FREE SURFACE FLOW SIMULATIONS BY SPH TECHNIQUES

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The solution of many problems related with large deformations, complex domains, etc., involves a high computational effort if the classical numerical techniques (finite elements, finite differences, etc.) are used. For this and other reasons other methods have been proposed in the last years. One of the families of new techniques is the so-called "meshless methods". Their main feature is to avoid the rigid connectivity demanded by other usual formulations to discretize the integration domain.

The Smooth Particle Hydrodynamic (SPH) is a pure Lagrangian meshless method developed in the seventies and eighties by Lucy [1], Monaghan [2] and others. At first, it was applied mainly to astrophysical problems. But nowadays it is used in a great variety of applications both as a Lagrangian or Eulerian method [3]. One of the main fields of application of this technique is fluid mechanic analysis [4]. If the method is set up as a Lagrangian technique, the motion of a discrete number of particles of a fluid can be followed in time. The linear and angular momentum preserving properties of SPH formulations is the central issue in this case.

The use of SPH methods applied to free surface problems has been studied. Two different formulations have been analyzed: the standard SPH method and the corrected SPH method. In both cases we have stated the equations that represent the physical phenomenon and then we have selected the points where we want to calculate the solution. Finally we have approximated the differential equation in both spatial and time dimensions and replaced it by the corresponding algebraic equations. Furthermore, we have analyzed the adequate corrections applied to preserve linear and angular momentums. Several examples are presented to show the behavior of the SPH approaches and to trace its engineering applications like those related with the coastal or hydraulic engineering field.

References

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