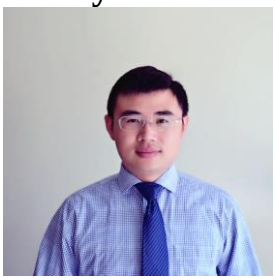
The Department of Mechanical Engineering/College of Engineering and Applied Sciences

Stony Brook University

Mechanical Engineering Seminar

Faculty Candidate



Jun Li, Ph.D.

Postdoctoral Scholar in the Graduate Aerospace Laboratories at California Institute of Technology

Lecture Title: Characterization and Modeling of Time and Temperature Dependent Polymer Membranes

Monday, April 21, 2014 at 2PM, Room 173 Light Engineering Building

Abstract

Membranes are becoming increasingly important and widely used in diverse fields including deployable and lightweight structures, environmental protection and purification systems, and energy conversion and storage devices. Understanding the mechanics of membranes that exhibit time and temperature dependent behavior is critical to ensure long-term reliability in applications. However, the nonlinear viscoelasticity of polymers coupled with the small thickness of membranes pose challenges in characterization and modeling. In this talk, I will describe a hybrid method (experimental + computational) to develop nonlinear orthotropic viscoelastic models for the linear low density polyethylene (LLDPE) membranes used in the NASA Superpressure Balloon. I will first show that the master curves of creep compliance obtained from creep tests and oscillation tests for linear viscoelastic characterization are not equivalent due to the semi-crystalline nature of LLDPE and one has to be careful to choose between the two approaches. A nonlinear viscoelastic membrane model based on the free volume theory is developed while it couples the through-plane strain to the in-plane deformation of the membrane, and in practice the through-plane material properties are difficult to measure. I will present a two-step computational scheme combining an evolutionary algorithm and a simplex optimization to extract material parameters through inverse analysis of experimental results. The validity of the model is then demonstrated on tests at a wide range of temperatures and strain rates. Finally, I will discuss several possible avenues of future research.

Biography

Dr. Jun Li is a postdoctoral scholar in the Graduate Aerospace Laboratories at the California Institute of Technology. He received his Ph.D. in Mechanical Engineering from the University of Illinois at Urbana-Champaign (UIUC) in 2012, as well as M.S. in Mathematics and in Theoretical and Applied Mechanics. At UIUC, he contributed to the mechanics of fractal and random materials leading to over 10 journal publications. He delivered a keynote at the 10th US National Congress on Computational Mechanics and received the best poster award of "Emerging Researchers in Biomedical Engineering" at 2011 ASME International Mechanical Engineering Congress and Exposition. Prior to UIUC, he obtained B.S. in Mechanical Engineering with a minor in Mathematics from Shanghai Jiaotong University in 2005. His research interest is to develop theoretical analysis methods integrated with computational techniques and experimental characterizations for the design, optimization, and assessment of novel materials and structures.

Directions: Please refer to website: http://www.sunysb.edu or call 631-632-8310 for more information.
Check http://me.eng.sunysb.edu for any changes to location or time.

Stony Brook University