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Date: Friday, October 9, 2026

Time: 12:00 to 1:00 PM

Location: SR2 130

Title: Optical Coherence Elastography and Applications in Tissue Biomechanics

Abstract: The mechanical properties of biological tissues play a fundamental role in maintaining tissue structure, regulating cellular behavior, and determining physiological function. Changes in tissue biomechanics are also closely associated with disease progression, aging, and pathological remodeling. However, quantitative characterization of tissue mechanical properties remains challenging because conventional mechanical testing often requires physical contact, tissue excision, or mechanical loading, while many imaging-based approaches have limited spatial resolution or provide only indirect measures of tissue mechanics. Optical coherence elastography (OCE) offers a promising non-contact and high-resolution approach by integrating optical coherence tomography with controlled mechanical excitation and phase-sensitive measurements to visualize and quantify tissue deformation and mechanical-wave propagation.

In this seminar, I will discuss the development and application of OCE methods for quantitative and spatially resolved characterization of tissue biomechanics. Different excitation strategies, including air-pulse, acoustic, piezoelectric, and reverberant-field excitation, will be discussed in the context of measuring tissue deformation and mechanical-wave propagation. Applications spanning the cornea, lens, brain, bone marrow, and other biological tissues will be presented to demonstrate the ability of OCE to resolve biomechanical heterogeneity at tissue and sub-tissue scales.

I will also discuss ongoing efforts to integrate optical imaging, computational analysis, and multimodal biomechanical measurements to better understand the relationship between tissue structure, mechanical properties, and biological function. Ultimately, these approaches aim to establish quantitative optical methods for investigating tissue mechanobiology and developing sensitive biomarkers of disease-related biomechanical changes.

Bio: Amandeep Singh is a Postdoctoral Fellow in the Department of Biomedical Engineering at the University of Houston, where he works in the Biomedical Optics Laboratory under the guidance of Dr. Kirill V. Larin. His research focuses on optical and computational imaging approaches for quantitative characterization of tissue biomechanics using optical coherence elastography. Dr. Singh earned his Ph.D. in Biomedical Engineering from the Indian Institute of Technology Hyderabad, India, where his doctoral research focused on holography-based optical elastography and the development of high-resolution optical methods for measuring tissue mechanical properties. His research combines optical coherence tomography, holographic imaging, phase-sensitive detection, mechanical excitation, and computational analysis. His current research encompasses the development and application of non-contact OCE approaches for investigating corneal biomechanics, bone marrow mechanics, crystalline lens elasticity, and neurodegenerative disease models. He has contributed to several pioneering studies demonstrating the clinical and translational potential of OCE in ophthalmology, tissue engineering, and disease diagnostics. Amandeep has published his research in peer-reviewed journals and presented his work at international conferences in biomedical optics and optical engineering. His research has been recognized through competitive research fellowships, travel awards, conference grants, and research project funding from the University of Houston, IIT Hyderabad, SPIE, and UGC. His broader research vision is to develop quantitative optical imaging technologies that connect tissue structure, biomechanics, and biological function.