

DEPARTMENT OF MECHANICAL ENGINEERING

SEMINAR SERIES

Human-interactive Thermofluidics: Advancing Human-Centric Control of Heat and Flow

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Abstract

Diverse forms of energy at varying intensities must penetrate skin tissue to achieve diagnostic and therapeutic objectives in medical applications, as well as to enhance human thermal comfort and energy efficiency in built environments. The controlled delivery of fluids and energy to specific tissue depths must overcome the skin barrier, which consists of multiple layers with distinct physicochemical properties, including mechanical, optical, thermal, dielectric, and acoustic characteristics. I have employed multiphysics computational and experimental approaches to understand the interactions between delivered light, fluids, and energy with living tissues. This knowledge contributes to the design of effective therapeutic techniques and advanced localized radiant heating solutions targeted at specific sites within the human body. I have demonstrated the application of these research methodologies in developing medical devices such as radiofrequency hyperthermia and high-intensity focused ultrasound for cancer treatment, near-infrared laser ablation for endoscopic submucosal dissection, and pressure-driven needle-free jet injection for intradermal drug delivery. Looking ahead, I aim to expand my research to explore human-centric control of heat and flow, grounded in a deeper understanding not only of the physical and physiological aspects but also of the psychological and behavioral factors related to human interactions with external thermal and fluidic stimuli. By integrating non-invasive or non-contact real-time sensing techniques for skin tissue properties and psychophysiological states, my work will provide pioneering insights into patient-specific medical treatment devices and personalized microclimate control in future transportation modes and smart buildings, all within the framework of human-interactive thermofluidics.

Speaker Bio

Dr. Jung Kyung Kim directs the Biomedical Device Lab and serves as a tenured professor in the School of Mechanical Engineering at Kookmin University in Seoul, South Korea. He is currently a visiting researcher with the Neural Engineering Group at The City College of New York, where he conducts research in neural interfacing and neuromodulation. Recently, he led a Korean government-sponsored project titled “Basic Research Lab for Human Interactive Thermal Management of Future Mobility” as principal investigator. Dr. Kim received his B.Sc. degree in Mechanical Engineering, followed by M.S. and Ph.D. degrees in Biomedical Engineering from Seoul National University. Before joining Kookmin University, he was a postdoctoral fellow in the Departments of Medicine and Physiology at the University of California, San Francisco, USA.

Date: Thursday, September 24, 2026

Location: Steinman 254

Time: 2:00 PM

Host: Taehun Lee

Attendance open to all interested persons

