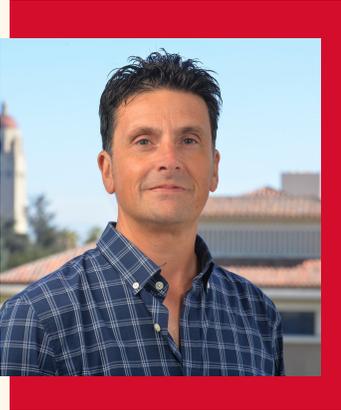


Apr 11, 2019

Towards Exascale Simulations of Particle-Laden Turbulence in a Radiation Environment: The PSAAP Program at Stanford



Gianluca Iaccarino

Professor Department of Mechanical Engineering, Stanford University, CA

ABSTRACT:

In the framework of the Predictive Science Academic Alliance Program (PSAAP) the US Department of Energy is funding a Multidisciplinary Simulation Center at Stanford University to explore exascale computing strategies for multiphysics simulations. Stanford Center's research portfolio blends efforts in computer science, uncertainty quantification, and computational physics to tackle a challenging physical problem: the transfer of radiative energy to a turbulent mixture of air and solid particles. The context is provided by a relatively untested and poorly understood method of harvesting solar energy. The talk will describe the Center's effort to develop and validate a computational environment to simulate this challenging multi-physics problem emphasizing the strategies employed to carry out high-fidelity simulations and how uncertainty quantification techniques can be used to assess the overall performance of the system. A novel task-based programming system (Legion) is being deployed to tackle heterogeneous compute systems and retain portability and performance on next-generation computer architectures. Details of the implementation challenges and results obtained on various architectures will be discussed. The integration of large scale simulations and multi-level sampling for uncertainty analysis within the Legion framework will also be summarized.

BIOGRAPHY:

Gianluca Iaccarino is Director of the Institute for Computational Mathematical Engineering (<https://icme.stanford.edu>) and a professor in the Mechanical Engineering Department at Stanford University. He received his PhD in Italy from the Politecnico di Bari (Italy) and has worked for several years at the Center for Turbulence Research (NASA Ames & Stanford) before joining the faculty at Stanford in 2007. Since 2014, he is the Director of the PSAAP Center at Stanford, funded by the US Department of Energy focused on multiphysics simulations, uncertainty quantification and exascale computing (<http://exascale.stanford.edu>). In 2010, he received the Presidential Early Career Award for Scientists and Engineers (PECASE) award, in the last couple of years, he has received best paper awards from AIAA, ASME and Turbo Expo Conferences.