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Simulation of Turbulent Flow with Discontinuous Spectral Element Method

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ABSTRACT:

Turbulent flows are ubiquitous in natural phenomena and technological applications, such as severe storms around the world and combustion in jet engines. Understanding and prediction of turbulence has remained one of the longest-standing, unsolved problems in science, despite nearly two centuries of widespread research. This is primarily due to the tremendous variations in flow properties in both time and space. Supercomputers are now routinely used to simulate and predict turbulent flows using thousands of processors in parallel. One of the main difficulties associated with such large-scale simulations is the huge amount of data that needs to be processed in order to provide useful information for physical understanding and practical applications. This talk discusses the work of our group on development of a discontinuous spectral element method over the past two decades. Several examples of turbulent flow simulations using the method will be presented.

BIOGRAPHY:

Farzad Mashayek received a Ph.D. degree in Mechanical Engineering from the State University of New York at Buffalo in 1994. He is currently Professor and Head of the Aerospace and Mechanical Engineering at the University of Arizona. Formerly, he served in a similar role at the Department of Mechanical and Industrial Engineering at the University of Illinois at Chicago overseeing a multi-fold growth in size and productivity. Mashayek's research interests are in the areas of turbulent combustion, plasma, electrostatic atomization and solid-ion batteries. He is a Fellow of the American Society of Mechanical Engineers and an Associate Fellow of the American Institute of Aeronautics and Astronautics. Mashayek has received the CAREER award form the National Science Foundation and the Young Investigator award from the U.S. Office of Naval Research. He has organized and hosted multiple conferences and technical sessions in the areas related to turbulent reacting flows.