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Experimental study on the optimum design of diffuser-augmented horizontal-axis tidal turbine

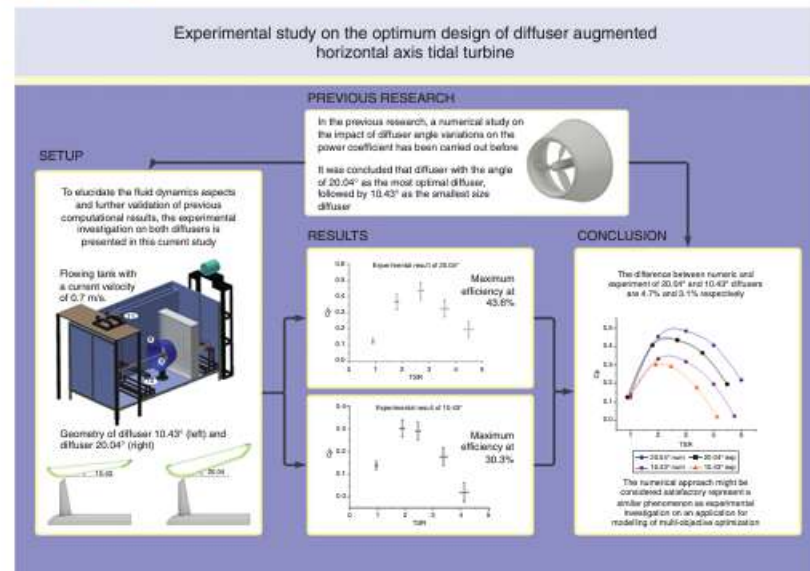Evi Elisa Ambarita, Harinaldi*, Rifqi Azhari and Ridho Irwansyah

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Abstract

Ocean current energy is a promising and reliable resource that offers sustainability and predictability in realizing green future needs. A diffuser-augmented horizontal-axis turbine is utilized to generate ocean current energy. A numerical study on the impact of diffuser angle variations on the power coefficient has been carried out in the previous research. To elucidate the fluid dynamics aspects and further validation of previous computational results, the experimental investigation on the optimal design of tidal turbine with 20.04° diffuser augmentation is presented in this study. The study was conducted in a flowing tank with a current velocity of 0.7 m/s. The maximum power coefficient of 20.04° is 0.436 experimentally, which is a little smaller than the numerical value. Moreover, to reinforce the 20.04° result, a diffuser with an angle of 10.43° was also manufactured and tested experimentally. The maximum power coefficient of 10.43° is 0.303 experimentally, which is 3% smaller than the numerical value. It was concluded that the numerical approach might be considered satisfactory and represent similar phenomena to the experimental investigation in an application for modelling of multi-objective optimization.

Graphical Abstract

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