Department of
Mechanical Engineering
The University of Hong Kong

SEMINAR

Title: **Insect-scale aerial robots driven by soft artificial muscles**

Speaker: **Prof. Kevin Yufeng Chen**

Assistant Professor

Department of Electrical Engineering and Computer Science

School of Engineering, Massachusetts Institute of Technology

USA

Venue: **CPD2.37 – Centennial Campus**

Date: **January 13, 2025 (Monday)**

Time: **15:30 pm**

Abstract: Flapping-wing flight at the insect-scale is incredibly challenging. Insect muscles not only power flight but also absorb in-flight collisional impact, making these tiny flyers simultaneously agile and robust. In contrast, existing aerial robots have not demonstrated these properties. Rigid robots are fragile against collisions, while soft-driven systems suffer limited speed, precision, and controllability. In this talk, I will describe our effort in developing a new class of bio-inspired micro-flyers, ones that are powered by high bandwidth soft actuators and equipped with rigid appendages. We constructed the first heavier-than-air aerial robot powered by soft artificial muscles, which can demonstrate a 1000-second hovering flight. In addition, our robot can recover from in-flight collisions and perform somersaults within 0.10 seconds. This work demonstrates for the first time that soft aerial robots can achieve agile and robust flight capabilities absent in rigid-powered micro-aerial vehicles, thus showing the

potential of a new class of hybrid soft-rigid robots. I will also discuss our recent progress in incorporating onboard sensors, electronics, and batteries.

Biography: Kevin Chen is an associate professor at the Department of Electrical Engineering and Computer Science, MIT, USA. He received his PhD in Engineering Sciences at Harvard University in 2017 and his bachelor's degree in Applied and Engineering Physics from Cornell University in 2012. His research interests include high bandwidth soft actuators, microrobotics, and aerial robotics. He has published in top journals including Nature, Science Robotics, Advanced Materials, PNAS, Nature Communications, IEEE TRO, and Journal of Fluid Mechanics. He is a recipient of the Steven Vogel Young Investigator Award, the NSF CAREER Award, the Office of Naval Research Young Investigator Award, multiple best paper awards (TRO 21, RAL 20, IROS 15), and the Ruth and Joel Spira Teaching Excellence Award.

Title: **Advancing Miniature Aerial Robotics: Bio-Inspired Design and Mechanical Intelligence**

Speaker: **Prof. Pakpong Chirarattananon**

Associate Professor

Department of Biomedical Engineering and Mechanical Engineering

City University of Hong Kong

Venue: **CPD2.37 – Centennial Campus**

Date: **January 13, 2025 (Monday)**

Time: **16:15 pm**

Abstract: Advancing small aerial robots involves overcoming challenges in efficiency, versatility, and autonomy posed by miniaturization and resource constraints. My research embraces bio-inspired design principles and mechanical intelligence to push boundaries in what's achievable. This talk will explore how bio-inspiration and a minimalist approach have led to significant advancements. We will discuss our recent work on the Hopcopter, a novel hybrid hopping-flying robot. Our design showcases how

passive elements can simplify actuation and improve overall agility, demonstrating how compliant mechanisms and energy recuperation can radically enhance performance of robotic locomotion systems. Together, these biologically-motivated innovations enable miniature aerial vehicles to take on increasingly complex real-world tasks with limited payload capacity and power.

Biography: Pakpong Chirarattananon is an Associate Professor in the Departments of Biomedical Engineering and Mechanical Engineering at the City University of Hong Kong. He received his Ph.D. in Engineering Sciences from Harvard University in 2014 and B.A. in Natural Sciences from the University of Cambridge. His research is primarily centered on biologically-inspired robotic systems, micro aerial vehicles, and hybrid locomotion. Pakpong has developed a highly efficient revolving-wing drones, flapping-wing robots, and multimodal multirotors, with publications in prestigious journals such as Science, Nature, and Science Robotics. His approach involves the use of intelligent mechanisms to address the complexities of power, dynamics, and control, as he seeks to enhance the capabilities of small robotic devices through a deeper understanding of the synergy between mechanical design, actuation, dynamics, control strategies, and environmental conditions. Pakpong serves as an Associate Editor for the International Journal of Robotics Research (IJRR) and IEEE Robotics and Automation Letters (RA-L). His contributions to the field have been recognized with numerous accolades, including the 2021 IEEE Transactions on Robotics King-Sun Fu Memorial Best Paper Award.

ALL INTERESTED ARE WELCOME

For further information, please contact Prof. Fu Zhang