JOHNS HOPKINS
Center for Environmental
& Applied Fluid Mechanics

Weekly CEAFM Seminar: Spring 2014

Date: **Friday, April 25, 2014**

Time: 11:00 AM

Location: Gilman 50 (Marjorie M. Fisher Room)

Speaker: **Dr. Sankaran Sundaresan** (Princeton University)

Title: ***"Filtered Two-Fluid Models for Fluidized Gas-Particle Suspensions"***

Abstract

Gas-particle flows in turbulent fluidized beds and risers exhibit large fluctuations in velocities and local suspension density. These fluctuations are associated with the random motion of the individual particles and with the chaotic motion of particle clusters. These clusters occur over a wide range of length scales and their dynamics span a broad range of time scales. This broad range of scales has made it difficult to construct efficient flow models required for practical analysis of flows in turbulent fluidized beds and risers. In this presentation, I will discuss the results of our ongoing study aimed at the development of filtered hydrodynamic models for such systems. These filtered two-fluid models are conceptually analogous to the Large Eddy Simulation models for turbulent flows.

By systematically filtering computational data generated through highly resolved simulations of fluidized suspensions in simple flow geometries, we have constructed constitutive relations for the drag coefficient and particle phase stresses appearing in the filtered model equations. The filtered drag coefficient decreased systematically with increasing filter width, while the filtered particle-phase stresses increased with filter size. Both two- and three-dimensional simulations manifest nearly identical scaling.

We have verified the coarse-graining approach which uses the filtered drag coefficient and particle phase stresses by comparing the results obtained in test simulations using the filtered model equations with those obtained by highly resolved simulations of the kinetic theory model. As expected, the filtered model equations yielded coarser structures than those seen in the kinetic theory simulations, and they also led to a converged solution at much coarser grid resolutions. The details of these results will be described in the presentation, where I will also present our efforts towards validation of the approach against experimental data.