Informal sessions

During ASim2024, we will hold several informal/organized sessions designed to promote new ideas, debates, and discussions in an informal setting. Informal/organized sessions are not paper-based, but can be interactive, collaborative, and fun.

The informal/organized sessions will take place in the afternoon on December 8 (one day before the main conference) and on December 9 and 10 in parallel to regular sessions consisting of research presentations on submitted papers. The tentative program is as follows.

Details of the sessions can be found on the following pages.

Date and time	Session A	Session B
December 8 1:30 pm – 3:30 pm	Simulating and optimizing building-vehicle-grid interaction The Hong Kong University of Science and Technology, Hong Kong, Prof. Zhe Wang Tsinghua University, Prof. Geng Yang	Surrogate modeling for multi-scale building performance simulation and its applications Yonsei University, South Korea Prof. Jungmin Han
December 8 4:00 pm – 5:30 pm	Urban scale modeling to inform city planning of decarbonization and climate resilience Lawrence Berkeley National Laboratory, USA Dr. Tianzhen Hong	
December 9 Morning	Path to Carbon Neutrality for Mega Cities: Focusing on Rating Methods University of Illinois at Urbana-Champaign Dr. Yun Kyu Yi	
December 9 Afternoon 1	Indoor Green Building Simulation with OpenFOAM and BIM HVACTool TIAN Building Engineering, Germany Thomas Tian	Visualizing invisible heat: analysis methods for radiant heat transfer National University of Singapore, Singapore, Dr. Chong Zhun Min Adrian
December 9 Afternoon 2	Novel machine learning paradigms-enabled solutions for smart building energy modeling and management Shenzhen University, China, Dr. Cheng Fan	
December 10 Morning	CFD Applications in Building Performance Simulation and Beyond National University of Singapore, Singapore Dr. Lup Wai Chew	
December 10 Afternoon 1	Bits4Watts 2024: International Workshop on Low-Carbon Building and Urban Energy Systems Powered by Data, AI, and Smart Controls National University of Singapore, Singapore Dr. Maomao Hu	
December 10 Afternoon 2	Model-based control strategy and application Tianjin University, China, Dr. Y. Ding; Prof. Zhe Tian	

Informal Session Content (may be updated)

Session title	Simulating and optimizing building-vehicle-grid interaction
Time	December 8, afternoon
Keywords	Building-vehicle-grid interaction, smart grid, electric vehicle
Highlights	• Given the growing popularity of electric vehicles, the interplay among buildings, electric vehicles, and the power grid has gained significant importance in establishing a versatile, efficient, and intelligent energy infrastructure. • The objective of this session is to facilitate the exchange of research pertaining to the modeling and optimization of the interaction between buildings, electric vehicles, and the power grid.
Session description	With the increasing prominence of electric vehicles (EVs) and the pressing need for sustainable energy solutions, understanding and improving the dynamic relationship between buildings, EVs, and the power grid has become of paramount importance. The seminar aims to foster an environment for knowledge exchange and collaboration among researchers, industry experts, and policymakers in the field of energy systems and sustainable transportation. By bringing together experts from various disciplines, we will explore the latest advancements in modeling and optimizing the intricate interplay between buildings, EVs, and the power grid. By the end of the session, participants will have a deeper understanding of the state-of-the-art modeling and optimization techniques for more efficient building-vehicle-grid interaction, and will be able to identify existing gaps that need to be addressed in future research and development.
Length of session	90-120 minutes
Presenters	The presentation titles are to be determined. The following presenters agree to give a talk in this session: • Borong LIN, Tsinghua University • Zhe WANG, The Hong Kong University of Science and Technology • Weirong ZHANG, Beijing University of Technology • Shiming TIAN, China Electric Power Research Institute • Yang GENG, Tsinghua University

Informal Session Content (continued)

