water bodies. In our study, pontoon is not merely a land making solution but rather it is filled with opportunities to enhance greening and availability of open space, conserve coastal biodiversity, promote active lifestyle, and all in all, elevate the living standards for both land bound and water bound neighbourhoods. This presentation will explore the conceptual technical aspects of pontoon settlement and human centric design strategies that can re-define our city's relationship with the precious water bodies.

Speaker

Prof. Zhenyu YIN

Professor
Department of Civil and Environmental Engineering, The Hong Kong Polytechnic University, Hong Kong SAR

Biography:

Prof. Zhen-Yu YIN, currently full Professor of Geotechnical Engineering at The Hong Kong Polytechnic University. He received his BEng from Zhejiang University, MSc and PhD from Ecole Centrale de Nantes (France) in 2003 and 2006. He has published over 200 SCI papers with an H index of 53 according to WoS. He is Associate Committee Member of Granular Materials Committee of ASCE; Associate Editor of ***European Journal of Environmental and Civil Engineering and Geotechnique Letters***; and Editorial Board Members of some top journals (***Canadian Geotechnical Journal, International Journal of Geomechanics ASCE, Computers and Geotechnics, Soils and Foundations, Acta Geotechnica, Transportation Geotechnics***, ***GeoRisk***, etc.).

Topic:

Offshore Caisson Foundation in Sand: From Numerical Modelling to Macroelement Design Tool
Date: 6 July 2023 Time: 17:20 – 17:40

Abstract:

This work deals with the response of caisson foundations in sand for offshore wind turbines submitted to combined monotonic and cyclic loadings. First, the failure process and failure envelope (or bearing capacity diagram) of a caisson foundation in sand under combined monotonic loadings is numerically investigated. A Combined Lagrangian-Smoothed Particle Hydrodynamics (CLSPH) method is adopted to consider large deformation. A recently developed critical state model for sand (SIMSAND) is then introduced and combined with the CLSPH method. Different parameters affecting the shape and size of the failure envelope are considered, as soil density and stiffness, friction strength, grain breakage, geometry and aspect ratio of the foundation. An analytical formula is introduced to describe the 3D failure surface reproducing the numerical results. Based on the proposed analytical formula, a macro-element for the caisson foundation in sand submitted to monotonic and cyclic loadings is finally developed within the framework of hypoplasticity. Validation is provided through comparison with experimental results.

Speaker

Prof. Hongbin LIU

Chair Professor
Department of Ocean Science, The Hong Kong University of Science and Technology, Hong Kong SAR

Biography:

Prof. LIU obtained his PhD in Oceanography from University of Hawaii in 1997. He joined HKUST in 2005 and was conferred the Chair Professor title in 2021. Prof. Liu is a distinguished scholar in biological oceanography, specialized in marine microbial ecology and biogeochemical cycling. His current research interests cover broad spectra in marine science, including microbial diversity and metabolic functions, microbial food web dynamics and carbon and nitrogen cycling, global change biology, and environmental stress in estuarine and coastal ecosystems.

Prof. LIU serves as editor or editorial board member for a number of international journals and the guest editor for six special volumes in the field of marine sciences. He is a Member of the American Geophysical Union (AGU), American Society of Microbiology (ASM) Association for the Sciences of Limnology and Oceanography (ASLO) and is elected ASLO Fellow in 2019. He has served as the Chair of the Gordon Research Conference – Marine Molecular Ecology in 2015. He also serves in various panels of Hong Kong SAR government, including the Red Tide Expert Advisory Group (RTEAG), Dumping at Sea Appeal Board Panel, and Water Pollution Control Appeal Board Panel.

Topic:

Main Environmental Issues Associated with Floating Structures
Date: 6 July 2023 Time: 17:40 – 18:00

Abstract:

A large floating structure on aquatic systems will undoubtedly affect the surrounding environment, which could be both positive and negative. On the positive side, it may provide habitats for marine fish and benthic fauna. The presence of the submerged surfaces of floating objects in water bodies provides large underwater surfaces that become available for filter feeders and other benthic organisms to colonize; they filter out suspended plankton, leading to less turbid and clean water. On the negative side, studies show lower dissolved oxygen concentrations and higher temperature measured underneath the floating structures. The decomposition of bio-depositions of dead organisms increases the oxygen demand and nutrient/carbon load at the bottom of the water body, which could lead to deterioration in water quality. The changes to the habitat conditions may lead to undesired proliferation of invasive species that take over the existing ecosystem. Moreover, the floating structure may dampen or alter the water current, promoting sedimentation. Finally, pollutant released from the structure and human activity may affect the water quality around the floating structure. However, the quantitative and long-term environmental impact of floating structures on aquatic systems is still lacking.

Invited Keynote

Prof. Tomoaki UTSUNOMIYA

Professor
Department of Marine Systems Engineering, Kyushu University, Japan

Biography:

Prof. Tomoaki UTSUNOMIYA is currently a Professor at Department of Marine Systems Engineering, Kyushu University, Japan. His research interests have been in the areas of fluid-structure interactions, dynamics of offshore structures, hydroelastic analysis of Very Large Floating Structures (VLFS), dynamics of floating bridges, and dynamics of floating offshore wind turbines. He has been actively working for development of floating offshore wind turbines (FOWTs); the developed FOWT of a hybrid-spar type has been commercialized as the first grid-connected floating wind turbine in Asia-Pacific.

