6th European Conference on Computational Mechanics (ECCM 6)
7th European Conference on Computational Fluid Dynamics (ECFD 7)
11-15 June 2018, Glasgow, UK

Theorical and experimental investigation on the water exit problem

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Keywords: *water exit, analytical models, Principle of Virtual Power, numerical simulations, experiments.*

The aim of the present work is to study theorically and experimentally the evolution of the wetted surface during the lifting of a floating body initially lying at the free surface and the evolution of the hydrodynamic loads. There are few analytical models dedicated to this water exit problem and one of the difficulties concerns the parameters governing the dynamics of the wetted surface. It remains difficult to define at which moment the fluid particles are considered to be leaving the body surface. Korobkin [1] proposed a water exit model in which he introduced a condition for the prediction of the contact point position, introducing a proportionnality factor (γ) between the time derivative of the contact point position ($\dot{c}$) and the horizontal velocity (φ_x) at the contact point location ($x = \pm c(t)$): $\dot{c}(t) = -\gamma\varphi_x(x = c(t), z = 0, t)$. The results of this model, compared with CFD simulations, seem to give a good approximation of the hydrodynamic force $F(t)$ with $\gamma = 2$, but the prediction of the contact point position seems to be better with $\gamma = 1$. In this model, the gravity is not taken account. The influence of gravity is negligible if the acceleration of the body is much larger than the acceleration of gravity. However, this is not always the case in experiments and for practical applications. We are developing a model taking into account the gravity. For this purpose, we propose to model the water column that is dragged under the body. The description of the dynamics of the column is based on the Principle of Virtual Power (PVP) and the use of an approximate velocity field. Results from the model are compared with Numerical simulations performed using the Eulerian module of the Finite Element software ABAQUS/Explicit [2]. In parallel, we are working on an experimental setup to visualize the wetted surface of the body during the lifting [2]. The experiments are conducted with transparent mock-ups of different shapes and a LED edge-lighting system. This setup make it possible to illuminate the contact line which delimits the surface of contact between the body and the water and to measure the hydrodynamic force on the mock-up.

REFERENCES

[1] A.A. Korobkin. A linearized model of water exit. *J. Fluid Mech*, 737:368–386, 2013.

[2] A. Tassin, et al. Étude expérimentale et numérique du phénomène de sortie d'eau. In *15 ^{èmes} journées de l'hydrodynamique*, 2016.