Prosthesis and exoskeleton emulators for rapid evaluation of human response to intervention

ABSTRACT: It is an exciting time in robotic prosthesis and exoskeleton design, with clever innovations emerging quickly. But will these technologies provide real benefits to their human users? It is surprisingly difficult to predict how humans will respond and adapt to wearable robotic devices, and many years of development are typically required before proposed designs can be tested on humans. What if we could test our ideas for device function quickly, without the overhead of designing product-like prototypes?

We have developed a system for rapid emulation of robotic ankle prostheses and orthoses, which we have used in experiments that reveal quantitative relationships between device behavior and human performance. Recent results include characterizing the trade-offs between ankle push-off work, motor size and metabolic energy cost, as well as the relationship between step-by-step adjustments in device behavior and gait stability for the human-robot system. We will discuss how this biomechanics-centered approach to the design of assistive robots will lead to empirically-verified design guidelines, facilitate new approaches in online adaptation, user-specialization, and clinical diagnosis, and speed the arrival of better wearable robots.

BIO: Steve Collins is an Assistant Professor in the Department of Mechanical Engineering at Carnegie Mellon University. He is director of the Experimental Biomechatronics Laboratory, organizes the CMU Bipedal Locomotion Seminar, and teaches courses on Design and Biomechatronics. Steve received his B.S. from Cornell in 2002, his Ph.D. in Mechanical Engineering from the University of Michigan in 2008, and performed postdoctoral research at T.U. Delft in the Netherlands until 2010 when he joined CMU. He is founder of Intelligent Prosthetic Systems L.L.C., a member of the scientific board of Dynamic Walking, and the latest recipient of the American Society of Biomechanics Young Investigator Award.

Host: Chris Atkeson
For Appointments: Stephanie Matvey (smatvey@cs.cmu.edu)