APCOM & ISCM
11-14th December, 2013, Singapore

Simulation of 2D Free-surface Potential Flows Using a Robust Local Polynomial Collocation Method

Nan-Jing Wu[1], *Ting-Kuei Tsay[2], Yang-Yih Chen[1,3], and I-Chen Tsu[2]

[1] Tainan Hydraulics Laboratory, National Cheng Kung University, Tainan City 70955, Taiwan.
[2] Department of Civil Engineering, National Taiwan University, Taipei City 10617, Taiwan.
[3] Department of Marine Environment and Engineering, National Sun Yat-sen University, Kaohsiung City 80424, Taiwan.

*Corresponding author: tktsay@ntu.edu.tw

In this study a mesh-free numerical model for simulating the 2D free-surface potential flows is established. A Lagrangian time marching scheme is chosen for the boundary conditions of the moving and deforming free surface while a local polynomial collocation method is applied for solving the Laplace equation at each time step. The collocation method was developed in a way that the governing equation is satisfied on boundaries as well as boundary conditions. This gives the accurate estimation of the velocity potential at any free surface node, which represents the velocity vector at that specific node. Therefore, the trajectories of the free surface nodes can be predicted precisely. The numerical model is applied to the simulation of free surface waves in the liquid sloshing of a swaying tank. Present model is verified by comparing the numerical results with experimental data. Fairly good agreements are observed.

Keywords: mesh-free, collocation, sloshing, free surface waves