Topic:

Examples of Floating Infrastructure in Japan - Yumemai Floating Bridge in Osaka and Floating Offshore Wind Turbine in Goto Islands
Date: 7 July 2023 Time: 09:00 – 09:30

Abstract:

Floating structures may be utilized as important civil infrastructures. In this talk, two such examples in Japan will be presented. The first one is "Yumemai Floating Bridge" in Osaka bay. This floating bridge is an arch bridge having two rectangular pontoons. It has a unique feature that can open the navigation channel by swinging around a pivot axis in case of accident in the channel. The second one is "Spar-type Floating Offshore Wind Turbine" in Goto Islands. This is the first grid-connected floating wind turbine in Japan (and in Asia-Pacific). It mounts 2-MW wind turbine whose rotor diameter is 80 meters. It is the outcome of the demonstration project by Ministry of the Environment, Japan. The outline of the demonstration project will also be given.

Speaker

Ir Prof. Chi-sun POON

Michael Anson Professor in Civil Engineering
Chair Professor of Sustainable Construction Materials
Head of Department of Civil and Environmental Engineering
Director of Research Centre for Resources Engineering towards Carbon Neutrality
The Hong Kong Polytechnic University, Hong Kong SAR

Biography:

Ir Prof. POON is Michael Anson Professor in Civil Engineering, Chair Professor of Sustainable Construction Materials and Head of the Civil and Environmental Engineering Department of HK PolyU. He specialises in the teaching and research of civil engineering materials, eco-friendly construction materials and waste management. He is a Fellow of the Hong Kong Institution of Engineers and the Hong Kong Concrete Institute and has been serving actively in various professional and government bodies and committees. He is a pioneer in the research on valorising different types of wastes as construction materials. His extensive publications in the area make him one of the leading scholars in this field. He has a Google Scholar H-index of >100. According to metrics compiled by Stanford University, Prof. POON is listed among the top 2% of the world's most highly cited scientists in the field of Building & Construction. He was appointed Changjiang Scholar Chair Professor in 2017 and awarded the State Technological Innovation Award in 2017 (2nd Class).

Topic:

Light-Weight High-Performance Concrete for Floating Structures
Date: 7 July 2023 Time: 09:30 – 10:00

Abstract:

Developing floating structures is a promising strategy to alleviate the land shortage in Hong Kong. This paper aims to introduce a novel method to design low-carbon high-performance, lightweight concrete (HPLC) towards efficient application for floating structures. To enhance the mechanical properties and durability of lightweight concrete, three strategies have been attempted: the use of a good-quality binder matrix, the selection of proper lightweight materials, and the addition of fibres. An ultra-high-performance cementitious composite (UHPC) was used as a binder to combine with different types of lightweight aggregates (LWA), which produced an HPLC with high structural efficiency, good thermal insulation, low autogenous shrinkage and permeability. In addition, micro-sized hollow glass microspheres were used to design a new ultra-high-performance, lightweight concrete (UHP-LWC) with high structural efficiency (compressive strength > 120 MPa, density ≈ 1800 kg/m^3). Using glass microspheres with a highly stiff shell improved the fundamental properties of the UHP-LWC, including thermal insulation, sound absorption, resistance to water ingress and electrical resistivity.

Speaker

Prof. Peng FENG

Professor
Department of Civil Engineering, Tsinghua University, China

Biography:

Prof. Peng FENG is Head of Department of Civil Engineering, Tsinghua University. He received his B.S. degree (2000) and Ph.D. degree (2005) in Civil Engineering from Tsinghua University. Afterwards, he went to Composites Lab of Lehigh University as a research scientist. He returned to Tsinghua University in 2005 and has remained ever since. During his research life, he has been a visiting scholar to The Hong Kong Polytechnic University, ***École*** Polytechnique ***Fédérale*** de Lausanne (EPFL), University of Wollongong, and the University of Illinois at Urbana-Champaign.

Prof. FENG works on a wide range of inter-disciplinary engineering innovation, especially on structural technologies with emerging materials, systems and construction for civil engineering. His research interests include high performance fibre-reinforce polymer (FRP) composite structures, concrete material and structures, and advanced construction technology. He has authored/co-authored more than 100 international journal papers, 70 Chinese journal papers and about 100 conference papers leading to about 6,000 citations and H-index 40 according to Google Scholar Citations. He is the inventor of 22 patents on novel structural technologies. Prof. FENG is the project leader of an ISO standard and the Chair of four Chinese National Standards, also is the committee member of 15 relevant codes/standards. He is a frequent speaker in international/national conferences and seminars, and he gave 35 keynote or invited lectures in the last twelve years. Prof. Feng's research contributions have been recognized by a number of honours, including IIFC Fellow, Chang Jiang Scholar, and Xplore Prize.

Topic:

Novel FRP Prestressed Concrete Assembled Floating Structure like Bamboo Raft
Date: 7 July 2023 Time: 10:00 – 10:30

Abstract:

With the economic development of coastal cities and the progress of ocean engineering technology, offshore platform will enter a rapid growth. In order to improve the construction efficiency of offshore engineering and extend the service life of offshore platforms, a novel fibre-reinforced polymer (FRP) prestressed concrete assembled floating structure like bamboo raft is presented. The concept is a new VLFS type emerging from bamboo rafts, a traditional Chinese transport. Longitudinal bamboo is replaced with concrete pipes and transverse bamboo is replaced with connecting beams. Corrosion-resistant FRP composites are utilized to improve life span. Compared with traditional VLFS, the new structure has the following advantages: high design freedom, outstanding durability, low crack control level, and high efficiency in construction. In this presentation, the structure and construction scheme of the assembled floating structure will be introduced in detail. Further, the structural performance calculated by structural analysis and hydrodynamic analysis will be discussed. Structural analysis is conducted under prestressed and hydrostatic condition using finite element method. Hydrodynamic analysis is conducted under different wave directions, wave periods and structure sizes using FE-BE method.

