



# Biomedical Engineering

*Lecture Series Seminar*

**Multiscale Analysis of Tissue Engineering Scaffolds and Breast Tumor**

**Dr. Vinu Unnikrishnan**

Texas A&M University

Time: 1:00 p.m – 2.00 pm

Location: EC 2300

**Abstract:** An understanding of the structure–property relationship is essential for the estimation of mechanical properties of hierarchical bio-materials like nano-material based biopolymers and soft tissues. A computational study of these complex systems involves the coupling of physics occurring at different length and time scales. In the first part of this talk, a multiscale computational analysis of nano-material based biopolymers, involving the atomistic-scale modeling of the nano-structure, followed by a systematic and rigorous up-scaling of the mechanical properties using nonlinear homogenization models would be discussed. These mechanical characterizations of nano-polymers help in the development of efficient scaffolds for tissue cultures.

In the second part of this talk, a mechano-biological computational model to analyze the effect of varying micro-structural constituents (especially collagen content) on the mechanical behavior of breast and tumor tissue would be presented. The correlation between the change in breast density and the corresponding change in the mechanical response of breast tissue would also be discussed. This study aims at providing clinical diagnostic tools to supplement current breast examination guidelines, and can be further enhanced using information from imaging techniques like elastography. These fundamental biomedical researches on developing novel mathematical computational formulations not only helps in understanding and providing patient-specific diagnosis of pathological conditions of the human body but also helps in developing biomedical hazard mitigating standards.

**Bio:** Dr. Vinu Unnikrishnan is a post-doctoral research associate in the Department of Mechanical Engineering at Texas A&M University, College Station, TX. He received his Ph.D. in Civil Engineering from Texas A&M University in 2007. His doctoral research was carried out under the supervision of Professor J. N. Reddy on the *multiscale modeling of nano- and biological systems*, where he developed multiscale methods for the mechanical and thermal characteristics of carbon-nanotube and polymeric based composite systems for use in advanced bio-medical and industrial applications. He is currently focused on developing computational models for the bio-mechanical characterization of human pathological conditions like breast tumor, pelvic prolapse, uterine scarring, atherosclerosis etc. His research focus also involves developing nonlinear homogenization methods using continuum mechanics principles together with advanced computational techniques.