

Toward High-Fidelity Robotic Simulation:

Physical Twins for Sustainable and Safe Interaction

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機械システム系第2演習室（イーストウィング4階）

Abstract : Robotic systems operating in applications such as healthcare and agriculture require safe, adaptive interaction with humans and/or complex environments; however, their development is constrained by variability, limited data, and safety concerns. This talk presents physical twins: tunable, sensorised, and repeatable physical analogues, as a unifying framework for benchmarking, training, and studying human-robot interaction. This talk will first introduce healthcare applications, including robotic patient platforms that integrate sensing with expressive feedback-such as synthesized pain sounds and facial expressions, to enable realistic and controlled training for clinical tasks like palpation and diagnosis, as well as residual limb phantoms for repeatable prosthetic socket evaluation under dynamic conditions. It will then extend this approach to agriculture, where soft physical twins of fruits emulate biological properties to enable controlled evaluation of robotic harvesting systems. Together, these systems demonstrate how physical twins provide scalable, controllable, and human-centered platforms for real-world robotics.

Bio : Dr. Thilina Lalitharatne is an Assistant Professor in Robotics and Mechatronics at the Centre for Advanced Robotics, School of Engineering and Materials Science, Queen Mary University of London (QMUL), UK. Prior to joining QMUL, he was a postdoctoral research associate at the Morph Lab, Dyson School of Design Engineering, Imperial College London, and a visiting research fellow at the Bioinspired Robotics Lab (BIRL), University of Cambridge. Before this, he served as a Senior Lecturer in the Department of Mechanical Engineering at University of Moratuwa, Sri Lanka. He earned his PhD in Robotics and Intelligent Systems from Saga University, Japan. Dr. Lalitharatne has been a member of the IEEE Robotics and Automation Society (RAS), and IEEE Engineering in Medicine and Biology Society (EMBS) since 2012. His research interests include Human-Robot Interaction (HRI), Medical and Soft Robotics, and Embodied Communication and Intelligence.