Invited Keynote

Mr Anil THAPAR

Executive Director
Paaras Marine Solutions Pte. Ltd, Singapore

Biography:

Mr Anil THAPAR is Naval Architect with combined experience of more than 30 years in a range of multi-disciplinary projects that include floating structures. Currently, he is Executive Director at Paaras Marine Solutions Pte Ltd, Singapore.

He has been involved in design and implementation of different types of floating structures such as modular 120m x 83m Floating Platform at Marina Bay in Singapore, Floating Platform at landfill facility at Semakau in Singapore, specialised floating structures designs such as floating villa (Maldives), Floating Pier (Timor-Leste), Floating Berths for yacht marina and coast guard boats, and Very Large Floating Structure (VLFS) for storage of oil products and petrochemicals and floating solar farms.

Anil is Founding Member of the Society of Floating Structures (Singapore) and Associate Member of the Society of Naval Architects, New Jersey.

Topic:

Trends of Application of Floating Structures in South-East Asia
Date: 7 July 2023 Time: 10:50 – 11:20

Abstract:

Proximity to water, whether coastline or riverbanks, has influenced development of civilisations. Rivers and oceans addressed food security aspects such as irrigation for agriculture and fishing as well as connectivity for trade to other population centres. Floating structures have traditionally been used in South-East Asia for various applications. These range from floating markets in Thailand to floating houseboats in South-East Asian countries.

Given the changes in key drivers such as increase in population with resulting higher demand for land and rising sea levels that is impacting coastal societies, new trends are emerging for application of Floating Structures. These applications are being developed to address different requirements such as industrial, habitation, food security or even social. Inherent advantages of floating structures over land based fixed structures e.g., flexibility about relocation to different sites, scalability, ability to withstand effects of climate change such as rise in sea water levels are being realised in recent times. Positive environmental impacts with improved sustainability options are part of the trend of applications of floating structures.

Speaker

Prof. Xin WANG

Professor of School of Civil Engineering
Vice Dean of International Institute for Urban Systems Engineering
Southeast University, China

Biography:

WANG Xin is a Professor in School of Civil Engineering and Vice Dean of International Institute for Urban Systems Engineering at Southeast University, China. His research interests comprise the long-term behaviour and life prediction of FRP composites and high performance and longevity structural system with FRP. He has led/is leading over 10 key projects including two National Key R&D Plan, five National Science Foundation, National Key Technology R&D Program, and etc. Prof. WANG has published over 160 academic papers including 130 SCI-indexed journal papers and two books. His h-index in Scopus is 29 and total citation is over 3200. He also owned 35 patents. He has edited 12 ISO/National/industrial codes/specifications. He obtained several awards such as the distinguished young scholar of composites and structures for construction engineering, first prize award from the Ministry of Education, China, etc. He is serving as the Vice-Chair of FRP Application Committee of CCES and the Council Member of International Institute for FRP in Construction (IIFC), EC Member of International Society for Basalt Fiber and Composites, and several national committees of FRP. He has co-chaired FRPRCS-12 and APFIS-2015 joint international conference. His research output has been applied in several key constructions including Huang Maohai cross sea bridge-West link of Hong Kong Zhuhai Macao Bridge, Sichuan Tibet Railway Bridge, Nanjing Yangzi River bridge, and the island tower in South China Sea, etc.

Topic:

Design and Development of Coiled FRP Rope for Offshore Platform
Date: 7 July 2023 Time: 11:20 – 11:40

Abstract:

To overcome the limitations of conventional steel rope such as heavy self-weight, corrosion and synthetic fibre rope, including ease of wear and large creep rate for the lifting systems in offshore platform, the FRP rope is developed to achieve corrosion resistance and superior long-term performance. However, conventional FRP although shows superior strength and stiffness along the fibre directions, it is very difficult to be coiled due to the limitation of the matrix and fibre layout direction, which makes it not suitable to be lift system rope. The studies from the matrix of fibre and twisting of single tendon of the rope were conducted to overcome above disadvantages. The different toughening materials, twisting length, layout of tendons were studied by experiments and FEM focusing on their mechanical properties and coiling behaviour. The results show that by using toughening material, the elongation of the matrix of FRP can be enhanced around 30% and their elastic modulus is lowered 47% compared to the control EP resin, which makes FRP easier to be bent. The strength and modulus of FRP with modified resin maintain constantly with the control one while the bending performance shows significant improvement. The strength of the rope exhibits increase with the increase of twisting length. By using FEM simulation, the relationship among the mechanical properties and friction coefficient, single tendon diameter, twisting length and layout are clarified. As a result, the coiled FRP rope are developed which achieves a tensile strength of 80-90% compared to conventional FRP cable and coiling diameter decrease from 150 to 20 times of the diameter.

Speaker

Prof. Xiao Lin ZHAO

Chair Professor of Civil Infrastructure
Department of Civil and Environmental Engineering, The Hong Kong Polytechnic University, Hong Kong SAR

Biography:

Prof. X. L. ZHAO is the Chair Professor of Civil Infrastructure in the Department of Civil and Environmental Engineering at The Hong Kong Polytechnic University. He is a Fellow of the Australian Academy of Engineering and Technology. He held the Chair of Civil Engineering from 2001 to 2019 and then the Head of Department of Civil Engineering from 2008 to 2011 at Monash University, Australia. Before joining PolyU, Prof. ZHAO was the Associate Dean (International) in the Faculty of Engineering at the University of New South Wales, Australia. His current research focuses on high-performance sustainable materials in civil engineering applications, steel-concrete-FRP hybrid construction and floating structure technology. Professor ZHAO has published 9 books and over 400 refereed journal papers. He has supervised more than 50 PhD students.

