

# Research Centre for Advanced Design, Materials and Manufacturing Technologies (RCADMM) Research Seminar

## ADVANCED DESIGN OF ROBOTIC AND THERMAL SYSTEMS

**DATE: 8 January 2021 (Friday)**

**TIME: 3:00 pm – 4:30 pm**

**VENUE: ONLINE (Microsoft Teams)**

*The seminar is fully supported by a grant from  
the Research Grants Council of the HKSAR,  
China. (Project No.: UGC/IDS(R)24/19)*

**Registration!**



### **Dr Sau-chung FU**

Research Assistant Professor  
Department of Mechanical Engineering, HKU

### **Topic**

Enhanced Heat Sink Technology using a  
Bio-inspired Passive Fluttering Mechanism



### **Abstract**

Heat is always generated in almost all electronic and mechanical processes. In order to prevent overheating of a system, heat sink is usually installed to dissipate the heat to the surrounding fluid. Heat sink uses an extended fin structure to increase the area for heat transfer. However, its cooling capacity is typically limited by the boundary layer on the surface at which the air is almost motionless, and the ineffective thermal mixing of the core flow. Hoping for a breakthrough, we try to learn from nature. It is observed that, under heat stress, some birds flutter their gular region. Flutter is a self-excited flow-induced flapping motion. This phenomenon dramatically increases the cooling effect; meanwhile, the gular vibrates under its natural frequency thereby requiring minimal amount of calories. Inspired by gular flutter, it is proposed to insert some small flexible flags into the cavities between adjacent fins of a heat sink. The flags will flutter and generate vortices and turbulence to break the thermal boundary layer. This project aims at understanding the fluttering dynamics of flags and its effect on heat transfer, and developing a novel heat sink technology by fluttering mechanism. The recent works we have done by using this bio-inspired idea will be discussed in this presentation.

## **Dr Eva CHAN**

Technical Manager, Nano and  
Advanced Materials Institute, HKUST



### **Topic**

Development of the Robotic System for Onsite Concrete Printing

### **Abstract**

Three-dimensional concrete printing (3DCP) is an innovative construction method which allows human labor to be replaced by digitally controlled robots. Using this technology, it expresses the construction field to become error reduction, less waste materials, more design flexibility and early completion of tasks in pre-designed schedule. However, the application of 3DCP is not so popular and widely used in Hong Kong. The reason is that there are many building regulation standards for the design and construction of building to ensure health and safety for people in or about the buildings. Therefore, 3DCP technology still has gaps to be developed in the Hong Kong construction industry. In this seminar, it aims to elaborate the tendency of how to make use of the new robotic system to print the construction components in Hong Kong.

## **Dr ZHANG Hao**

Lecturer-Designate, School of Professional Education  
and Executive Development, PolyU



### **Topic**

Green Retrofit Strategies for Aged Buildings in Hong Kong

### **Abstract**

Hong Kong faces an imminent aging building crisis, with many buildings having become unsightly and also potentially hazardous. The retrofit or rehabilitation of existing buildings, especially the redevelopment of external walls, is therefore very common in Hong Kong. Several potential strategies for re-development of aged buildings are proposed in this research, including green facades, movable sunshades, cooling paint and green windcatchers using waste heat from air conditioners. Their feasibility and effectiveness are evaluated and compared to make effort for sustainable development of Hong Kong's built environment-reducing indoor energy consumption, improving outdoor thermal comfort and air quality, mitigating the urban heat island (UHI) effect and promoting city breathability. To this end, both the environmental scale experiments and computational fluid dynamics (CFD)-based analytical procedures will be developed to build the three-dimensional model to replicate the high-density urban building complexes in Hong Kong. The optimal design layouts of the proposed strategies will be quantitatively investigated.

*All are welcome!*

**Please scan the QR code for registration**



**For enquiry, please contact Ms Jenny Li at [jenny.li@speed-polyu.edu.hk](mailto:jenny.li@speed-polyu.edu.hk) on or before 6 January 2021.**