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Nonlinear Wave Amplification in front of Reflective Structures

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This paper focuses on a large wave amplification phenomenon occuring in front of reflective marine or coastal structures due to the implication of tertiary interactions between the incoming waves and the reflected wave field. These nonlinear wave interactions are not restricted to some local area but take place over a wide zone on the weather side of the structure. Several experiments involving a rectangular barge model and different bottom-mounted structures in deep and shallow water have been already conducted on this topic. A striking feature of these tests was a large amplification of waves in front of the structure, with wave heights more than five times higher than the incoming wave field in most critical cases ! As a consequence, during the experimental campaign on the barge model, the barge nearly sank through shipping large amounts of water due to extreme run-up observed at midship. The run-ups were depending very much upon the steepness of the incoming waves, showing that it was directly related to nonlinearity. Some physical interpretation of the phenomenom has been proposed by Molin *et al.* (2005). It advocates that the reflected wave fields tend to slow down the incoming waves by reducing their wavelength due to third order interactions in the wave steepness, thus acting as a shoal. As a consequence, the incoming crest-lines bend and the wave energy gets focused toward the middle of the structure. In order to determine a range of occurence of this critical phenomenom, numerical calculations using the highly-accurate Boussinesq-type model presented in Jamois *et al.* (2004) have been done. The results of the numerical model are compared to experiments and a very good agreement is obtained. Results from experiments on a vertical rigid plate model submitted to both normal and oblique waves will be presented.

References

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