Topic:

Developing Floating Structure Technology (FST) for Hong Kong's Sustainable Growth and Liveability
Date: 7 July 2023 Time: 11:40 – 12:00

Abstract:

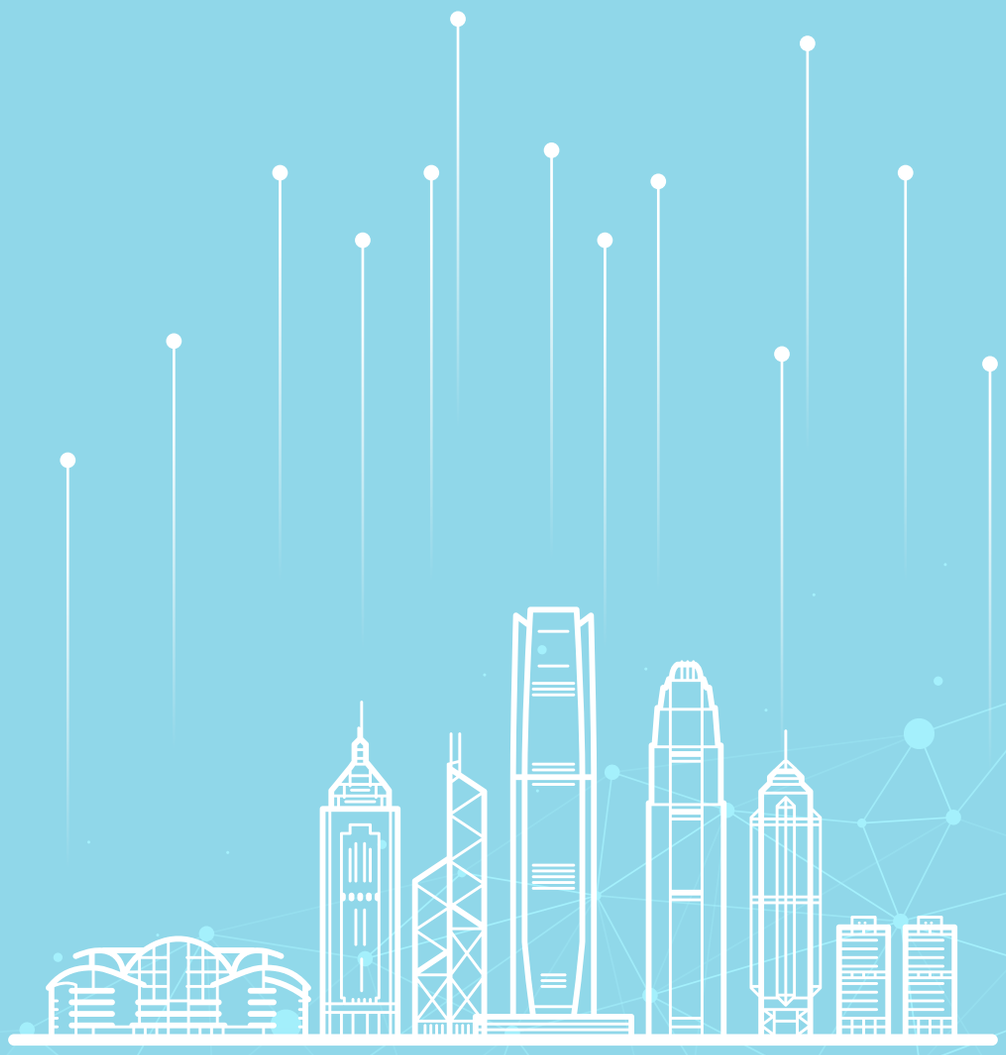
This talk presents a vision for developing Floating Structure Technology (FST) for Hong Kong's sustainable growth and liveability. It highlights the key features of FST, particularly the adoption of a hybrid approach combining both floating structure solutions and conventional land reclamation for the creation of habitable land from the sea. The challenges and opportunities in deploying such a hybrid solution will be addressed. These include innovative and durable materials; optimal floating platforms to carry a range of superstructures designed to meet various spatial programmatic and functional requirements and sites at different water depths; connection systems; stability of floating structures; the ecological and environment impacts; and obtaining social acceptance.

Workshop 3: Urban Carbon Neutrality

Session Chair: Prof. Jerry YAN

Date & Time: 6 July 2023; 14:00 – 18:00
7 July 2023; 09:00 – 12:00

Venue: FJ303, 3/F, Core F



Invited Keynote

Prof. Markus KRAFT

Director
Cambridge Centre for Advanced Research and Education, Singapore

Professor
Department of Chemical Engineering and Biotechnology, University of Cambridge, UK

Biography:

Prof. KRAFT researches data-driven modelling, machine learning, and semantic web technologies and has pioneered the World Avatar – an all-encompassing knowledge graph approach to developing a dynamic world model. He co-edited the book ***Intelligent Decarbonisation*** which comprehensively assesses the current and future impact of digital technologies and artificial intelligence on the decarbonisation of key economic sectors. He is a Fellow of Churchill College and a Professor in the Department of Chemical Engineering and Biotechnology at the University of Cambridge. He also is the Director of the Cambridge Centre for Advanced Research and Education in Singapore (CARES), the University of Cambridge's first overseas research centre, based at CREATE.

Topic:

Big Data and Climate Change: How Cities Can Become More Resilient and Efficient
Date: 6 July 2023 Time: 14:00 – 14:30

Abstract:

This presentation focuses on the potential of big data and digitization to enhance the resilience of cities in the face of climate change and extreme weather events, while also supporting decarbonization efforts. It highlights the growing importance of integrating big data and digital technologies into city planning and management to improve climate risk assessments, early warning systems, and the monitoring and response to extreme weather events. The presentation also discusses how digital technologies can facilitate the deployment of renewable energy and energy-efficient building systems, thereby contributing to decarbonization. It concludes by emphasizing the need for policymakers, urban planners, and researchers to prioritize the use of big data and digital technologies in promoting climate resilience and decarbonization in cities.

