Contribution ID: **94** Type: **Paper**

On the Application of a Vortex Lattice Method to Lifting Bodies Close to a Free Surface

Friday, 17 June 2022 10:00 (20 minutes)

The interaction of the free surface with either lifting and non lifting, submerged, bodies moving beneath it is of primary interest in naval architecture. Indeed, there are many examples of possible applications such as rudders, stabilizer fins, hydrofoils among the others. The hydrodynamic problem of a submerged lifting body moving close to a free surface presents several complexities that need to be properly addressed in order to achieve a reliable solution. Such a type of problem can be studied and solved in the framework of a potential flow theory, assuming incompressible, irrotational, ideal fluid. The problem can be further simplified by considering that the disturbance of the free surface due to the presence of the hydrofoil are small compared to the water depth and the wavelength, resulting in the opportunity to linearize the free surface conditions around the undisturbed free surface level. The boundary value problem that rises from these assumptions is solved by using an ad-hoc developed Vortex Lattice Method (VLM). The lattice of vortex rings is used to model the effects related to the lift while linear sources are used to simulate the effect of the thickness of the hydrofoil. The developed method is described and validated by comparison against available experimental data on flat plates and hydrofoils. The analysis then focuses on the convergence properties of the method, especially with respect to the panel mesh used for the free surface discretization, and on a sensitivity with respect to some peculiar operating parameters such as the speed, the depth of the foil with respect to the free surface and the aspect ratio.

Primary authors: Dr SOLARI, Raffaele (DITEN, University of Genoa); Prof. BAGNERINI, Patrizia (DIME, University of Genoa); VERNENGO, Giuliano (University of Genoa)

Presenter: Dr SOLARI, Raffaele (DITEN, University of Genoa)

Session Classification: 5B

Track Classification: Numerical hydrodynamics