Mechanics of foams and lattice materials

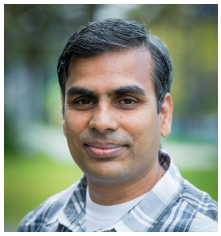
Overview

Recent advancements in micro and nanotechnology and fast prototyping manufacturing methods enable us to build solids with complex microarchitecture. The ability to tailor microstructures opens up the possibility to design materials with desired mechanical, thermal and vibroacoustic properties. This has lead to increased research efforts in the last decade in ultralight lattice materials, cellular solids, and metal foams. The literature in this area is spread across many journals that focus on materials, structures, vibroacoustics, and applied physics, and research monographs. A systematic and unified synthesis will greatly help consolidate conceptual building blocks in this emerging field of research and serve as a useful reference to researchers based in universities and industrial research labs.

The set of lectures proposed in this GIAN course will expose the participants to this emerging area with an emphasis on mechanics, design, and performance of cellular solids, metal foams, and lattice structures. Applications include sandwich beams and panels for lightweight and multifunctional structural applications in Aerospace, Automotive, and other mechanical structures. Topics covered in this short course are elastic and plastic deformation properties under static and dynamic loads; vibroacoustics response; fabrication and testing. The participants are expected to leave this short course with a sound understanding of the fundamental mechanics principles and consequent applications.

Course Dates	**December 16 – 24, 2019, Number of participants for the course will be limited to fifty.**
Modules	**Module 1: Introduction to architectured materials: Foams and lattices** **Module 2: Static response: Stiffness and strength** **Module 3: Dynamic response: Waves and vibroacoustics** **Module 4: Case study: Sandwich panel design** **Module 5: Other Applications: Aerospace, Biomedical and Communications**
Target Audience	- you are a structural engineer or research scientist interested in designing components using lattice materials and/or metal foams - you are an advanced undergraduate/ graduate student or faculty from academic institution interested in architectured materials and their applications with background knowledge in strength of materials, solid mechanics and dynamics.
Fees	The participation fees for taking the course is as follows: **Participants from abroad: US $500** **Industry/ Research Organizations: Rs. 16000** **Academic Institutions: Rs. 12000** **Graduate Students/ Research Scholars: Rs. 2000** The above fee includes all instructional materials, computer use for tutorials and assignments, laboratory equipment usage charges. Depending on availability, the participants will be provided with accommodation on payment basis. Additional fee of Rs. 2500/- shall be paid for lunch and refreshments offered during the course.

The Faculty



A. Srikantha Phani received his Ph.D. in Dynamics and Vibration from the University of Cambridge in 2004. At UBC, he leads a combined theoretical-experimental research program, focusing on dynamic response and structure-property relations of lattice materials, structures, and devices, using a variety of modeling and simulation methodologies, ranging from atomistic to continuum models. Some of his contributions include Bloch wave formulation for band gap (phonon transport) analysis in 2D lattice materials, elucidation of bandgap formation mechanisms in locally resonant acoustic metamaterials, he is the principal editor for a research monograph on Dynamics of Lattice Materials, to be published by John Wiley and Sons. He served on NSERC (Canda) and NSF (USA) committees.

Dr. Ramji obtained his B.E in Mechanical Engineering from Algappa College of Engineering and Technology, Karaikudi in 2001. Later, he did his M.Tech in Engineering Mechanics from Applied Mechanics Department, IIT Madras in 2003. He was a gold medalist in his M. Tech Batch. He continued his Ph.D. program in the same Applied Mechanics Department, IIT Madras in the area of digital photoelasticity and graduated in Dec 2007. He was awarded Prof. Ramamurthi Best Ph.D. thesis award in 2008 from the Applied Mechanics Department, IIT Madras-based on the thesis work. Currently, he is an associate Professor in the Department of Mechanical and Aerospace Engineering IIT Hyderabad. His areas of interest are material characterization, experimental solid mechanics, Composite structures, and Fundamental Fracture mechanics.

Dr. B. Venkatesham is an Associate Professor at the Indian Institute of Technology, Hyderabad. He earned his Doctorate from Indian Institute of Science, Bangalore, specializing in Duct Acoustics. He worked as a Lead Engineer around 10 years at the General Electric Global Research Centre before joining IIT Hyderabad in 2010. At GE, He worked on research projects and product development programs in industries spanning Energy, Appliances, Business equipment and Locomotive. He conducted 12 Industrial training programs related to Noise & Vibration. He has published 10 papers in International Journals, 36 conference papers and 3 patents in the area of Engineering Acoustics. His main research interests are in the areas of Break-out noise modeling, Acoustic-Structural coupling systems, Noise Control Engineering applications, and sound quality.

Dr. Syed Nizamuddin Khaderi received his MTech from IIT Kanpur and Ph.D. from the University of Groningen, The Netherlands. Prior to joining IIT Hyderabad, he worked as a research associate at the University of Cambridge, UK and as a scientist at the Institute of High-Performance Computing, Singapore. His research expertise is on computational solid mechanics with a strong focus on lattice materials, metal foams, and fluid-structure interaction.