Invited Keynote

Prof. Jianping WU

Professor of School of Civil Engineering
Director of Tsinghua University-University of Cambridge-Massachusetts Institute of Technology Future Transport Research Center
Tsinghua University, China

Biography:

Prof. Jianping WU, PhD, Professor in the School of Civil Engineering at Tsinghua University, China, Director of Tsinghua University-University of Cambridge-Massachusetts Institute of Technology Future Transport Research Center, Academician of Russian Academy of Engineering, the "Chang Jiang Scholar" Professor of Ministry of Education of China. Professor WU received his bachelor's and master's degrees in Civil Engineering at Zhejiang University, China, and his PhD degree in Transportation Engineering at University of Southampton, UK. His research interests include: i) driving behaviour and traffic simulation, ii) autonomous driving and simulation tests, and iii) sustainable future transportation systems. His latest innovative research results are: i) the invention of on-line traffic simulation platform, which evolves traditional traffic simulation from an offline assessment tool of traffic flow into an online traffic management tool; ii) the invention of closed-loop testing technology for autonomous driving vehicles under combined virtual and real testing environments, which will increase the efficiency of autonomous driving vehicles tests by 50-200 times. He has been the main investigator for over 80 research projects and authored and co-authored over 350 papers in international journals and conferences.

Prof. WU is a Member of Environment and Engineering Committee of World Federation of Engineering Organizations, Fellow of IET (UK), Fellow of China Simulation Federation, Member of the 10th National Committee of CAST, Smart Airport Advisor to Ministry of Transport of China, Development Advisor of the Greater Bay Area of Zhejiang Province, Transport Advisers to Beijing, Hangzhou, Nanning and Haikou municipal governments.

Topic:

Autonomous Driving and the Challengers to Future City
Date: 6 July 2023 Time: 14:30 – 15:00

Abstract:

With the rapid development of information technology, communication technology and artificial intelligence technology, autonomous driving and future transport are quickly approaching to us. However, from the first true autonomous driving car on the road to the era of fully autonomous driving, there will be a period of mixed traffic of autonomous driving vehicles and human driving vehicles. How to ensure that autonomous driving vehicles and human driving vehicles live in harmony during this period and build a safe and efficient future transport system is a new challenge for future traffic managers. This speech first describes the characteristics and prospects of autonomous driving and future transport, and then predicts the impacts and changes that autonomous driving and future transport will bring to future cities and future society, and finally, analyse and predict the challenges and opportunities in the development of autonomous driving and future transport.

Speaker

Dr Xiaonan WANG

Associate Professor
Department of Chemical Engineering at Tsinghua University, China

Biography:

Dr Xiaonan WANG is currently an Associate Professor in the Department of Chemical Engineering at Tsinghua University. She received her BEng from Tsinghua University in 2011 and PhD from University of California, Davis in 2015. After working as a Postdoctoral Research Associate at Imperial College London, she joined the National University of Singapore (NUS) as an Assistant Professor since 2017 and later became an Adjunct Associate Professor. Her research focuses on the development of intelligent computational methods including multi-scale modelling, optimization, data analytics and machine learning for applications in advanced materials, energy, environmental and manufacturing systems to support smart and sustainable development. She is leading a Smart Systems Engineering research group at Tsinghua and NUS of more than 20 team members as PI and also led the Artificial Intelligence for Accelerated Materials Development programs in China and Singapore. She has published more than 130 peer-reviewed papers, organized and chaired several international conferences, and delivered more than 60 presentations and invited talks at conferences and universities on five continents. She is an associate editor and editorial board member of 10 SCI journals e.g., Applied Energy, Advanced Intelligent Systems. She was recognized as a World's Top 2% Scientists, ACS Sustainable Chemistry & Engineering Lectureship Award Winner, AIChE-SLS Outstanding Young Principal Investigator, IChemE Global Awards Young Researcher finalist and selected for Royal Society International Exchanges Award, as well several best paper awards at IEEE and Applied Energy conferences and journals.

Topic:

Harnessing the Power of Data via Smart Systems Engineering towards an Intelligent Carbon-Neutral Future
Date: 6 July 2023 Time: 15:30 – 16:00

Abstract:

In light of the pressing environmental and climate change challenges, smart novel approaches are indispensable for sustainable development towards a net-zero future. Advances in artificial intelligence (AI), especially machine learning (ML), provide an enormous variety of smart tools for processing complex data generated from experimental and computational research, as well as industrial applications. AI and ML have substantially impacted the research and development norm of new materials and processes for energy and environment. This talk will first provide an overview and perspectives on ML applications to molecule/materials discovery and synthesis, as well as environmental management. Lab-scale low-carbon materials and processes research enabled by simulation and AI technologies driven by the integration of various cyber technologies with the physical system for rapid treatment through automation and connected entities. Active learning strategies are highlighted to incorporate ML in the high-throughput computational and/or experimental loop as an effective approach to accelerate the discovery of new materials with desired functionality such as CO_2 capture and utilization. The capability of generative AI has also influenced many scientific domains by producing new data and understanding. Multi-scale AI and Optimization technologies help energy systems achieve low-carbon sustainable development, drawing on the intelligent digital twin to assist the planning of carbon peaking and carbon neutrality roadmaps. Ultimately, these smart technologies could enable accelerated materials discovery and process optimization, thereby facilitating improvement in energy efficiency, emission reduction, and eventually the realization of net-zero emission target.

