CARNEGIE MELLON UNIVERSITY
BME 2025 SPRING SEMINAR SERIES

Neuromechanics-driven Exoskeletons for Precision Rehabilitation

PRESENTED BY

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SCHEDULE

Doherty Hall (DH) 2315

Tuesday,
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(11:00-12:00 PM)

Preserving mobility and decreasing fall risk in older adults is a key public health challenge. While lower-limb robotic exoskeletons have the potential to address this need, there are key limitations that need to be overcome. First, balance augmentation is a nascent objective in the field, and robust controllers that can aid in balance and decrease the risk of falling are needed. Second, devices are primarily designed to assist the wearer; however, this assistance, if used over long periods of time, can lead to tissue maladaptation. Thus, rehabilitative exoskeletons need to be considered, but there is a limited understanding of the individual-specific mechanisms driving impaired mobility and balance to determine what component of the neuromuscular system a rehabilitative exoskeleton should target. Lastly, challenges persist in developing devices that individuals like and have agency over. In this seminar, I will highlight my work to address these gaps by 1) developing a neuromechanics-informed exoskeleton control paradigm for balance augmentation, 2) identifying the underlying mechanisms contributing to mobility impairments using joint and whole-body measurements, and 3) developing a framework for quantifying how devices integrate with the human neuromuscular system. In combination, this work provides a framework for designing lower-limb robotic exoskeletons as effective rehabilitative tools to preserve mobility and enhance quality of life throughout the lifespan.

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