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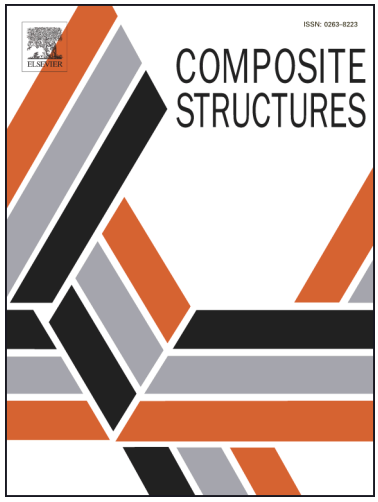

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Numerical and Experimental Study on Hydroelasticity in Water-entry problem of a Composite Ship-hull Structure

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Abstract: The problem of hydroelastic impact draws immense attention in marine structural design due to the complex interactions between structure and fluid. In this study, the water entry problem of a composite ship-hull structure, which is one segment of an idealized ship bottom structure, is investigated. This structure was made of composite lightweight structures and the bottom panel consists of 3 longitudinal stiffeners and 2 transverse frames. In the numerical model, a CFD solver and a FEM solver are coupled through the interface of structure and fluid, and solved through using a partitioned approach. Correspondingly, a series of drop tests of this structure were conducted. The falling displacement, acceleration, pressure and stress responses were measured and the experimental uncertainty was studied through analyzing the repeatability, symmetry and oscillations. Numerical results were compared with the experimental ones, and reasonable agreements on falling kinemics, slamming loads and stress responses are achieved. Meanwhile, the hydroelastic effects on the hydrodynamic pressure and stress responses were discussed through analyzing the natural frequency of structure. High hydroelastic effects are observed and more than one mode shape dominates the structural deformation in case of hydroelastic impact.

Key words: Water impact; Hydroelasticity; Ship-hull Structure; Fluid/structure interaction

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