

PHYSICS AND SIMULATION OF HYDROFOILS

PATRICK QUEUTEY, JEROEN WACKERS

* LHEEA Lab, CNRS UMR 6598,
Centrale Nantes, BP. 92101 , 44321 Nantes Cedex 3, FRANCE
Patrick.Queutey@ec-nantes.fr , Jeroen.Wackers@ec-nantes.fr
<https://lheea.ec-nantes.fr/>

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ABSTRACT

In the marine domain, hydrofoils are lift-generating surfaces operating below the free surface. By creating forces and moments, lifting surfaces are used for the control and stabilisation of ships. Furthermore, hydrofoils can create a vertical lift able to support the weight of a ship, which reduces the ship's drag by decreasing the wetted area of the ship, but also by decreasing the wave added resistance. Seakeeping capabilities can be improved as the ship's response to waves is reduced.

The flow around hydrofoils is characterised by specific physical effects, due to the high pressure differences associated with a lifting surface, which occur in close proximity to the free surface. This leads to a strong dependence of the forces on the hydrofoil immersion, to the generation of trailing vortices and their interaction with the surface, to a risk of ventilation, etc. Furthermore, the high speeds often involved with hydrofoils make cavitation a serious risk.

Following its first edition at MARINE 2019, the objective of this mini-symposium is to study how these particular physics influence the design and performance evaluation of hydrofoils. The session is naturally cross-disciplinary, and contributions are invited on such different subjects as numerical simulation techniques and results, physical phenomena like ventilation, cavitation and fluid-structure interaction, experimental techniques and analysis of experiments, and (automatic) design optimisation. Any other topics related to hydrofoils are also appreciated.