Session title	Surrogate modeling for multi-scale building performance simulation and its applications
Time	December 8, afternoon
Keywords	Surrogate modeling, building performance simulation, energy modeling, wind modeling, generative modeling, Artificial Intelligence
Highlights	Participants will • Understand the basics of surrogate modeling and its applications in building performance simulations • Try hands-on activities with prepared files, using a campus model as test-case • Run various simulations including energy, airflow, and other associated metrics
Session description	This workshop will introduce participants to the fundamentals of surrogate modeling and its applications in multi-scale building performance simulation. Surrogate models are computationally efficient approximations of complex, high-fidelity simulation models, enabling faster design space exploration and optimization. During the workshop, participants will gain an understanding of the basics of surrogate models, their use cases, and applications in building performance simulation. They will explore surrogate modeling for energy and wind analysis using Python in Google Colab, Rhino3D, and Grasshopper. Participants will engage in hands-on activities using prepared files and a provided campus model as a test case, allowing them to run various simulations, including energy and wind analyses, and gain practical experience with surrogate modeling techniques. The workshop will also discuss the potential benefits and applications of surrogate modeling in building performance simulation, as well as various methods suitable for different use cases. This will include topics such as design optimization and real-time performance prediction. By the end of the workshop, participants will have a good foundational understanding of surrogate modeling techniques and their applications in multi-scale building performance simulation. They will be equipped with the knowledge and skills necessary to implement surrogate models in their own projects, enabling more efficient and effective design processes. Workshop followed by the lecture. Integrated workflow: Rhino and Grasshopper and Colab/Jupyter Notebook Requirements Bring your laptop with Rhino, Grasshopper installed and Google Colab if interested to follow along. A Google Drive with workshop files will be provided prior to the workshop.
Length of session	60-90 minutes
Presenters	• Jung Min Han, Yonsei University • Yu Qian Ang, National University of Singapore

Informal Session Content (continued)

Session title	Urban scale modeling to inform city planning of decarbonization and climate resilience
Time	December 8, afternoon
Keywords	urban building modeling, urban energy system, decarbonization, climate resilience, building simulation
Highlights	• UBEM is a powerful modeling and simulation technique to provide insights informing city decision making on building energy use, decarbonization, building climate resilience, and urban environment sustainability. • Four presentations highlight recent research on UBEM for cities in USA and China. The approaches can be adopted for other cities and countries.
Session description	This session showcase recent interesting research of using urban scale modeling to assess urban wind environment, building energy performance, building resilience, and anthropogenic heat from buildings in cities. Four presentations are: Title: A downscaling prediction method of wind environment suitable for urban building energy consumption analysis Abstract: Urban microclimate changes have a great impact on building energy consumption. The setting of boundary conditions in numerical simulation affects the accuracy of wind environment simulation. However, urban morphology is complex, and commonly used downscaling simulation methods are time-consuming and computationally intensive. In response to the above issues, this study proposes an ANN-based wind environment downscaling prediction model based on prototype block models (PBMs). The PBMs model established in the study takes into account the urban morphological factors that affect the characteristics of the urban wind environment. The ANN model is used to extract the CFD wind speed simulation results of BMPs, thereby saving computing time. Taking the Nanjing area as an example, by comparing the predictive performance under 15 combinations of explanatory variables, the effectiveness of the proposed method was validated. Title: Assessing building stock resilience to extreme cold weather based on urban building energy modeling Abstract: Climate change and expected extreme weather conditions have raised significant concerns, particularly regarding the energy supply for urban buildings. In cities with district heating, high-resolution simulations of building energy demand are crucial for efficient energy allocation and scheduling. However, variations in building age and envelope degradation make it difficult to capture thermal properties accurately. Additionally, spatial weather differences in the urban area impact energy demand. This study proposes a novel UBEM approach to assess building stock resilience, considering the distribution of envelope thermal properties and microclimate conditions. A validated UBEM of Beijing is established and building resilience to future cold waves and retrofit strategies are analyzed. The results show that the approach effectively produces high-resolution energy demand analyses during extreme weather. Title: Urban building energy modeling based on a modularized neural network incorporating physical priors Abstract: Bottom-up UBEM models require detailed building information and substantial modeling effort, while top-down models cannot intrinsically predict future trends and provide only aggregated data without precise spatial or temporal detail. To improve the scalability and the reliability of bottom-up models, this study proposes a

	modularized neural network incorporating physical priors, offering an effective solution for urban-scale building energy modeling. The integration of physical constraints ensures accurate responses to varying conditions. The proposed model demonstrates high accuracy in energy demand calculations. Title: Integrating urban building energy modeling with urban microclimate modeling to quantify the anthropogenic heat from buildings and its impact on urban environment Abstract: Anthropogenic heat (AH) from buildings increases urban air temperature and contributes to the urban heat island effect. Building AH exhibits strong seasonal and diurnal patterns with large spatial variations. Building AH peaks in May and reaches a maximum of 878 W/m2, with higher AH attributed to large building density, a high percentage of industrial buildings, and older building stock. During the July 2018 heatwave in LA County, building AH leads to a daily max and min ambient temperature increase of up to 0.6 ◦C and 2.9 0.6 ◦C respectively. It is recommended that reducing summer building AH should be considered by policy makers in developing mitigation measures for cities to transition to clean energy while improving heat resilience.
Length of session	60-90 minutes
Presenters	• Prof. Da Yan, Tsinghua University, China. Assessing building stock resilience to extreme cold weather based on urban building energy modeling; • Prof. Bing Dong, Syracuse University, USA. Urban building energy modeling based on a modularized neural network incorporating physical priors; • Dr. Xin Zhou, Southeast University, China. A downscaling prediction method of wind environment suitable for urban building energy consumption analysis; • Dr. Tianzhen Hong, LBNL, USA. Integrating urban building energy modeling with urban microclimate modeling to quantify the anthropogenic heat from buildings and its impact on urban environment.

