

2012-2013

# Graduate Seminar Series

## **The Department of Mechanical Engineering – Engineering Mechanics**

Proudly Presents

**Professor Todd Murphey  
Mechanical Engineering and  
Physical Therapy and Human Movement Science  
Northwestern University**



Todd Murphey is an Associate professor of Mechanical Engineering at Northwestern University, with a secondary appointment in Physical Therapy and Human Movement Science. He received an undergraduate degree in mathematics from the University of Arizona and a Ph.D. in Control and Dynamical Systems from the California Institute of Technology. He is a recipient of a National Science Foundation CAREER award. His research interests include computational methods in dynamics and control and design of embedded systems.

**Thursday, Sept. 20, 2012    4:00 – 5:00 p.m.    Room 112, ME-EM Bldg.**

### **Control Synthesis for Discrete Mechanical Systems**

Mechanical systems are typically nonlinear and constrained and are often under actuated with many degrees of freedom. Moreover, the choice of numerical methods for simulation can have a dramatic impact on control synthesis, particularly for high degree-of-freedom systems. Integrated methods that are specifically applicable to mechanical systems, such as variation integrators, can make simulation much more stable at the cost of making control synthesis less intuitive. This talk highlights our recent work on software automation of control synthesis for mechanical systems, including the use of discrete mechanical system representations for nonlinear controller and estimator design. I will discuss animatronics marionettes and walking robots as example applications. The talk will end with a discussion of the role that mechanical design plays in controlling impacting mechanical systems.