

Multiscale Modeling of Heterogeneous Structures

Overview

Heterogeneous materials like concrete, fiber-matrix composites and soft-tissues in the human body, play significant role in various applications in Civil, Aerospace, Marine, Biology, etc. The properties of the heterogeneous materials are strongly influenced by the properties in the atomistic, micro, as well as the macro scales. Due to this strong hierarchical nature, it is difficult to determine the response of these materials purely from a macro scale or continuum level. Atomistic level simulations can capture the strong interdependence between the different levels. However, the exorbitant computational costs involved in the atomistic level simulation prevent the characterization of the properties for the various applications. A multiscale method, which transfers the knowledge gained at the atomistic to the micro level and subsequently to the macro level, is required to understand the properties of these heterogeneous systems.

This short course focuses on the micromechanical-based homogenization procedures and multiscale approaches necessary for the characterization of heterogeneous composite systems. The course will present a broad overview of multiscale modeling, micromechanics and continuum mechanics. Various hands-on activities, mathematical simulations and computational tools are included in this course to provide a practical understanding of the applications of micromechanics and multiscale modeling techniques to various complex heterogeneous systems with special emphasis on concrete, nanocomposites and biological materials.

Upon completion, participants will have a clear understanding of the principles in atomistic simulation, micromechanics and continuum-scale modeling of heterogeneous systems and how to apply this knowledge to study complex heterogeneous composite systems based on a “Physics” based modeling approach.

Objectives

The primary objectives of the course are as follows:

- Exposing participants to the fundamentals of multiscale modeling of heterogeneous materials.
- Provide broad overview of various multiscale modeling techniques with specific emphasis on micromechanical based homogenization techniques and continuum mechanics principles.
- Providing hands-on activities, mathematical simulations and computational tools to provide a practical understanding of multiscale simulation of complex heterogeneous materials like concrete, nanocomposites and soft biological materials.
- Enhancing the capability of the participants to diversify into multiscale modeling of complex composite materials using “physics based modeling” techniques.

Dates	<ul style="list-style-type: none"> • June 4th to 16th 2018. • Number of participants will be limited to FIFTY. • Registration is on a first come, first serve basis and space is limited. 	<p><u>Course Coordinators</u></p> <p>Dr.P.S. Raghuprasad Associate Professor Dept. of CT&M Sri Jayachamarajendra College of Engineering Mysuru-570006. Phone:+91-8762797041 e-mail: raghuprasad_ps@sjce.ac.in</p> <p>Prof. Dharshan.K Assistant Professor Dept. of CT&M Sri Jayachamarajendra College of Engineering Mysuru-570006. Phone:+91-9449476455 e-mail: dharshanrck@sjce.ac.in</p> <p>http://www.gian.iitkgp.ac.in/GREGN</p>
You Should Attend If...	<ul style="list-style-type: none"> ▪ Civil, Construction Technology and Management, Transportation and Environmental engineer. ▪ Executives, engineers and researchers from university, Consulting companies, researchers from government organizations, R&D laboratories. ▪ Students at all levels (B. Tech. /M.Sc. /M.Tech. /Ph.D.) and Faculty from reputed academic and technical institutions. ▪ Any others interested in expanding their qualifications/knowledge related to heterogeneous structures. 	
Pre-Requisite	<ul style="list-style-type: none"> • No special prerequisites. • However candidates must be interested in expanding their qualifications/knowledge related to heterogeneous structures. 	
Fees	<p>The participation fees for the course is as follows: Participants from:</p> <ul style="list-style-type: none"> • Abroad : US \$100 • Students / Industry / Academic Institutions / Research Organization: Rs. 2000.00 • Participants from host Institute: Rs.1000.00 • The above fee includes training program, Wi-Fi connectivity and computer use for tutorials, assignments etc. 	
General Information	<ul style="list-style-type: none"> • Participants are encouraged to bring their own laptop. • Participants are expected to make their own arrangements for food and accommodation. 	



Dr. Vinu U. Unnikrishnan is an Assistant Professor in Aerospace Engineering and Mechanics at the **University of Alabama**. He received his Ph.D. in Civil Engineering from Texas A&M University, College Station in 2007. Dr. Unnikrishnan's research interests are in the development of multiscale models of advanced composite systems for use in bio-medical, aerospace and industrial applications. He has authored over 40 journal papers and 5 book chapters in various topics in mechanics of nano and bio-materials and has 3 patent applications pending. He is currently the Associate Editor and Managing Editor of the journal Mechanics of Advanced Materials and Structures, and served as the secretary of the AIAA Materials Technical Committee. He is a member of the TMS Technical Committee on Nanomaterials and American Society of Composites Emerging Composites Committee. He is a member of the ASME, AIAA and TMS and is the recipient of the 2013-2014 SEC Faculty Travel Awards, and 2015 and 2016 U.S. Air Force Summer Faculty Fellowship.



Dr. P.S. Raghuprasad obtained his B.E. degree in Civil Engineering from University of Mysore, M.Tech. in Structural Engineering from Visvesvaraya Technological University, Belgaum and Ph.D in Civil Engineering from Kuvempu University. He has teaching & research experience of more than 20 years. At present he is an Associate Professor in the Department of Construction Technology and Management, Sri Jayachamarajendra College of Engineering, Mysuru, Karnataka, India. He has published more than 20 research papers in International and National Journals and conferences. His research interest includes Blended Cement Concrete, High Strength Concrete, Fiber Reinforced Concrete, Repair and Retrofitting measures for Earthquake Resistant Structures and Construction Management. He was awarded 2nd prize for his technical paper presented for Karnataka and Goa State Level Technical Paper Presentation Contest 2001 and also a recipient of "ACCE Sundaram Merit Award 2002" for best M.Tech. Dissertation at State Level for the year 2002.



Prof. Dharshan K. obtained his B.E. degree in Civil Engineering & M.Tech. in Construction Technology from Visvesvaraya Technological University, Belgaum. He has teaching experience of more than 5 years. At present he is an Assistant Professor in the Department of Construction Technology and Management, Sri Jayachamarajendra College of Engineering, Mysuru, Karnataka, India. He has published 5 research papers in National Conferences. His research interest includes Construction Materials and Construction Management and Building Services.