

Mechanical Engineering Seminar
Faculty Candidate



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High-Fidelity Simulation and Multi-scale Modeling Strategies for Investigation of Turbulent Flows: From Canonical to Practical Configurations

Monday, May 2, 2016 at 1:30PM, Room 173 Light Engineering Building

Abstract

An accurate description of turbulence and its interaction with other transport processes observed in engineering and natural systems is important from design and prediction perspective. Turbulence in such multi-physics systems exhibits a wide range of spatial and temporal scales, thus making the numerical prediction extremely challenging. In this talk, some of the novel high-fidelity simulation and multi-scale modeling strategies for investigation of such flows will be presented. The emphasis of these approaches is to alleviate the challenges faced by the well-established methods so that such flows can be examined with an increased level of fidelity, robustness and efficiency. The talk will focus on some of the key areas of multi-physics turbulent flows through canonical and practical examples. To begin with, the state-space based method for direct numerical simulation of particle-laden flows will be described. Next, the hybrid two-level large-eddy simulation framework for simulation of high Reynolds number flows will be presented. This will be followed by the analysis of results from large-eddy simulation employing the linear-eddy mixing model for the study of flame-turbulence interaction at low to high Karlovitz numbers and the investigation of combustion instabilities in a model combustor. Finally, the outstanding challenges and possible strategies for numerical investigation based design evaluation of practical systems leveraging the high-performance computing platforms will be presented.

Biography

Dr. Reetesh Ranjan is a Senior Research Engineer in the school of Aerospace Engineering at Georgia Institute of Technology. He is conducting research in the broader areas of theoretical and computational fluid mechanics and thermal sciences. He received M.S. and Ph.D. in Theoretical and Applied Mechanics in 2009 and 2012, respectively, from the University of Illinois at Urbana Champaign and B. Tech. in Mechanical Engineering from Indian Institute of Technology Kanpur in 2004. He worked at Ansys India from 2004 till 2007 as a Lead Application Engineer. He has received Fred B. Seely and Louis J. Larson fellowships, and Hassan Aref Memorial award for his academic and research accomplishments during his graduate education. He has also received Stanley I. Weiss outstanding thesis award from the department of Mechanical Science and Engineering for his Ph.D. dissertation.

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