TEES Center of Innovation in Mechanics for Design and Manufacturing

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in Mechanics
for Design and Manufacturing

CiMDM Distinguished Lecture Series

THE TRIBOLOGY OF TOUCH FOR HUMAN AND ROBOT FINGERS

The US is facing labor shortages, particularly in areas that require difficult manual work, such as manufacturing, food processing, and caregiving. "Augmentation," the integration of humans and automation, is a potential solution, but it is currently limited to large factories and repeated tasks due to the expertise required to program and integrate robots as well as the limitations of specialized end effectors, or the robot's "hands." Our human hands allow us to perform a wide variety of dexterous manipulation tasks and use a vast array of tools in our work. For augmentation to be successful, we need dramatic improvement in the hardware (hands), software (skills), and human interface of dexterous robots. This is the focus of the US National Science Foundation Engineering Research Center for Human AugmentatioN via Dexterity (HAND).

Looking at human dexterity and its enablers, the finger-device interface is important, with its complex contact mechanics driving the ability to sense force, contact area, and friction/slip as well as have stable control during both griping and sliding manipulative tasks. Much of this is enabled by human skin – both its unique and complex material properties as well as the four different types of mechanoreceptors that sense mechanical interactions during dexterous tasks and tactile exploration. This talk will explore the contact mechanics of human and robotic finger-device interfaces, important both to the capability of the robot's hands and to the haptic human interface designs that will enable the human to teach the robot tasks. It will cover the multiphysics of the touch interface, the contact mechanics of tactile roughness perception, design of novel actuators for hands, as well as bioinspired design of robot skins.

Dr. Cynthia Hipwell

Oscar S. Wyatt, Jr. '45 Chair II Professor
Deputy Director, Human AugmentatioN via Dexterity (HAND) NSF Engineering Research Center (ERC)

Tuesday, September 16, 2025
11:00 a.m. - 12:00 p.m. in MEOB 301

Cynthia Hipwell has been working in technology development based upon nanoscale phenomena for over 30 years. She received her B.S.M.E. from Rice University and her M.S. and Ph.D. in Mechanical Engineering from the University of California, Berkeley. Upon graduation, she went to work at Seagate Technology's Recording Head Division in Bloomington, MN. During her nearly two decades at Seagate, she held multiple individual contributor and leadership roles including Executive Director of Advanced Mechanical Technology and Executive Director of Advanced Transducer (Electrical) Development, leading the electrical feasibility demonstration of heads for the radical new recording technology Heat Assisted Magnetic Recording (HAMR). She was inducted into the National Academy of Engineering for "leadership in the development of technologies for areal density increase in hard disk drives" in 2016 as well as the National Academy of Inventors in 2018. Dr. Hipwell currently serves as the Oscar S. Wyatt, Jr. '45 Chair II in Mechanical Engineering and Deputy Director of the newly awarded Human AugmentatioN via Dexterity NSF Engineering Research Center. She has developed unique curricula in innovation and new product development for students, faculty, and industry, and is conducting research in nano and microscale phenomena in the finger-device interface for haptics and dexterous robotics.

Hosted by: Dr. J.N. Reddy