Coupling PFEM and DEM for the simulation of free-surface particle-laden flows

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ABSTRACT

We present a numerical procedure for the analysis of a multi-component medium where, at least, one phase is composed by a continuous fluid, and one of the other phases is formed by a number of disconnected solid particles surrounded by the fluid. The problems involving such fluids (known as *particulate* or *particle-laden* flows) are challenging from the numerical point of view, as they often require the consideration of different scales simultaneously (small particles and fluid).

In this work we focus on bi-component flows involving suspended rigid-solid spheres in an incompressible fluid with a free surface. For the numerical solution we present a hybrid approach in which the suspended particles are individually tracked, but the details of the flow around them are smoothed [1].

The motion of the solid particles within the fluid is simulated using an explicit *Discrete Element Method* (DEM) [2, 3], whereas the dynamics of the free surface flow is modelled through an implicit stabilized *Particle Finite Element Method* (PFEM) [4, 5]. The coupling between the two numerical procedures is performed through a sub-stepping staggered scheme.

Different 3D examples will be shown to validate the proposed coupled PFEM-DEM technique and illustrate some of the many possible applications.

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