

**Stony Brook University
The Graduate School**

Doctoral Defense Announcement

Abstract

Simulation of Magnetohydrodynamic Multiphase Flow

By

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Computational Magnetohydrodynamics(MHD), greatly inspired over the last decades by magnetic confinement fusion and astrophysics problems, has achieved significant results. However, the existence of moving free material interfaces with complex geometries in many important MHD problems creates major complications for numerical algorithms.

We proposed a numerical algorithm for the study of Magnetohydrodynamics (MHD) of free surface flows at low magnetic Reynolds numbers. The numerical algorithm employs the method of front tracking and the Riemann problem for material interfaces, second order Godunov-type hyperbolic solvers, and the embedded boundary method for the elliptic problem in complex domains. The code is applied for the numerical simulations of free surface conductive liquid undergoing phase transitions. Examples include the simulations of mercury jet distortion in non-uniform magnetic field, liquid metal target for the Neutrino Factory/Muon Collider, and laser ablation plasma plume in the process of nanotube synthesis.

Date: May 11th, 2007

Time: 12:40PM

Place: Math Tower, Room P-131

Program: Applied Mathematics and Statistics

Dissertation Advisor: James Glimm