Speaker

Ir Prof. Lin LU

Professor
Department of Building Environment and Energy Engineering, The Hong Kong Polytechnic University, Hong Kong SAR

Biography:

Ir Prof. Lin LU is a highly cited researcher by Clarivate Analytics in Engineering (2018) and a World's Top 2% Scientist by Stanford University in Energy. She has published 5 books/handbook chapters and over 300 SCI-cited journal papers in renewable energy, building sciences and engineering. Her current research interests focus on smart exploitation of solar energy and deep space cooling, engineered nanomaterial development towards energy smart building envelopes, and fundamentals of fluid mechanics and heat/mass transfer to enhance building energy systems.

Ir Prof. LU has been the recipient of prestigious awards mostly as the first awardee, including 2nd class innovation award of Ministry of Education of China (2019), PolyU FCE Dean's Award for Outstanding Achievement in Research Funding (2012, 2014, 2019) and in Research (2018), PolyU FCE Dean's Award for Highly-cited Papers (2019), Highly Cited Researcher by Clarivate Analytics in Engineering (2018), 2017 Hong Kong Green Innovations Awards, TechConnect 2017 Global Innovation Award (USA), a Special Merit Award and a Gold Medal in 2017 from the 44th International Exhibition of Inventions of Geneva, etc. She is the Section Editor-in-Chief (Energy Sustainability) of ***International Journal of Sustainability*** and the Chairman of the Energy Institute (Hong Kong Branch).

Topic:

Solar Reflectance Index (SRI) Based Functional Nanomaterial Solutions to Energy Smart Building Envelope
Date: 6 July 2023 Time: 16:00 – 16:30

Abstract:

The Solar Reflectance Index (SRI) is a measure of the solar reflectance and emissivity of materials that can be used as an indicator of how hot they are likely to become when solar radiation is incident on their surface. The lower the SRI, the hotter a material is likely to become in the sunshine. For our building skins and urban skins, we should choose materials with high SRI to reduce our building surface temperatures and building energy use for space cooling; to alleviate urban heat island effect; and to reduce our city's temperature and the Earth's temperatures. SRI based green building assessment criteria and cool roof scheme will be shared towards energy smart building envelopes. In addition, our advanced spectral selective nanomaterial solutions to cooling down our buildings via passive radiative cooling will be introduced.

Speaker

Dr Yuntian CHEN

Assistant Professor
Eastern Institute for Advanced Study, China

Co-Founder
RealAI

Biography:

Yuntian CHEN is an Assistant Professor (Ph.D. Supervisor) at EIAS. His research field includes scientific machine learning and intelligent energy system. He is interested in the integration of domain knowledge and data-driven models. He graduated from the Department of Energy and Power Engineering of Tsinghua University with a dual bachelor's degree in economics from Peking University. He obtained Ph.D. degree from Peking University with merit. He was the Co-Founder of RealAI. He is a Member of the Young Editorial Board of Advances in Applied Energy.

He has published more than 20 papers, obtained 15 authorized patents, and presided over 9 projects with a total funding of 14.9 million CNY. His research has been selected as the cover article of Advanced Science. He received the Advances in Applied Energy 2021 Highly Cited Research Paper Award and was selected for the Yongjiang Talent Project.

Topic:

Scientific Machine Learning in Smart Energy
Date: 6 July 2023 Time: 16:30 – 17:00

Abstract:

Machine learning has been widely applied in the energy industry, but it still faces issues such as low model precision and robustness due to data scarcity and complex scenarios. This report explores the integration of knowledge in the energy industry with machine learning models. Knowledge embedding can break down the barriers between knowledge and data, thereby establishing machine learning models with physical common sense. Besides, human understanding of the world is always limited, and knowledge discovery can use machine learning to extract new knowledge from observations. By combining knowledge embedding and knowledge discovery, a closed loop of knowledge generation and utilization can be formed in the energy field, thus constructing smart energy models that are physically reasonable, mathematically accurate, and computationally stable and efficient. This report will discuss the progress in knowledge embedding and knowledge discovery in the field of smart energy, as well as potential applications in load forecasting and power forecasting.

Invited Keynote

Prof. Perry Pei-Ju YANG

Professor and Director of Eco Urban Lab
School of City & Regional Planning and School of Architecture, Georgia Institute of Technology, USA

Biography:

Prof. Perry YANG is a Professor and Director of Eco Urban Lab of the School of City & Regional Planning and the School of Architecture at the Georgia Institute of Technology. Prof. YANG's work incorporates urban design with ecology, data analytics and smart urban systems for shaping sustainable, resilient and socially inclusive urban spaces, focusing on Asian cities. He has published more than fifty articles and book chapters in this area during the past decade, including the book ***Urban Systems Design: Creating Sustainable Smart Cities in the Internet of Things Era*** that he co-edited and co-authored in 2020. Beyond writing, Prof. YANG has been awarded more than ten prizes in international competitions continuously from 2005 in Asian cities, including ***the 2009 World Games Park*** at Kaohsiung, Taiwan, a project opened in July 2009 and featured by CNN as an "eco-friendly" venue. From 2017 to 2023, he has been involved in smart city projects in collaboration with the University of Tokyo and Global Carbon Project (GCP). Prof. YANG served as the endowed Bayer Chair Professor of UNEP Institute at Tongji University from 2014 to 2018. He was appointed a Visiting Professor at the Department of Urban Engineering of the University of Tokyo from 2022 to 2023. Prior to joining Georgia Tech faculty, he was SPURS Fellow at MIT from 1999 to 2000, and an Assistant Professor at the Department of Architecture of the National University of Singapore from 2001 to 2008.

