

DEPARTMENT OF MECHANICAL ENGINEERING
Purdue School of Engineering and Technology

FALL 2008 SEMINAR SERIES

Date: Thursday, November 6, 2008

Time: 10:30 am – 12:00 pm

Room: SL 165

Everyone is invited

Thesis Seminar

**Unsteady CFD Simulations of Moving-body Flows by a Dynamic
Unstructured Overset Grid Method**

**Jingxin Liu, Ph.D. Candidate, School of Mechanical Engineering,
Purdue University**

Abstract.

Simulating the unsteady flows around rigid moving bodies is complex and difficult. A new Computational Fluid Dynamics (CFD) algorithm for simulation of complex unsteady flows around moving bodies using an unstructured overset or Chimera grid method is presented. A highly automated three-dimensional tetrahedral unstructured overset grid method is developed to model moving parts of arbitrary geometry. Compressible internal flows in industrial flow-control moving valves, such as butterfly valves, and an internal combustion (IC) "engine" assembly with piston movement, are targeted as the main applications of the method. "Choked" flows, complex system of expansion and shock waves developed at downstream of the valves and transonic, supersonic flows in the vicinity of the valve-disk and downstream, turbulent and jet flows in an IC engine will be predicted. A one-cell overlapping domain and interpolation stencils between background grid and minor grid are established for computational efficiency purposes. We demonstrate the automated mesh cutting capabilities of the developed overset grid method and simulate the steady phenomenon for flow around control valves at different fixed opening positions of the valve. Comparisons with experimental results for steady and unsteady flows are performed. The unsteady flow simulations and results validations for an IC engine with piston movements are performed with satisfactory agreements. Mesh refinement and conservation studies performed showed the accuracy and efficiency of the developed method.

About the Speaker.

Jingxin Liu is a Ph.D. student at the School of Mechanical Engineering, Purdue University and a Research Assistant at the Computational Fluid Dynamics Laboratory at IUPUI. He received his bachelor's and Master's degrees at Northwestern Polytechnical University, 1999 and 2002, respectively. He has been a Research Assistant at Technical Assistance Program (TAP) of Purdue University and the CFD Lab of IUPUI since 2004. His academic advisors are Dr. Akin Ecer and Dr. Steve Frankel and committee members are Dr. Hasan U. Akay, Dr. Jayathi Y. Murthy and Dr. Gregory A. Blaisdell.