UNIVERSITY OF MINNESOTA

Twin Cities Campus

Department of Aerospace Engineering and Mechanics

Institute of Technology

107 Akerman Hall
110 Union Street SE
Minneapolis, MN 55455

612-625-8000
Fax: 612-626-1558
E-mail: dept@aem.umn.edu

Postdoctoral Associate Position:

Multi-scale particle-continuum simulation of hypersonic flows and gas-surface interactions

Professor T.E. Schwartzentruber
National Hypersonics Research Center
Department of Aerospace Engineering and Mechanics
University of Minnesota
Minneapolis, MN

We are seeking an outstanding postdoctoral researcher to develop advanced multi-scale simulation methods for application to hypersonic flow and gas-surface interaction problems. Research opportunities exist in three areas: 1) algorithm development of the direct simulation Monte Carlo (DSMC) particle method, 2) coupling the DSMC method with state-of-the-art continuum Navier-Stokes (NS) solution methods, and 3) coupling the DSMC method with Molecular Dynamics (MD) methods to investigate gas-surface interactions.

A hybrid DSMC-NS approach is desirable for high-altitude, high-speed flows where the mean-free-path of the gas becomes comparable to vehicle or local gradient length-scales. Such conditions occur near sharp leading edges and in shock interaction regions typical of hypersonic vehicles, as well as within blunt-body re-entry flowfields. The coupled DSMC-MD method will be used to investigate surface catalysis and ablation in hypersonic flows; an example of which is the interaction between high-energy gas flow and a sharp leading edge. MD simulation has the potential to accurately model the interaction between gas molecules and surface (solid) molecules, but remains far too computationally expensive to simulate the surrounding gas flow. The DSMC method, however, is an accurate and efficient particle method for simulation of hypersonic gas flows that uses similar molecular information as an MD simulation. Research will thus investigate various ways of spatially and temporally coupling the DSMC method in the gas with the MD method next to the surface.

Applicants must hold a PhD degree in a closely related area (aerospace or mechanical engineering) prior to the start-date of the position. Applicants with PhD degrees in computer science or computer engineering who have experience in applied numerical simulation will also be considered. Research experience and expertise in CFD and/or DSMC and/or MD code development (C and/or Fortran 90) is an advantage. The position is available immediately. Funding is available through August 31, 2009. Continuation after this date is subject to available funding. Applications will be considered until the position is filled.

Interested individuals are encouraged to contact Professor Schwartzentruber. However, all applicants must also apply online in order to be considered part of the official applicant pool. To apply online, please visit https://employment.umn.edu and search for Requisition Number 148979.

Thomas E. Schwartzentruber

Assistant Professor
Department of Aerospace Engineering and Mechanics
University of Minnesota
Email: schwartz@aem.umn.edu