Topic:

Incorporating Data Analytics into Urban Systems Design for Carbon Neutrality
Date: 7 July 2023 Time: 09:00 – 09:30

Abstract:

Future cities development is becoming data-driven in the context of data science, pervasive computing, internet of things (IoT) and urban automation. The emerging technologies are changing models of future urban living in the post-cyber space era. Ideas and methods for designing of zero carbon smart cities are urgently needed. They consist of smart homes, creative work places, interactive public spaces and critical infrastructure systems that are becoming situational, and have to be more adaptable and resilient for future changes. The talk introduces emerging models of smart cities development in Asian primate cities, including Tokyo, Singapore and Hong Kong. It explores future urban living in the face of global climate change, radical urban changes and impacts of emerging technologies to cities development. Asian primate cities are facing these challenges and are experimenting new models of smart cities living laboratory to reduce urban carbon emission to zero before 2050. Novel methods are to be developed to integrate city information system, creative design, systems engineering, policy and technological applications to offer solutions and strategies for addressing the above global challenges.

Invited Keynote

Prof. Fengqi YOU

Roxanne E. and Michael J. Zak Professor in Energy Systems Engineering
Smith School of Chemical and Biomolecular Engineering, Cornell University, USA

Biography:

Prof. Fengqi YOU is the Roxanne E. and Michael J. Zak Professor in Energy Systems Engineering at Cornell University. He also serves as Chair of Ph.D. Studies in Cornell Systems Engineering, Co-director of the Cornell University AI for Science Institute, Associate Director of Cornell Energy Systems Institute, Co-lead of Schmidt AI in Science Program at Cornell, and Associate Director of Cornell Institute for Digital Agriculture. His research focuses on fundamental theory and methods in systems engineering and artificial intelligence, as well as their applications to energy systems, and sustainability. Fengqi has an h-index of 76 and published over 250 refereed articles in journals such as ***Science, Nature Sustainability, Nature Communications***, and ***Science Advances***. Some of his research results have been editorially highlighted in Science and Nature, featured on journal covers (e.g., ***Energy & Environmental Science***), and covered by major media outlets (e.g., The New York Times, BBC, Reuters, The Wall Street Journal, Daily Mail, Fortune, Newsweek, BusinessWeek, New Scientist, Popular Science, and National Geographic). He is an award-winning scholar and teacher, having received over 20 major national/international awards over the past six years from the American Institute of Chemical Engineers (AIChE), American Chemical Society (ACS), Royal Society of Chemistry (RSC), American Society for Engineering Education (ASEE), American Automatic Control Council (AACC), in addition to multiple best paper awards. He is an elected Fellow of the Royal Society of Chemistry (FRSC), Fellow of the AIChE, and Fellow of the American Association for the Advancement of Science (AAAS).

Topic:

Deep Learning for Carbon Neutrality: AI Applications across Scales
Date: 7 July 2023 Time: 09:30 – 10:00

Abstract:

Recent advances in machine learning, coupled with the rapid growth of computing power and scientific data infrastructures, led to increasing interest in applying deep learning-based methods for carbon neutrality. This presentation will briefly introduce our recent efforts in developing deep learning models and relevant AI tools in the quest for sustainability and carbon neutrality. Specifically, we will first present the results of several research projects, in collaboration with experimental materials scientists, to illustrate the applications of deep learning on: (a) Integrated design of metal-organic frameworks (MOFs) and adsorption processes via rapid, in-silico screening of MOFs for economically-efficient post-combustion CO_2 capture and separation; (b) Understanding hierarchical protein assembly and developing soft sensors based on liquid crystal (LC) systems by analysing complex spatiotemporal LC optical responses indicating the phase states of multi-protein assemblies formed at interfaces through high-throughput experiments; and (c) Inverse molecular design by developing expressive representations and effective data-driven models for quantitative structure-property relationships and quantum computing-assisted automated molecular structure optimization. The second half of the presentation will focus on the multi-scale applications of deep learning in materials discovery, polymer and protein structure optimization, plastic waste management, natural resource conservation, carbon-neutral energy transition, sustainable food production, reliable power supply, and climate adaptation. The presentation will conclude with our perspectives on integrating research and educational activities and catalysing interdisciplinary collaborations to unlock unique opportunities toward a paradigm shift in AI for Science to support urban carbon neutrality.

Invited Keynote

Prof. Yingru ZHAO

Professor
College of Energy, Xiamen University, China

Vice Chairman
Fujian Electric Power Engineering Society, China

Biography:

Prof. Yingru ZHAO received her Ph.D. from the Department of Physics at Xiamen University in 2008 and worked as a Research Associate at Imperial College London from 2008 to 2011. She was selected for Lindau Project by the Sino-German Center in 2008, and was selected by the "New Century Excellent Talents Support Plan" of the Ministry of Education and the "High-level Overseas Talents Program of Xiamen City" in 2011. In 2021, she won the "Fujian Provincial Outstanding Youth Fund". Her interdisciplinary research background includes physics, chemical engineering, and energy, with a focus on modelling, simulation, optimization and decision-making of energy and power systems. She has published over 100 journal articles, edited or co-edited 10 Chinese and English monographs, and has been granted 9 patents and 3 software copyrights. She has led a total of 30 national-level, provincial-level, and commissioned projects from enterprises and institutions, and has guided the implementation of a number of smart integrated energy projects. She serves as Associate Editor of journal ***Applied Energy*** and the review journal ***Renewable and Sustainable Energy Transitions,*** as well as editorial board member of journals such as Progress in Energy, Smart Energy, etc., and as Special Editor-in-Chief of the journal ***Global Energy Interconnection.*** She also serves as Vice Chairman of the Fujian Electric Power Engineering Society. She has won national-level and provincial-level awards such as the "Applied Energy Outstanding Paper Award", "Huaxia Construction Science and Technology Award", "Fujian Electric Power Technology Outstanding Contribution Award", and "Fujian Electric Power Technology Progress Award".

