



## Mechanical Engineering Department Seminar Series

### Fluid Power for Wearable Robots



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Mechanical Engineering,  
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**Tuesday, September 29, 2015**

**4:00 – 5:00 pm**

**Room 1018 DOW**

**Abstract:**

Recently, there has been a resurgence of interest in powered wearable robots including powered exoskeletons for human assistance. Because they are worn, the actuators for such machines must be exceptionally small and exceptionally light, while still being able to deliver substantial power and force. It is an ideal application for fluid power because it has unsurpassed force and power density compared to electric motors. Fluid power, which includes hydraulics and pneumatics, has traditionally been used in large machines such as punch presses, excavators and motion bases for full-scale flight simulators. Bringing fluid power to the small scale required for wearable robots, however, comes with interesting engineering challenges that include control and efficiency considerations. This talk will overview the field of wearable robots, and will briefly review some work in muscle-powered orthotics to enable primitive walking by people with spinal cord injury. Next, fluid power will be introduced, including the key properties that make it attractive for power transmission and actuation. The bulk of the talk will address fluid power on the small scale including modeling and simulation results to predict efficiency and weight of fluid power systems at the small scale, engineering design guidelines for small scale hydraulics and applications that include a hydraulic powered ankle-foot orthosis that has exceptional torque yet is still light weight. The research that will be presented is connected to the Center for Compact and Efficient Fluid Power, an NSF Engineering Research Center.

**Bio:**

William Durfee is Professor and Director of Design Education in the Department of Mechanical Engineering at the University of Minnesota, Minneapolis, USA. He received his undergraduate degree from Harvard University and his graduate degrees from the Massachusetts Institute of Technology. His professional interests include the design of medical devices, rehabilitation engineering, advanced orthotics, biomechanics and physiology of human muscle including electrical stimulation of muscle, product design and design education.