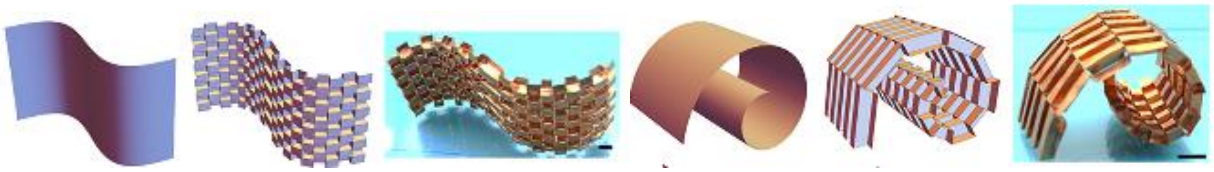
Mechanics of mechanical metamaterials



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Overview

The course gives an overview of mechanical metamaterials and the aspects of modelling them. A specific emphasis will be laid on the discussion of static and dynamic response of mechanical meta materials through super cell and phenomenological models. Micromechanics based constitutive models to describe the mechanical behaviour of fibre network metamaterials will be discussed. Recent advances such as origami-based folding and energy absorption capabilities of metamaterials will also be discussed. The course syllabus is as follows:

1. Introduction of mechanical metamaterials

1.1 Two dimensional and three-dimensional metamaterials, including honeycombs, fiber network materials, lattice materials, micro lattice materials, origami-based folding materials

1.2 Geometric modeling of materials with regular and irregular microstructures

1.3 Manufacturing of metamaterials, including honeycombs, fiber network materials, lattice materials, micro lattice materials and folding materials)

2. Static mechanical properties of mechanical metamaterials

2.1 Homogenization techniques

2.2 Super cell modeling

2.3 Phenomenological modeling

3. Impact responses of mechanical metamaterials

3.1 Hexagonal honeycombs

3.2 Auxetic double-arrow honeycombs

4. Wave propagation in mechanical metamaterials

4.1 Homogenization modeling of elastic wave

4.2 Tuning elastic wave in metamaterials

5. Fiber network metamaterials

5.1 Micromechanical constitutive modeling

5.2 Effects of imperfections

5.3 Rate dependent constitutive modeling

6. Origami-based folding metamaterials

6.1 Geometrical modeling

6.2 Mechanical properties and bi-stability

6.3 Energy absorption capability

Dates	**18 – 22 November 2019**
Venue	**Department of Mechanical Engineering, Indian Institute of Technology Madras, Chennai**
You Should Attend If…	▪ you are a mechanical/civil/aerospace/materials engineer or a research scientist interested in designing novel actuators employing the mechanical metamaterials. ▪ you are a student or faculty from an academic institution interested in learning the recent trends in architectured materials providing exotic properties and their mechanical response.
Fees	The participation fees for attending the course is as follows: **Participants from abroad: US $ 500** **Student participants: INR 2500** **Faculty participants: INR 5000** **Industry: INR 10000** **Research Organizations: INR 7500** The above fee includes all instructional materials, computer use for tutorials and assignments, refreshments during the lectures. **Modes of payment:** Online transfer: Account Name: CCE IIT Madras Acc. No: **36401111110** Branch: SBI, IIT Madras Branch, Chennai IFSC Code: SBIN0001055 Swift Code: SBININBB453 Note: The participants should be mentioned the purpose of GIAN while the transaction and have to send the transaction details to cceoffice@iitm.ac.in or gian@iitm.ac.in **OR** Demand draft in favour of "**CCE IIT Madras**" payable at **Chennai**. The demand draft is to be sent to the course coordinator at the address given below. Address of the Course Coordinator: Dr. Ratna Kumar Annabattula Associate Professor 208, Machine Design Section Department of Mechanical Engineering IIT Madras Chennai – 600036, INDIA. Ph: +91-44-2257 4719
Accommodation	The participants may be provided with hostel accommodation, depending on availability, on payment basis. Request for hostel accommodation may be submitted through the link: http://hosteldine.iitm.ac.in/iitmhostel/
Registration Procedure	1. Go to GIAN website (http://www.gian.iitkgp.ac.in/GREGN/index) First time users need to register and pay a one-time fee of INR 500 / 2. Enrol for the course: Mechanics of mechanical metamaterials. Once you enrol for the course, an Enrolment/Application number will be generated, and the course coordinators will be notified.

The Faculty

Dr. Changqing Chen is currently a professor and director of the Institute of Solid Mechanics, a part of School of Aerospace Engineering at Tsinghua University, Beijing, P. R. China. Prof. Chen's research interests include numerical modeling of the microstructure evolution of materials, nano- and micro-mechanics of cellular materials, and atomistic simulation of the mechanical behavior of ferroelectric ceramics. He is the principal investigator (PI) or co-PI of ten research grants on the aforementioned topics from the Natural Science Foundation of China (NSFC), Chinese Ministry of Science and Technology, and the Chinese industry. He is on the editorial board of four international journals and has received several awards for his outstanding contributions to mechanics of materials. He was recipient of the Chinese National Science Foundation's National Outstanding Young Investigator Award for his work on mechanics of functional materials.

Dr. Ratna Kumar Annabattula is an Associate Professor in the Department of Mechanical Engineering, IIT Madras. His current research interests include mechanics of stimuli-responsive thin films, mechanics of granular materials for energy and multiscale materials modeling. He received his PhD from University of Groningen, The Netherlands in 2011. He received his B.E. (Andhra University) and M.E. (Indian Institute of Science) in 2002 and 2004, respectively, both in Mechanical Engineering. He was as a postdoctoral researcher at Karlsruhe Institute of Technology, Germany for about two and half years before joining IIT Madras in December 2012.

Course Co-ordinator

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