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PSEUDO-LOCAL ABSORBING BOUNDARY CONDITION FOR THE SIMULATION OF WATER GRAVITY WAVES IN OPEN DOMAINS

José A. González[1,*] and K. C. Park[2]

[1] Escuela Técnica Superior de Ingeniería, Universidad de Sevilla, Camino de los Descubrimientos s/n, Sevilla 41092, Spain, japerez@us.es

[2] Department of Aerospace Engineering Sciences, University of Colorado at Boulder, CO 80309-429, USA, kcpark@colorado.edu

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This work concerns the numerical tools needed for the simulation of some practical fluid-structure interaction (FSI) problems usually present in many ocean engineering applications, that is: the presence of a flexible structure floating or in contact with an open or infinite external fluid that is exciting the structure with surface gravity waves.

A correct definition of the absorbing boundary conditions is critical in this type of applications. Time domain absorbing boundary conditions for water gravity waves in open domains have normally been treated using the following methods: the *Orlanski condition*, a time domain extension of the Sommerfeld condition; the absorbing layer or *beach* method, an extension of the fluid domain with a zone that includes artificial damping; the *perfectly matched layer*, similar to the the beach method but the extension now models the same fluid equations with an additional dissipation term; or using *shell functions*, Green functions or Boundary Element Methods.

On the contrary, our method relies on the assertion of J. Falnes [1] that *"a good wave absorber must be a good wave maker"*. Linear traveling waves can be expressed as a superposition of different modes with a well defined structure. Defining a field of Lagrange multipliers on the open boundary, the pressure distribution can be used to decompose the wave in its modal components through a least squares approximation. Knowing the modes and the impedance forces corresponding to each frequency [2], the same wave but out of phase and in opposite direction is sent by the absorbing boundary to avoid reflections by destructive interference.

Our approach to the FSI problem uses a Total Lagrangian description of motion [3], solving the equations in time with a unified displacement formulation for the fluid and the structure that facilitates the connection of fluid-structure systems and also simplifies the treatment of the fluid free surface. Gravity waves are generated in one side of the external fluid domain and absorbed in the other using the proposed wave-absorbing boundary condition; fluid and structure are connected using localized Lagrange multipliers.

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