

**Dynamics & Control Approaches to Probe-based Rapid
Broadband Nanomechanical Spectroscopy and High-Speed
Imaging of Soft and Biological Materials**

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2004 Black

Abstract

Nanoscale morphological characterization and mechanical properties quantification of soft and biological materials play an important role in areas ranging from nano-composite material synthesis and characterization, cellular mechanics to drug design. Frontier studies in these areas demand the coordination between nanoscale morphological evolution and mechanical behavior variations through simultaneous measurement of these two aspects of properties. Atomic force microscope (AFM) is very promising in achieving such simultaneous measurements at high-speed and broadband owing to its unique capability in applying force stimuli and then, measuring the response at specific locations in a physiologically friendly environment with piconewton force and nanometer spatial resolution. Challenges, however, arise as current AFM systems are unable to account for the complex and coupled dynamics of the measurement system and probe-sample interaction during high-speed imaging and broadband measurements. In this talk, I will present the creation of a set of dynamics and control tools to probe-based high-speed imaging and rapid broadband nanomechanical spectroscopy of soft and biological materials. I will also demonstrate the experimental implementation of these approaches in biomedical applications including study of elasticity oscillations of cell membrane under cholesterol treatment, the variation of rate-dependent elastic modulus of cervix cancer cell during the epithelial-mesenchymal transition (EMT) process, and adaptive imaging of prostate cancer cell at over 8 times faster speed. I will conclude the talk with a brief discussion of my future research and teaching plan.

Biography

Juan Ren is currently a Ph.D. candidate in the Department of Mechanical and Aerospace Engineering of Rutgers University. She received her bachelor's degree in Mechanical Engineering from Xi'an Jiaotong University, China in 2009. Her research interests include dynamics and control approaches to cellular and sub-cellular biological studies; mechatronics development to nanoscale experimental mechanics of soft and biological materials, and dynamics modeling and control for nanoscale biomedical applications.

This seminar counts towards the ME 600 seminar requirement for Mechanical Engineering graduate students.

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