BIOENGINEERING
Spring 2020 Seminar

Date: **Thursday, February 20, 2020**

Time: **12:00 pm - 1:00pm**

Location: **Exploratory Hall, Room L111**

(Videoconferencing to SciTech, K. Johnson Hall Rm 254)

Spandan Maiti, Ph.D.

Biography: Dr. Maiti obtained his PhD from the Aerospace Engineering Department of the University of Illinois at Urbana-Champaign. After a post-doctoral fellowship at the Beckman Institute, University of Illinois, he joined the faculty of Mechanical Engineering-Engineering Mechanics at the Michigan Technological University. He is currently an Associate Professor at the Department of Bioengineering, University of Pittsburgh. His research interest is in the area of computational biomechanics with an emphasis on the failure of soft native tissue. He has authored more than twenty journal papers in this area, and his work is supported by NSF and NIH.

Title: Biomechanics of Ascending Thoracic Aortic Dissection

Abstract: Type A Aortic Dissection (TAAD), initiating from an intimal tear in the ascending aorta and eventually propagating through the aortic media delaminating the media layers, is a major health concern. Mortality rate associated with this disease is very high, but our ability to predict patient-specific dissection risk is not adequate. Current clinical guidelines for the TAAD risk mitigation recommend prophylactic surgical replacement of the ascending aorta at an aneurysm diameter >5.5cm. However, large retrospective series and data from the international registry of acute aortic dissection has shown that as high as 62% of patients with TAAD have aortic diameters distinctly less than 5.5 cm. This data strongly indicates the clinical need for improved evidence-based dissection risk prediction metrics for better patient outcome.

From a biomechanical perspective, dissection is the biomechanical failure of the aortic wall whenever ascending aortic wall stress exceeds corresponding wall strength. However, regionally varying patient-specific biaxial wall stress compounded with highly anisotropic aortic wall strength precludes such simple assessment of the dissection risk, and necessitates mechanistic understanding of the wall tissue failure. Overall research goal of our lab is to quantify structure-property relationship of the ascending aortic wall tissue to determine failure mechanisms operative at different length scales, and use that knowledge towards patient-specific dissection risk adjudication in a non-invasive manner. In this presentation, I will demonstrate how highly complex pre-failure and failure biomechanics of the aortic wall emerges from the sub-tissue scale interaction of its structural components. We will also demonstrate how the failure biomechanics of the ascending aorta can be utilized for the construction of biomechanics-based metrics for dissection risk prediction. Such metrics will help identify the role of biomechanics on patient-specific dissection risk and will offer a novel perspective for the management and risk stratification of affected patients and improve patient care and outcomes.