# Modelling approaches for coupled multiphysics engineering problems

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## Overview

Most of the mechanical, aerospace, electrical and civil engineering problems in applications involve the integrations of solid and fluid dynamics coupled with the effects of control, acoustics, electrodynamics, thermal chemical etc. In order to study such problems, single-discipline oriented traditional science and engineering knowledge are proving to be less effective (exceptions do exist!), because solutions of such problems require interdisciplinary and multiphysics approaches. The purpose of this course is to provide students, practicing engineers and faculty members a detailed overview of multiphysics concepts for solving practical problems. The instructors will present a class of coupled-field problems interfacing two or more engineering concepts, introduce fundamental concepts, coupling mechanisms, and discuss modeling and analysis tools to study such problems. In particular, the instructor will introduce next-generation multiphysics computational approaches designed to efficiently exploit modern massively parallel and distributed computing resources on high performance computing (HPC).

The course would be taught in an intercative format where instructors would teach computational aspects of coupled-field problems and would encourage participants to design and analyze their own problems from academic as well as application domains. Further tutorials session would cover the hands on how to simulate the problems using a next-generation HPC computers and commercial codes.

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| **Modules** | **A: Fundamentals of multiphysics engineering problems**<br>**B: Computational approaches for solving coupled problems**<br>**Course Duration: December 18 - December 22, 2017**<br>**Number of participants for the course will be limited to fifty (50).** |
| **You Should Attend If…** | • you are practicing engineers or research scientists interested in solving multidiscipline problems<br>• you are B. Tech./M. Tech./Ph.D. students interested in study or research in solving coupled problems<br>• you are faculty members from academic institutions involved in teaching and research on computational mechanics |
| **Fees** | The participation fees for taking the course is as follows:<br>**Participants from abroad: US $400**<br>**Industry: Rs. 7000/-**<br>**Student: Rs 1000/-**<br>**Faculty: Rs. 3000/-**<br>The above fee 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

**Prof. Vinod Kumar** is an Associate Professor of Mechanical Engineering at the University of Texas at El Paso. He completed Bachelor of Technology (B. Tech.) degree in the Aerospace Engineering from Indian Institute of Technology (IIT - Kanpur). He holds a Ph.D. in Mechanical Engineering (2005) from Rice University, USA. He worked at Fluent Inc. (now a wholly owned subsidiary of ANSYS Inc.) for two years and also has two years of postdoctoral experience at Rice University in high performance computing. He has more than 15 years of teaching, research and industrial experience in developing, using, and supporting advanced computational algorithms for single and multiphase fluid dynamics problems in several funded activities from U.S. Department of Energy (DOE) and Air Force Office of Scientific Research as well as visiting faculty positions at several DOE National Labs. He has work experience in the Computer Science Research Institute at Sandia National Laboratories (SNL). He is involved with the development of advanced computational techniques for climate models at Princeton University, Oak Ridge National Laboratory. He also worked with National Energy Technology Laboratories-Morgantown and involved in developing high performance computational capability for an open source reservoir simulator.

**Prof. Manabendra Pathak** is an Associate Professor of Mechanical Engineering at Indian Institute of Technology, Patna. His research interests are Computational Fluid Dynamics, Two-phase flow, non-Newtonian fluid flow, Renewable energy etc. He has several years of experience in developing numerical techniques for solution of two-phase flows using different dicretization techniques such as finite difference, finite volume and boundary element method.

**Dr. Amit Kumar Verma** is an Assistant Professor of Mathematics at Indian Institute of Technology, Patna. His research interest is Analysis of Nonlinear Differential Equations (Nonlinear Singular Two Point and Multi Point Boundary Value Problems), Numerical Solutions of ODEs and PDEs.

## Course Coordinator

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