Abstract Submitted
for the DFD08 Meeting of
The American Physical Society

A variable-density fictitious-domain method for fully resolved simulation of high-density ratio fluid-particle systems SOURABH APTE, Oregon State University — A numerical scheme for fully resolved simulation of fluid-particle systems with freely moving rigid particles is developed. The approach is based on a fictitious domain method wherein the entire fluid-particle domain is assumed to be a fluid and the flow inside the particle domain is constrained to be a rigid body motion using an additional rigidity constraint in a three-stage fractional step scheme. The particle is assumed to be made up of material points moving on a fixed background mesh where the fluid flow equations are solved. The basic finite-volume solver is based on a co-located grid incompressible, but variable-density, flow. The incompressibility constraint is imposed by solving a variable-coefficient pressure equation giving rise to a stable scheme for high density ratio fluid-particle systems. This scheme is used to simulate a range of single and multiple particle problems in laminar flows. Application of the scheme for the simulation of large number of fully resolved particles in wall-bounded turbulent flows, such as those occur in sediment transport, will be discussed.

Sourabh Apte
Oregon State University

Date submitted: 03 Aug 2008 Electronic form version 1.4