The Department of Mechanical Engineering College of Engineering and Applied Sciences Stony Brook University

## **Mechanical Engineering Seminar**



Dr. Yunbo Zhang, Associate Professor Department of Industrial & Systems Engineering, Rochester Institute of Technology "Towards Seamless Human-Robot Collaboration (HRC): Interfaces, Algorithms, and Workflows for Enabling Robots to Learn from Humans" Friday, November 15th, 2024 at 1:00 PM, Room 173 Light Engineering Building

## Abstract

Human-robot collaboration (HRC) is pivotal for the ongoing transition towards the new industrial revolution (Industry 4.0), where robots work alongside human partners to automate repetitive and physically demanding tasks, as well as to replace humans in hazardous or extreme working environments. Meanwhile, human workers supervise and verify the entire process, making critical decisions by leveraging their higher-level decision-making abilities. Nevertheless, the current level of HRC falls far short of what is expected for human-like collaboration. From a human perspective, current interfaces for HRC are unintuitive, time-consuming, and lack intelligence. It is challenging for robots to understand human workers' high-level intentions and respond appropriately. Moreover, human expertise, cognitive abilities, and decision-making capabilities have not been effectively transferred to or utilized by robots. Current approaches struggle with handling complex, multi-step tasks and require significant time and data to enable robots to learn from humans. To tackle these issues and enable human-like robot learning, Dr. Zhang has delved into a multidisciplinary research area that intersects multiple domains, including Robotics AI, Computer Vision (CV), and Human-Computer Interaction (HCI). In this talk, Dr. Zhang will present his research progress in three aspects: 1) Extended Reality (XR) interfaces and new paradigms that enable communication and teach-and-learn interactions between humans and robots; 2) Multimodal Large Language Model (MLLM)-based interactive frameworks for long-horizon manipulation with failure recovery; and 3) zero-shot, few-shot, and unsupervised learning algorithms for manipulation.

## **Biography**

Dr. Yunbo "Will" Zhang is currently an Assistant Professor in the Department of Industrial & Systems Engineering at the Rochester Institute of Technology (RIT). He is also affiliated with the School of Information (iSchool) at RIT. His research interests include Human-Robot Collaboration, Robot Learning, AI/ML in Manufacturing, AR/VR for Design and Manufacturing, Human-computer Interaction, Smart Manufacturing. He has actively taken on leadership roles in editing papers and organizing technical sessions in his field, including: Program Chair for the 2024 Symposium on Solid and Physical Modeling (SPM) and Chair of the Virtual Environments and Systems (VES) Technical Committee within the ASME CIE Division for 2023–2024. Additionally, he has contributed as an Associate Editor for Frontiers in Robotics and AI and the Journal of Intelligent Manufacturing (JIMS), while guest editing special issues on key topics like Industry 5.0 and Extended Reality in the ASME Journal of Computing and Information Science in Engineering (JCISE) and the Journal of Manufacturing Systems (JMS). His work has been recognized with the 2024 Technical Committee Leadership Award from the ASME Computers and Information in Engineering Division, along with a Silver Medal at the 2019 International Exhibition of Inventions of Geneva

