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THE DEPARTMENT OF MECHANICAL ENGINEERING PRESENTS

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Twisted String Artificial Muscles for Compliant, Compact, and Dexterous Robots

To make robots more ubiquitous in scenarios where safe interaction with humans is necessary, it is highly desirable but challenging to develop compliant, compact, and dexterous robots. Artificial muscles belong to an important class of compliant actuators that are widely adopted to move robots to complete different tasks. Although artificial muscles are highly desirable, compliant, compact, and dexterous robots are difficult to realize, partly because existing artificial muscles often exhibit complex properties and poor performance in one or more key aspects. Twisted string actuators (TSAs) overcome many common limitations of existing artificial muscles. However, TSAs are conventionally constructed from rigid strings and motors. While TSAs have been successfully applied in a number of rigid robotic systems, few studies have been conducted to apply TSAs to move compliant or soft robots. In this talk, I will first discuss how to develop compliant, self-sensing, and large-strain TSAs by modifying the string materials and actuation strategies. Conventional stiff strings will be replaced by compliant and smart material-based strings, and the strings will be overtwisted and coiled after being fully twisted. I will then briefly present our work on a TSA-based soft robotic gripper and a TSA-based wearable glove.

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Jun Zhang is an assistant professor in the Department of Mechanical Engineering at the University of Nevada, Reno, where he has served on the faculty since 2018. Prior to this, he received his B.S. from the University of Science and Technology of China in 2011 and Ph.D. from the Michigan State University in 2015, followed by post-doctoral research at the University of California, San Diego. His research interests include robotics, smart materials, artificial muscles, and dynamics and control. He is an Associate Editor of IEEE Robotics and Automation Letters and several robotics and control conferences. He was a Guest Editor of the International Journal of Intelligent Robotics and Applications for its focused section on Flexible Mechatronics for Robotics. His work on self-sensing twisted string actuators won a 2021 IEEE Robotics and Automation Letters Best Paper Award.