Informal Session Content (continued)

Session title	Path to Carbon Neutrality for Mega Cities: Focusing on Rating Methods
Time	December 9, morning
Keywords	Carbon neutral, Energy rating system, Data uncertainty, Inverse Modeling, Mixed use and building type
Highlights	• In this session, we will hear from experts and gather audience opinions on achieving carbon neutrality in mega cities. • We'll discuss strategies for reducing and offsetting carbon emissions with help of energy rating systems. • We'll also address data uncertainty and its impact on building assessments and decision-making. • Additionally, we like to discuss on inverse modeling by inferring unknown parameters from observed data.
Session description	In this session, we will hear from experts and collect audience opinions on important topics related to sustainable building practices and energy management, particularly focusing on achieving carbon neutrality in mega cities. We like to discuss on strategies to reduce and offset carbon emissions using the energy rating system to evaluate and compare the energy performance of buildings. The session also like to address and hear about data uncertainty, highlighting how variability and inaccuracies in data can impact building assessments and decision-making. We also delve into inverse modeling, a technique used to infer unknown parameters based on observed data, which can be crucial for improving energy simulations and building performance. Finally, we will consider the implications of mixed-use and building types, exploring how different building functions and designs influence energy consumption and sustainability strategies.
Length of session	30-60 minutes
Presenters	• Dr.Yun Kyu Yi, University of Illinois at Urbana-Champaign, • Dr. Ki-hyung Yu, Korea Institute of Civil Engineering and Building Technology. • Include more participant as need

Informal Session Content (continued)

Session title	Indoor Green Building Simulation with OpenFOAM and BIM HVACTool
Time	December 9, afternoon
Keywords	OpenFOAM, BIM HVACTool, CFD, Indoor Simulation
Highlights	• Setting up an indoor simulation for OpenFOAM using BIM HVACTool • Demonstrating all necessary steps for the simulation process • Focusing on thermal comfort evaluation • Showcasing the workflow from BIM model to CFD analysis • Explaining key parameters and settings for accurate results • Visualize the simulation results using ParaView and render them with NVIDIA Optix
Session description	This session will demonstrate the setup of an indoor simulation for OpenFOAM using BIM HVACTool software. We will guide you through all necessary steps in the simulation process, focusing particularly on evaluating thermal comfort. The demonstration will cover the entire workflow, from the initial BIM model to the CFD analysis. Throughout the session, we will explain key parameters and settings crucial for accurate results. Additionally, we will show how to visualize the simulation results using ParaView and render them with NVIDIA Optix, providing a comprehensive overview of the thermal comfort assessment and visualization process in building design.
Length of session	90-120 minutes
Presenters	• Thomas Tian, TIAN Building Engineering

Informal Session Content (continued)

