MODELLING WAVE OVERTOPPING WITH SMOOTHED PARTICLE HYDRODYNAMICS

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The design of sea defence is mainly based on the knowledge of wave runup, wave overtopping and wave strength, *i.e.* more generally interactions between waves and a coastal structure. The high number of phenomena involved in these mechanisms, as well as the wide variety of shapes allowed to a dyke, including berms, varying slopes, wall crests, etc., suggest to the coastal engineer that the use of experimental techniques is the most appropriate way to achieve such a design with the required accuracy.

However, at the end of the 70's, the Smoothed Particle Hydrodynamics (SPH) lagrangian numerical method was invented to simulate astrophysical problems, for which a Lagrangian formalism is helpful (Monaghan, 1992). A few years later, this method was successfully applied to other fields, in particular fluid mechanics. It proved its ability to simulate flows involving complicated free surfaces and walls. During the past years, the present authors developed appropriate turbulent closures for SPH, in particular a mixing length model and a k–ε one (Violeau and Issa, 2004).

The SPH turbulent code developed by the authors was used to reproduce Stansby and Feng's experiments (2004) regarding wave propagation and overtopping in a flume. Figure 1 shows a comparison between the present simulation and measurements in terms of free surface elevation at two locations in the wave tank, showing a fairly good agreement. However, extended comparisons reveal some discrepancies between experimental and modeled velocity fields. Progress have to be done regarding free surface turbulent boundary conditions and spatial discretization in order to predict a complete wave motion with accuracy at all stages. Future work will concern investigations in this field.

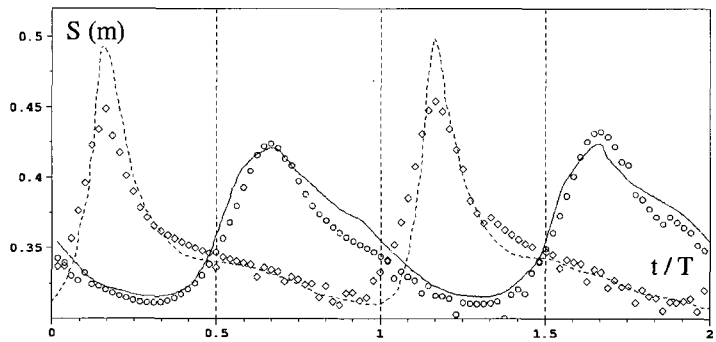

Fig. 1 Surface elevation S at x = 2.47 (○) and x = 4.47 (◇): comparison between model with 19,000 particles (symbols) and experiments (lines) by Stansby and Feng (2004).

REFERENCES

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