Numerical and experimental investigation of water entry and exit of a cone

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ABSTRACT

The aim of the present work is to study numerically and experimentally the evolution of the hydrodynamic loads during the combined water entry and exit of a cone. Many analytical and semi-analytical models of water impact have been developed. Comparatively, there are few studies on the water exit problem, i.e. the lifting of a floating body initially lying at the free surface or just after an entry stage. Tassin et al.[5] proposed a two-dimensional model for the description of water entry and exit of a body with a time-varying shape. This model used the modified Logvinovitch model, proposed by Korobkin[3], during the entry phase and a modified von Karman approach during the exit phase. In this approach, the contact point is defined as the intersection between the body and the water level at the transition between the entry and exit stage. The results obtained with this model, compared with experiments of water entry and exit of a cone [6], show that the proposed model provides a good approximation of the evolution of the radius of the wetted surface during the entry phase, but the prediction during the exit stage is further from experimental results. In order to predict more precisely the evolution of the contact surface and the hydrodynamic force during both the entry and exit phase, a fully nonlinear potential flow model was developped. This model is based on a mixed Eulerian-Lagrangian approach, originally proposed by Longuet-Higgins and Cokelet [4] and includes a simplified approach, based on finite element method, for the thin jet developing along the body. This model is used to simulate the detailed flow generated by the water entry of two-dimensional and axisymmetric bodies, Battisitin and Iafrati[1, 2], and was developed for both entry and exit phase. A comparison between numerical models and experiments will be presented.

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