Nonlinear Continuum Mechanics

Overview

Engineers and researchers working on bioengineering, soft tissue mechanics, tire industries, impact and penetration problems, satellites, fluid-structure interaction (e.g., blood flow in arteries, water slamming) and numerous other industries face challenges that require a sound understanding of principles of non-linear continuum mechanics. Structural components are generally exposed to environments that require studying multiphysics (e.g., coupled thermal, electrical and mechanical) response of materials. Furthermore, the need to reduce weight and find economical biological implants require that material's large deformations be accurately modeled. One can easily see large deformations of a balloon by blowing air in it, pulling skin on one's arm, stretching of soft tissues during surgery, bending of polymeric beams, and stretching of a rubber band. Metallic structures also undergo large deformations when exposed to severe environments such as high-speed impact of two automobiles. Fluids' and solids' deformations can involve large strain-rates, for example, during impact at 100 km/s of space debris on satellites.

The primary objectives of the course are:

i) Teaching kinematics and kinetics of finite deformations (e.g., stress and strain tensors suitable for large deformations, strain tensors and their work conjugate stress tensors)
ii) Equations governing large deformations of solids and fluids
iii) Development of material models for incompressible and unconstrained materials, material objectivity, 2nd law of thermodynamics
iv) Analytical solution of boundary-value problems, and
v) Energy principles for nonlinear elastic problems
vi) Micromechanical modeling of smart materials

Modules	**A: 12 hours lectures, 12 hours tutorials (Batra) : December 18-23, 2017** **B: 4 hours lectures, 4 hours tutorials (Ray) :** **Number of participants for the course will be limited to fifty (50).**
You Should Attend If…	▪ **You are a practicing engineer working on nonlinear large deformation problems** ▪ **You are a user of commercial codes for analyzing biomechanical, tire, impact and penetration problems** ▪ **you are either a M.Sc./Ph.D. student or a young faculty member interested in enhancing your knowledge of continuum mechanics and intend to work on non-linear finite deformation problems in functionally graded materials, soft tissues, biomechanics, soil mechanics, rubberlike materials, smart materials, etc.**
Fees	The participation fees for taking the course are as follows: **Participants from abroad : US $500.00** **Industry/ Research Organizations: Rs. 10,000.00** **Academic Institutions: Rs. 8,000.00** **Students : Rs. 3000.00** The above fees include all instructional materials, computer use for tutorials and assignments, laboratory equipment usage charges, 24 hr free internet facility. The participants will be provided with accommodation on payment basis.

The Faculty

Professor Romesh Batra is the Clifton C. Garvin Professor of Engineering Science and Mechanics at Virginia Polytechnic Institute and State University (Virginia Tech), Blacksburg, VA, USA. He has successfully mentored 35 Ph.D., 19 M.Sc. and nearly 60 Post-doctoral Fellows with whom he has published in reputable refereed and widely read journals 420 papers of which 40 are single-authored and about 300 have two authors. His publications have received nearly 15,000 citations with an H-index of 64 on google scholar (H = 54 on Scopus) as of 7 August 2017. His book "Elements of Continuum Mechanics" has been adopted at many universities. His honors include a 2015 ASME Honorary Membership, the 2016 ASME Robert Henry Thurston Lecture Award, a Virginia Outstanding Scientist Award (2011), a Virginia Outstanding Faculty Award (2010), and the Engineering Science Medal from the Society of Engineering Science (2006). He has been teaching courses on Continuum Mechanics, Nonlinear Elasticity and the Finite Element Method to Ph.D., M.Sc. and Post-doctoral fellows since 1974.

Professor Manas Chandra Ray is a professor of Mechanical Engineering at Indian Institute of Technology, Kharagpur, India. He is a pioneering researcher in the field of smart composite structures. He is also actively working in the research areas on active damping, micromechanics and nanomechanics, flexoelectric solids and strain gradient elasticity. He was a Visiting Associate Professor at Texas A&M University, College Station, Texas, USA during 2003 to 2004. He also held several Visiting Positions at Virginia Tech., Blacksburg, USA, University of Maryland at College Park, USA, Massachusetts Institute of Technology, Cambridge, MA, USA, University of California at Irvine, California, Texas Tech. University, Texas and Rensselaer Polytechnic Institute, Troy, New York. He is a Fellow of the Indian National Academy of Engineering.

Course Co-ordinator

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