Experimental investigation of IQFoil Lift and Drag in a towing tank

Jamie Cook[1], Joseph Banks[1],

[1] Maritime Engineering Research Group, School of Engineering, University of Southampton, UK

Abstract:

There has been limited towing tank testing for sailing hydrofoils producing both large forces and moments due to the challenges this presents to dynamometry.

In this paper, a windsurfing iQFOiL was tested in a towing tank using a new experimental rig to measure both lift and drag forces. Numerical predictions of the foil forces were created using XFLR5 to provide design loads for the dynamometry. The hydrofoil was tested up to speeds of 8 m/s and over a range of pitch angles, which affect the foil's angle of attack. Repeat tests were conducted and the measurement uncertainty was calculated to assess the reliability of the developed dynamometry and test methods, as presented in Figure 1. The impact of pitch angle and rear foil angle on the forces generated are presented and discussed.

It was found the equipment was capable of repeat readings within 0.5% when operating at realistic foiling speeds and could measure lift forces up to 1200 N. Furthermore, the equipment had an average uncertainty of 6.43 newtons and 2.19 newtons for lift and drag measurements respectively.

The interaction effects between the lift and drag forces measurements were assessed after the experiment and were shown to vary by up to 3.6%. Recommendations to improve the measurement accuracy are discussed and the suitability of the experiments for validation of numerical simulations are explored.

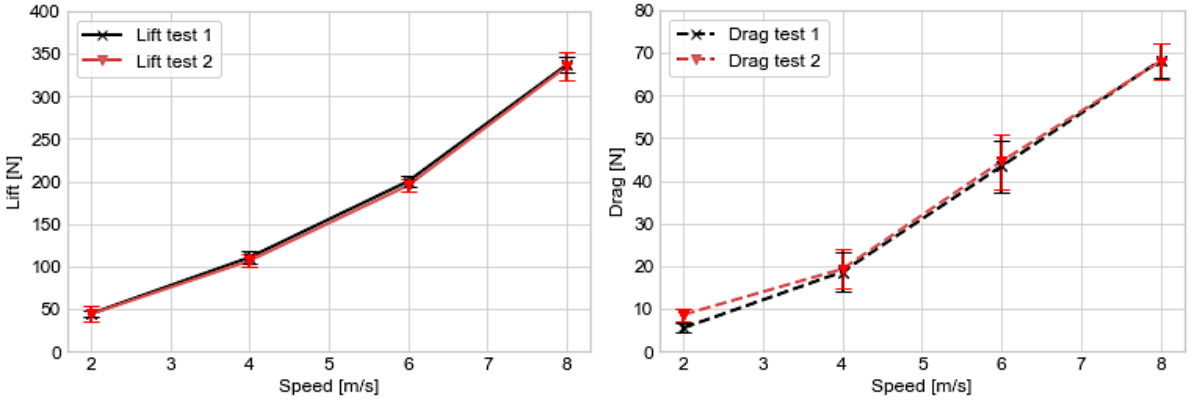

Figure 1-Measured lift and drag for increasing speed with a repeat reading (Pitch = 0◦, Rear wing chock = 1◦)