Joint Department of

BIOMEDICAL ENGINEERING

UNC CHAPEL HILL | NC STATE UNIVERSITY

Coulter Seminar Series Presents

Rehabilitation Engineering

Analyzing Movement by Observing Tissues

Darryl Thelen, Ph.D.
Weideman Professor of Mechanical Engineering
University of Wisconsin-Madison

Darryl Thelen is the Weideman Professor of Mechanical Engineering at the University of Wisconsin-Madison. He is also the Bollinger Chair of the Department of Mechanical Engineering. Prof. Thelen's neuromuscular biomechanics lab develops computational models, novel sensor technologies and dynamic imaging protocols to investigate the structure, mechanics and behavior of musculoskeletal tissues within the human body. Current projects are aimed at improving orthopedic treatments of gait disorders in children, enhancing the precision of total knee joint replacement and investigating biomechanical factors that contribute to osteoarthritis. His research has been supported by the NIH, NSF and a number of private companies and foundations. Dr. Thelen received his bachelor's degree in mechanical engineering from Michigan State University in 1987 and his MSE and PhD degrees in mechanical engineering from the University of Michigan in 1988 and 1992, respectively. He has been on the faculty of the University of Wisconsin-Madison since 2002.

ABSTRACT

Muscle-tendon units are the actuators that drive human movement. We will review our use of imaging and wearable sensors to characterize the kinematics and kinetics of muscle-tendon units. We will describe the use of ultrasound speckle-tracking techniques to assess tendon tissue deformation, and show evidence of sliding between tendon substructures that may be critical to normal muscle-tendon function. We will review our use of shear wave elastography to probe spatial and load-dependent variations in tendon tissue properties. Finally, we will introduce an exciting non-invasive approach to assess tendon kinetics by tracking vibrational behavior in tissue. We show both analytically and experimentally that, under loading, shear wave propagation in tendon increases directly with axial stress. We then introduce a remarkably simple shear wave tensiometer that uses micron-scale taps and skin-mounted accelerometers to track tendon wave speeds in vivo. Tendon wave speeds will be shown to modulate in phase with joint loading during dynamic movements such as walking and running. We will discuss the application of the tensiometers for investigating the biomechanics and motor control of movement, and the potential to use the technology to enhance the treatment of musculoskeletal injuries and movement disorders.

CLEAR Core
Closed Loop Engineering
for Advanced Rehabilitation
http://clear.bme.unc.edu

Friday, November 6th
12:00 Noon

Seminar will be presented virtually via Zoom:
https://go.unc.edu/f3QHx