Session title	Visualizing invisible heat: analysis methods for radiant heat transfer
Time	December 9, afternoon
Keywords	Heating and cooling, radiant systems, sensors, thermal comfort
Highlights	• Review the basics of heat transfer and thermal comfort characterization • History of measurements of thermal comfort variables: temperature, humidity, air movement, thermal radiation • Advanced techniques for measuring radiant heat transfer • Deep dive on radiant heat transfer spatial and temporal variations • Challenges in using temperature proxies such as Mean Radiant Temperature and Operative Temperature • The concept of a human-centric heat transfer analysis for rooms: the Human Coefficient of Performance (HCOP)
Session description	Achieving thermal comfort is the end goal of heating and cooling systems installed in buildings. Yet these systems rely limited feedback from thermostats that generally only measure air temperature. Historically the concept of thermal comfort is relatively new, and actually evolved out of occupational health studies of heat endurance. Many measurement devices and techniques, including the globe thermometer for radiant heat, are vestiges of studies of heat resilience in factories by doctors in the 1920's and 1930's. Since Fangers seminal work in the 1970's building comfort models that include inputs from the 4 key environmental variables, temperature, humidity, air speed, and radiant temperature, researchers have strived to achieve good scores of his metrics of PMV and PPD. But these metrics still use the old tools of globe thermometers and Mean Radiant Temperature. This workshop will present new tools and techniques for measuring radiant heat transfer, and expose participants to the significant and overlooked variation of radiant heat across small spaces and short periods of time. This spatial and temporal heterogeneity can only be measured with new tools, and demonstrates significant opportunities to reconsider how radiant heat can be used to create more nuanced control beyond the coarse zones of standard air conditioning. We will discuss how a Watts-based approach to thermal comfort can offer additional insights to human comfort that go beyond the Fanger's statistics, and take advantage of contemporary microprocessor hardware and computational power. Participants will come away with a new perspective on how we define the performance of heating and cooling systems – one that moves away from the failed paradigm of making rooms comfortable, and aims at making people comfortable. In the end the performance of building should not be based on performance normalized by floor area as in EUI, but rather the people whose heat transfer is managed most effectively with the least energy.
Length of session	60-90 mins
Presenters	• Forrest Meggers, Associate Professor, Director of CHAOS, Princeton University • Ippei Izuhara, President, GET/ General Manager, Sanken/ Visiting Fellow, Princeton University • Kianwee Chen, Environmental Technology Senior Researcher, GET/Sanken • Clayton Miller, Associate Professor, National University of Singapore • Genku Kayo, Associate Professor, Tokyo City University

Informal Session Content (continued)

Session title	Novel machine learning paradigms-enabled solutions for smart building energy modeling and management
Time	December 9, afternoon
Keywords	Machine learning; Smart building operation; Large language models; Data-driven models; Building energy management.
Highlights	• Introduction of typical data-driven solutions for building energy modeling and management. • Discussion on practical data challenges faced in building energy modeling and management together with the potentials of novel machine learning paradigms. • Applications of novel machine learning paradigms for smart building operations.
Session description	The rapid development in AI and machine learning has provided powerful tools to facilitate tasks in building energy modeling and management. This workshop focuses on introducing the potentials of novel machine learning paradigms in enhancing the working efficiency of building specialists and addressing possible data challenges in practice. As examples, invited speakers will talk about the use of large language models to achieve automated building energy modeling, which can greatly reduce the manual labors in software simulation. Other speakers will talk about solutions related to the development of reliable data-driven models for building energy management tasks such as short-term building energy prediction, fault detection and diagnosis, e.g., using semi-supervised learning to enhance model quality given limited labeled data, and applying transfer and federated learning to integrate multi-source building energy data for collaborative model training.
Length of session	60-90 minutes
Presenters	• Linda Fu Xiao, Professor, The Hong Kong Polytechnic University • Jianli Chen, Professor, Tongji University • Ke Yan, Professor, Hunan University • Marco Savino Piscitelli, Assistant professor, Polytechni di Torino • Cheng Fan, Associate professor, Shenzhen University

Informal Session Content (continued)

Session title	CFD Applications in Building Performance Simulation and Beyond
Time	December 10, morning
Keywords	Computational fluid dynamics (CFD); airflow simulations; best practice guideline; lesson learnt
Highlights	• Introduction to CFD in building performance simulation - Overview of the role of CFD in analyzing airflow, thermal comfort, indoor air quality, and energy efficiency in buildings. • Lessons learned from real-world case studies - Present a selection of case studies that showcase the application of CFD in building performance simulation, focusing on the successes, challenges, and lessons learned. • Best practices and guidelines for CFD simulations - Discuss key considerations, methodologies, and approaches for achieving accurate and reliable CFD simulations in building performance analysis. • Overcoming challenges in CFD simulations - Explore the limitations, potential pitfalls, and common challenges faced in CFD simulations, and provide strategies and solutions to overcome them. • Q&A and open discussion for participants to seek clarification, share their experiences, and gain insights.
Session description	The application of Computational Fluid Dynamics (CFD) in building performance simulation has gained significant importance in achieving sustainable and energy-efficient buildings. However, there are various challenges and considerations that need to be addressed to ensure accurate and reliable results, from grid generation to selection of boundary conditions as well as from model validation to result analysis. This session will provide a platform for sharing lessons learned and best practices in utilizing CFD for building performance simulation, enabling practitioners to enhance their understanding and improve their approach in this field. Through this session, we hope to: (1) Increased awareness of the successes, challenges, and lessons learned from real-world CFD applications in building performance simulation. (2) Improved understanding of best practices and guidelines for utilizing CFD effectively in building performance analysis. (3) Identification of potential pitfalls and challenges in CFD simulations and strategies to overcome them. (4) Enhanced collaboration and knowledge exchange among researchers, practitioners, and industry professionals in the field of CFD for building performance simulation.
Length of session	45-60 minutes
Presenters	• Yoshihide Tominaga (Niigata Institute of Technology) • Zitao Jiang (Niigata Institute of Technology) • Lup Wai Chew (National University of Singapore) • Hee Joo Poh (National University of Singapore)