Topic:

Key Technologies and Applications for Smart Integrated Energy Systems
Date: 7 July 2023 Time: 10:30 – 11:00

Abstract:

Smart integrated energy is a cutting-edge solution that embodies new technological, modelling, and business paradigms aligned with the dual carbon goal. It is also a crucial driver for developing a modernized energy framework. Integrated energy offers vital features such as high renewable energy penetration and multi-energy flow coupling. However, due to the significant fluctuations in renewable energy output and load demand, the system displays complex dynamic stochastic patterns and uncertainties. The stable, efficient, and economical performance of an integrated energy system depends on system-level optimal design and performance regulation. This strategy calls for a scientific approach to system planning and design while considering temporal and complementary characteristics between loads, capacity, and energy storage devices under various geographical and climatic conditions. Moreover, the integrated energy system relies on a variety of intelligent techniques to coordinate different supply and conversion technologies and align their application with the demand side. In managing complex participant problems, trade-offs between multiple competing objectives must be taken into account. This dynamic and spatially distributed optimization design and performance regulation based on smart integrated energy presents an innovative approach to energy management. This talk aims to introduce the research status, development trends, and challenges confronting smart integrated energy. It will focus on key technologies such as load forecasting, system design, and optimization decision-making, among others.

Speaker

Dr Haoran ZHANG

Assistant Professor
School of Urban Planning and Design, Peking University, China

Biography:

Dr Haoran ZHANG, Assistant Professor at School of Urban Planning and Design, Peking University. He got double bachelor's degrees in Industrial Engineering and Economics, and double Ph.D. degrees in Industrial Engineering and Sociocultural Environment Studies. He has published about 125 journal articles, with 80 ones as first/corresponding authors. He is the Editor-in-Chief of ***Handbook of Mobility Data Mining*** (3 volumes) and ***Big Data and Mobility as a Service***. He is also the subject editor of ***Advances in Applied Energy***. He led Small World AI project incubation, which received the 2021 Smart 50 Awards and 2021 R&D 100 Awards (IT/Electrical category). In 2020, he received the project of Leading Initiative for Excellent Young Researchers supported by the Ministry of Education, Culture, Sports, Science and Technology, Japan.

Topic:

Modular Metacognitive Digital Twin Technologies for Greener Cities & Cleaner Mobility
Date: 7 July 2023 Time: 11:00 – 11:30

Abstract:

Digital twin technology can improve the level of refined and intelligent management of cities, and has wide applications in urban planning, epidemic and disaster prevention, smart logistics, and sustainability assessment. Cell phone mobile data, as a more accessible fine-grained data set at the city level, has high mining value. However, the seemingly massive and huge cell phone mobile data actually contains serious problems such as sample scarcity, sampling bias, and heterogeneous errors. Then, how to simulate the real "big world" based on the "small world" constructed by the rough cell phone data and guided by the physical constraints of urban population movement behaviour becomes one of the research bases of the digital twin city. This talk will focus on our recently built small world AI model - cell phone mobile data processing and analysis system, and its application to smart stations, smart energy and urban sustainability indicators assessment.

Speaker

Dr Siqi BU

Associate Professor and Associate Head
Department of Electrical Engineering, The Hong Kong Polytechnic University, Hong Kong SAR

Biography:

Siqi BU received the Ph.D. degree from the electric power and energy research cluster, The Queen's University of Belfast. Then he was with National Grid UK as an experienced National Transmission System Planner and Operator. He is currently an Associate Professor and Associate Head with Department of Electrical Engineering, The Hong Kong Polytechnic University, and also a Chartered Engineer with UK Royal Engineering Council. His research interests include power system analysis, operation and control, considering renewable energy integration and smart grid application.

He serves as a Standing Director of IEEE PES Power System Relay and Control Satellite Committee, Secretary of IEEE PES long range planning committee, Advisory Expert of UK Government on Enabling Distribution System Operation Transition Strategies and TUS-CLP Smart Energy Technology Co. Ltd, External Examiner of HK VTC and NSFC, IET HK PES Officer, and TF Chair of IEEE OAJPE. He is an Editor of ***IEEE Transactions on Power Systems, IEEE Transactions on Consumer Electronics, IEEE Power Engineering Letters, IEEE OAJPE, CSEE JPES***, and ***PCMP*** etc., and a Guest Editor-in-Chief/Editor of ***Renewable & Sustainable Energy Reviews***, ***IET Renewable Power Generation, Frontiers in Energy Research and Smart Cities*** etc. He is a Senior Member of IEEE. He is the recipient of Outstanding Editor Awards from IEEE OAJPE, CSEE JPES and PCMP. He has received 3 Gold Awards, 2 Silver Awards and 2 Bronze Awards due to outstanding contributions to National Grid UK. He is also the recipient of Faculty Research Grant Achievement Award and Presidential GRF/ECS Awards from PolyU.

Topic:

Secure Operation of a Low-Carbon Sustainable Urban Grid
Date: 7 July 2023 Time: 11:30 – 12:00

Abstract:

Sustainability and security are sometimes two conflicting factors in the low-carbon urban grid operation, especially when considering the impact of massive distributed energy resources (DERs). Considering the fact that power industry is one of the main industrial sectors that should be responsible for carbon reductions in an urban city, this talk will firstly introduce the developing trend and growing risks during the low-carbon transition of so-called urban active distribution networks (ADNs), featured by the large-scale integration of distributed renewable energy sources and smart loads. To deal with these emerging challenges resulted from the decarbonization, the talk will then move on to some latest developed innovative techniques and tools to effectively accommodate and utilize the increasing DERs and mitigate the associated operational risks in ADNs, in order to enable the secure and economic operation of low-carbon sustainable urban grid for timely achieving of urban carbon neutrality.

Secretariat of RISUD Annual International Symposium (RAIS)

Email: info.rais@polyu.edu.hk
Tel: +852 3400 8475