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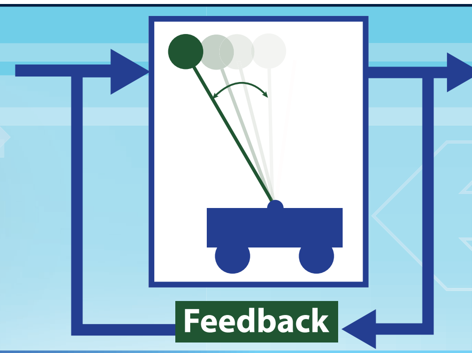
Control Seminar



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Wearable Robots to Induce Recovery of Motor Function after Neurological Injury

BRENT GILLESPIE

Professor

Friday, November 2, 2018

3:30 – 4:30 pm   1500 EECS

ABSTRACT: Robots designed for physical rehabilitation are usually ground-mounted devices with heavy motors. Yet motors are overkill for an application in which energetically passive robot behaviors have been found to produce the best patient outcomes. A robot that behaves passively discourages "slacking" and induces recovery by requiring effortful participation from the patient. Recognizing an opportunity to address rehabilitation with a lightweight wearable exoskeleton, my students and I have ditched motors in favor of transmissions—in particular fluid power transmissions. I will describe how a fluid circuit creates passive motion constraints while valves select transmission ratios and thereby place virtual guiding surfaces in the jointspace of the patient. We are designing feedback controllers for this very interesting hybrid nonholonomic system using differential geometric methods and a set of Jacobians that map between taskspace, jointspace, fluidic actuator space, and "valvespace" to guide the wearer's motion. I will also present results from experiments in which stroke patients produce motions without slacking using passive guidance from our prototype wearable robots.

BIO: Brent Gillespie is a Professor of Mechanical Engineering at the University of Michigan, just returning from his sabbatical at the Haptic Intelligence Department at the Max Planck Institute, Stuttgart, Germany. He received a Bachelor of Science in Mechanical Engineering from the University of California Davis in 1986, a Master of Music from the San Francisco Conservatory of Music in 1989, and a PhD in Mechanical Engineering from Stanford University in 1996. His research interests include haptic interface, human motor behavior, haptic shared control, and robot-assisted rehabilitation after neurological injury. Brent's awards include the Popular Science Invention Award (2016), the University of Michigan Provost's Teaching Innovation Prize (2012), and the Presidential Early Career Award for Scientists and Engineers (2001).

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