Informal Session Content (continued)

Session title	Bits4Watts 2024: International Workshop on Low-Carbon Building and Urban Energy Systems Powered by Data, AI, and Smart Controls
Time	December 10, afternoon
Keywords	Building and urban energy systems; Building decarbonization; Machine learning; Smart controls; Data analytics
Highlights	• 6 presentations by colleagues from Hong Kong, Italy, Japan, Singapore, and the UK • Recent developments and demonstrations of data management, artificial intelligence, model-based diagnostic and control technologies, and grid interactions
Session description	Digitalization is becoming increasingly crucial in making today's buildings low-carbon and energy-efficient. According to the International Energy Agency, utilizing the data from ubiquitous sensors, actuators, and IoT devices could save around 10% of energy use in residential and commercial buildings by 2040. By leveraging data and data-driven techniques, various stakeholders can gain valuable insights and make better decision-making throughout all phases, from design through construction to operations. This workshop aims to explore the integration of data, AI, and advanced controls in building energy management from individual buildings to the community scale. The workshop will feature selected presentations of case studies that highlight recent developments and demonstrations of data management, artificial intelligence, model-based diagnostic and control technologies, and grid interactions. The format will encourage an open discussion to address what is necessary to move from research to the widespread adoption of smart data-driven building technologies. By the end of the workshop, participants will have a deeper understanding of the current state of smart data-driven technologies in buildings and will be able to identify existing gaps that need to be addressed in future research and development. For more information, visit the workshop website at https://bits4watts.org/.
Length of session	90-120 minutes
Presenters	• Ruchi Choudhary, Professor, Cambridge University, UK • Alfonso Capozzoli, Professor, Polytechnic University of Turin, Italy • Linda Xiao, Professor, The Hong Kong Polytechnic University, Hong Kong • Shohei Miyata, Assistant Professor, The University of Tokyo, Japan • Zhe Wang, Assistant Professor, The Hong Kong University of Science and Technology, Hong Kong • Maomao Hu, Assistant Professor, National University of Singapore, Singapore

Informal Session Content (continued)

Session title	Model-based control strategy and application
Time	December 10, afternoon
Keywords	High-fidelity simulation, Model calibration, Control strategy, Engineering application
Highlights	• Development of high-fidelity simulation platform of building energy system • Generation and validation of building energy system operation strategies based on high-fidelity modelling
Session description	Under the background of low carbonization, the building energy is transforming to the system integrated with cooling, heating and power supply, which is more and more complex. On the other hand, the external energy price fluctuations are becoming more and more frequent, which brings more difficulties to the operation and maintenance of the system. With the high-fidelity simulation model system that fully reflects the actual dynamic feature of building energy system, it is feasible for researcher or engineer to optimize and generate control strategies online or offline for the system under the diverse conditions of different energy price policies, such as time-of-use power price or demand side response power price, etc. Besides, the HVAC control strategy optimization is a hot topic of study with the development of artificial intelligent technologies. A lot of control strategies is generated based on model or model-free technology. But them are seldom applied to real practical engineering. Lack of the tool to test the performance and reliability before engineering application is main reason. Then, developing the full-performance building energy system simulation platform is considered to be the important research of simulation engineering application. In order to realize the above research concepts, there are a long way to go. The following questions are expected to answer: 1.What kind of simulation model should be built? 2.How to achieve the high fidelity of the simulation model? 3.How to balance the computational efficiency and accuracy in the process of strategy optimization? 4.How to break through the barrier between the study results and the application. That is, how to apply the simulation strategy into the engineering application? 5.How about the application performance of optimized strategy generated by simulation in the actual project? 6.And so on… This session proposed hopes to gather researchers in the direction to exchange research ideas, technical routes and engineering application case study, promote the development of simulation modeling in the field of building energy, and better serve and support engineering practice.
Length of session	45-60 minutes
Presenters	Dr. J.D. Niu Assoc prof. Y. Ding Assoc prof. X. C. Yang Prof. J.Z. Ma Prof. J.Q. Peng Dr. J.J. Jiang