PRINCETON
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Maeder Hall, ACEE
3:30 PM

Human Locomotion: How Humans Move Efficiently and Stably

Manoj Srinivasan
Ohio State University

Healthy humans walk and run with lower energy consumption than most bipedal robots. Humans also move with greater stability, robustness, and versatility. In this two-part talk, I will first describe our experiments and optimization-based predictions, demonstrating that energy optimality can predict many aspects of human locomotion behavior: steady locomotion in a straight line, unsteady locomotion with changing speeds, and non-straight-line locomotion. Building on this evidence, I will describe a computational framework for designing robotic prosthesis and exoskeletons that minimize human walking effort, discussing two ongoing studies. In the second part of the talk, I will describe our attempts to characterize the controller humans use to walk and run stably. We performed human experiments to record responses to perturbations and deviations from normal locomotion, and derived simple controllers that fit these human control responses. We show that some aspects of these controllers can also be explained, at least qualitatively, by energy-optimal perturbation recovery.

Manoj Srinivasan is an associate professor in the department of Mechanical and Aerospace Engineering at the Ohio State University, and a visiting associate professor in Mechanical Engineering at the Massachusetts Institute of Technology. He received an undergraduate degree from the Indian Institute of Technology, Madras and a PhD from Cornell University, and was a post-doctoral researcher at Princeton. His current focus is on human and animal locomotion and assistive robotics, drawing on mechanics, dynamical systems, optimization, and biology. His work has been featured on the Discovery Channel, National Geographic, NPR, New Scientist, etc. He is a recipient of the NSF CAREER award and is on the Scientific Board of the Conference on Dynamic Walking.

Social Period outside of Maeder Hall, following the seminar

ALL VISITORS ARE WELCOME