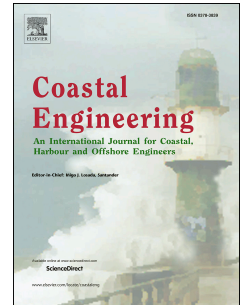


Accepted Manuscript

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PII: S0378-3839(17)30435-0

DOI: [10.1016/j.coastaleng.2018.07.007](https://doi.org/10.1016/j.coastaleng.2018.07.007)

Reference: CENG 3401

To appear in: *Coastal Engineering*

Received Date: 8 August 2017

Revised Date: 22 June 2018

Accepted Date: 15 July 2018

Please cite this article as: Meringolo, D.D., Liu, Y., Wang, X.-Y., Colagrossi, A., Energy balance during generation, propagation and absorption of gravity waves through the δ -LES-SPH model, *Coastal Engineering* (2018), doi: 10.1016/j.coastaleng.2018.07.007.

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Energy balance during generation, propagation and absorption of gravity waves through the δ -LES-SPH model

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Abstract

This paper presents a numerical analysis of the time behaviours of mechanical and internal fluid energies during generation, propagation and absorption of gravity waves. The analyses are performed through a Smoothed Particle Hydrodynamics (SPH) model in which the viscous and diffusive dissipations are determined through the turbulence closure model presented in Di Mascio et al. [32] and therefore are a function of the local and instantaneous flow conditions. The wave generation is obtained through the action of a moving paddle. Particular attention is given to the analysis of the energy introduced in the fluid domain as the work made by the moving solid boundary on the fluid mass. In a first problem, a comparison on the time evolution of the energy components is presented for a wave reflecting case, obtained by a flat bottom flume which ends with a vertical wall, and a wave absorbing case, obtained through the generation of breaking waves induced by a sloping bottom. Successively, the energy analysis is applied to study the performances of waves interacting with a curtain breakwater for which reference data are available in the literature. The time evolutions of the single energy components are analyzed separately for two sub-regions of the domain: the first one is the wave propagation region, while the second one is the breakwater region. A specific analysis is thus devoted to determine the amount of energy dissipated, only due to the presence of the curtain breakwater.

Key words: Smoothed Particle Hydrodynamics, Large Eddy Simulation, Solid-fluid work exchange, Wave energy decomposition, Energy dissipation, Curtain breakwater

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