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EDISON LECTURE SERIES

SPEAKER: Professor Gretar Tryggvason
Department of Mechanical Engineering
Worcester Polytechnic Institute
Worcester, Massachusetts

TOPIC: Direct Numerical Simulations Of Multiphase Flow

DATE: Tuesday, November 29, 2005

TIME: 3:30 p.m.

PLACE: 129 DeBartolo Hall

ABSTRACT

Direct numerical simulations have recently emerged as a viable tool to understand finite Reynolds number multiphase flows. The approach parallels DNS of turbulence, but the unsteady motion of a deforming phase boundary adds considerable complexity. After a brief overview of the numerical challenges we describe one approach, front-tracking, in some detail. The method has been used to study bubbly flows, where a parallel version of the code makes it possible to use large grids and resolve flows containing a few hundred bubbles. Recent results for drag reduction due to bubbles injected into a turbulent boundary layer, and for buoyancy driven bubbly flows in vertical channels, have already yielded new and unexpected insight into the dynamics of such flows and the subtle importance of accurately accounting for bubble deformability. The development of numerical methods for more complex multiphase flows, where it is necessary to include thermal and/or electric fields and phase changes, is also underway. A few examples of the influence of electric fields on the dispersion of drops in a channel flow, the effect of flow on the growth of microstructures during solidification, and boiling are presented.