

# **Propulsion Performance Analysis of Wave-powered Boats**

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Received 17 May 2019; received in revised form 21 July 2019; accepted 26 August 2019

DOI: <https://doi.org/10.46604/ijeti.2020.4276>

## **Abstract**

With the development of oceanographic research and marine environment protection, mobile marine platforms are applied for ocean observation for a long journey. Wave-powered boats are capable of applying wave motion to propel itself and make a long-duration survey. This paper presents the dynamics of the wave-powered boat under the excitation of the heave motion and pitch motion. Taking the wave-powered boat with double fins as an example, the heave and pitch motions of the boat are obtained by ANSYS-AQWA firstly. Then the relationship between propulsion performance and three factors, including wave height, wave period, and restoring stiffness of torsion spring, was analyzed through multibody dynamics software ADAMS. With the increase of sea state from level 1 to level 4 the average propulsion speed increased from 0.4m/s to 1.4m/s. Under the same wave height and period, with the increase of restoring stiffness of torsion spring from 0.0125N·m/deg to 0.3N·m/deg, the propulsion speed of the wave-powered boat increases first and then decreases, and there exists an optimum stiffness. Through the calculation it is found that when the restoring stiffness of torsional spring is increased from 0.025N·m/deg to 0.2N·m/deg with the sea state level 1 to 4, the wave powered boat has better propulsion performance.

**Keywords:** wave-powered boat, dynamics analysis, ADAMS

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