

# DEPARTMENT OF MECHANICAL ENGINEERING

## WILLIAM MAXWELL REED SEMINAR SERIES

### “Living on the edge - emerging interface problems in soft matter, cell and neuro mechanics”

Christian Franck, Ph.D.  
University of Wisconsin-Madison

**Abstract:** The last decade has fostered a significant amount of interdisciplinary research centered around emerging interface problems in cell biology. These include cell adhesion, migration, force sensing and transduction among many others – all processes that are facilitated through a cell-material interface. From a continuum point of view these interfaces are often characterized by non-planar geometries, adhesive contact, and finite deformation viscoelastic constitutive laws. Hence, they motivate a natural need for the development of full-field experimental techniques capable of fully resolving the spatial and temporal intricacies of the deformation they facilitate.

In this talk I will highlight some of our contributions to the advancement of full-field image and volume correlation based techniques, and their application in the reconstruction process of cellular stress, strain and traction fields in 3D. In particular, I will focus on how the use of digital volume correlation can provide crucial insight into the strain and strain-rate dependent injury progression of neurons in a 3D in-vitro model of traumatic brain injury, which provides a new and quantitative in-situ experimental approach for deciphering the intricate spatiotemporal details of a complex human disease.

**Bio:** Christian Franck is a mechanical engineer specializing in cellular biomechanics and new experimental mechanics techniques at the micro and nanoscale. He received his B.S. in aerospace engineering from the University of Virginia in 2003, and his M.S. and Ph.D. from the California Institute of Technology in 2004 and 2008. Dr. Franck held a post-doctoral position at Harvard investigating brain and neural trauma. He was an assistant and associate professor in mechanics at Brown University from 2009 - 2018, and is now the Grainger Institute for Engineering Associate Professor in Mechanical Engineering at the University of Wisconsin.

His lab at the University of Wisconsin-Madison has developed unique three-dimensional full-field imaging capabilities based on confocal microscopy and digital volume correlation. Current application areas of these three-dimensional microscopy techniques include understanding the 3D deformation behavior of neurons in the brain during traumatic brain injuries, the adhesion and migration behavior of human neutrophils in 3D environments, and the role of non-linear material deformations in soft matter.

**Date:** Friday, October 19<sup>th</sup>  
**Place:** CB 114

**Time:** 3PM  
**Contact:** Dr. Alexandre Martin 257-4462

Meet the speaker and have refreshments  
Attendance open to all interested persons