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The study on the morphing composite propeller for marine vehicle. Part I:

Design and numerical analysis

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Abstract: This paper details a novel morphing composite propeller (MCP) to improve the performance for marine vehicles (MVs). A MCP is designed with an active rotatable flap (ARF) to change the blade's local camber with flap rotation. A piezo-stack actuator has been connected with one transmission mechanism housed in the propeller blade to push the ARF to obtain various configuration of the MCP. A commercial Finite Element (FE) software ANSYS Fluent was employed to analyse and simulate the hydrodynamics around the propeller with the ARF ranging from -5° to $+5^\circ$ and the advance speeds ranging from 1.08 to 2.52 m/s. Finally, the FE results has been used to predict improved performances of the MCP and found the morphing composite propeller configuration has improved the efficiency by 1.1% while improving the structural durability.

Keywords: smart structure, morphing composite propeller, marine vehicles, transmission mechanism, hydrodynamic analysis, structure responses.

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