



THE OHIO STATE UNIVERSITY
COLLEGE OF ENGINEERING

Advanced Methods in the Dynamics and Control of Human and Animal Movement

MECHENG 7385

Credit Hours:

3.00 - 3.00

Course Levels:

Graduate (5000-8000 level)

Course Components:

Lecture

Course Description:

Mathematical ideas from control theory, optimization, nonlinear dynamics, and numerical computation that will be used to understand human, animal, and movement behavior and design.

Prerequisites and Co-requisites:

Prereq: 2030 (430), Math 2174, 2415 (415), 4568 (568), or 571, or Grad standing in Engineering.

Course Goals / Objectives:

- Learn about a various control theoretic and mathematical methods that are useful more broadly that for just the study of human and animal movement.
 - Learn about various theories of human and animal movement, including optimality and robustness and their use in building better robots.
 - Learn how to implement these ideas and theories to make predictions using computational techniques in MATLAB.
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Course Topics:

- Legged locomotion, various experiments, various simple mathematical models, energetics, and stability.
 - Stability: Notions of stability, eigenvalues, return maps, passive dynamic robots, actively controlled biped models, various control techniques, etc.
 - Optimal trajectory control: Finding motions that minimize energy, or maximize other performance measures. Optimal walking and running patterns, optimal athletic movements, etc.
 - Brief introduction to optimal feedback control, stochastic optimal control, and robustness. Finding body motions that are robust to external perturbations and internal muscle noise.
 - Bayesian and other optimal sensory integration. Estimation theory, in brief. How do animals know what's going on? Sensory illusions.
 - Learning theories in brief.
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Designation:

Elective