

## Structural Morphing on High Performance Composite Hydrofoil to Postpone Cavitation

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**Abstract :** For the top high performance foiling yachts, cavitation is often a limiting factor for take-off and top speed. This work investigates solutions to delay the onset of cavitation thanks to structural morphing. The structural morphing is based on compliant leading and trailing edge, with effect similar to flaps. It is shown here that the commonly accepted effect of flaps regarding the control of lift and drag forces can also be used to postpone the inception of cavitation. A numerical and experimental study is conducted in order to assess the effect of the geometric parameters of hydrofoil on their hydrodynamic performances and in cavitation inception. The effect of a 70% trailing edge and a 30% leading edge of NACA 0012 is investigated using Xfoil software at a constant Reynolds number 106. The simulations carried out for a range flaps deflections and various angles of attack. So, the result showed that the lift coefficient increase with the increase of flap deflection, but also with the increase of angle of attack and enlarged the bucket cavitation. To evaluate the efficiency of the Xfoil software, a 2D analysis flow over a NACA 0012 with leading and trailing edge flap was studied using Fluent software. The results of the two methods are in a good agreement. To validate the numerical approach, a passive adaptive composite model is built and tested in the hydrodynamic tunnel at the Research Institute of French Naval Academy. The model shows the ability to simulate the effect of flap by a LE and TE structural morphing due to hydrodynamic loading.

**Keywords :** cavitation, flaps, hydrofoil, panel method, xfoil

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