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Design of Bi-Directional Hydrofoils for Tidal Current Turbines
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Tidal Current Turbines operate in flows which reverse direction. Bi-directional hydrofoils have rotational symmetry and allow such turbines to operate without the need for pitch or yaw control, decreasing the initial and maintenance costs. A numerical test-bed was developed to automate the simulations of hydrofoils in OpenFOAM and was utilized to simulate the flow over eleven classes of hydrofoils comprising a total of 700 foil shapes at different angles of attack. For promising candidate foil shapes physical models of 75 mm chord and 150 mm span were fabricated and tested in the University of New Hampshire High-Speed Cavitation Tunnel (HiCaT). The experimental results were compared to the simulations for model validation. The numerical test-bed successfully generated simulations for a wide range of foil shapes, although, as expected, the $k-\omega$ - SST turbulence model employed here was not adequate for some of the foils and for large angles of attack at which separation occurred. An optimization algorithm is currently being coupled with the numerical test-bed and additional turbulence models will be implemented in the future.

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