ABSTRACT

Previous studies were found to be limited to some general shapes such as circle, square, rectangle, and ellipse. However, some studies extended to more complex shapes, but effects of sharp edges and roundness were not discussed much in a Immersed Boundary framework. This work highlights the settling behavior of different shaped particles. The effects of wall on settling are not discussed. Prior studies didn't account the material properties based collision strategy together with the distributed-Lagrange-multiplier (DLM) to model the particulate flow. This work focuses on development of such a collision strategy to model the particulate flow. Limited discussion was found on interactions between dilute and dense clusters. This work extends the discussion on mono- and poly-dispersed particulate suspension. This study presents the two-dimensional simulations of fluid-particle interactions taking into account the effects of geometric configuration and collisions.

Objectives of this thesis is: (a) To study the effects of particle shape on fluid-particle interactions**:** study the effects of sharp edges and circularity, study the effects of number of vertices, sedimentation of complex shaped particle, **(b)**To study the effects of particle-particle and particle-wall collisions on fluid-particle interactions**:** develop a collision strategy in an Eulerian-Lagrangian framework**,** validation and simulations of the particle-particle and particle-wall collisions**, (c)** To study the interactions between dense and dilute clusters**:** Mono-disperse particulate suspension, Poly-disperse particulate suspension.