

Abstract

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Optimization of Blade Pitch Angle of an Axial Turbine Used for Wave Energy Conversion.

Wells turbine is a part of OWC (Oscillating Water Column) which is one of the most practical wave energy converters. However, they suffer low aerodynamic efficiency and consequently low power produced. It is proposed to improve the aerodynamic efficiency of Wells turbines by optimizing the blade pitch angle. A fully automated optimization algorithm is implemented in the present work. Two different airfoil geometries are numerically investigated the standard NACA 0021 and an airfoil with optimized profile "AOP". Optimization results show that self pitch control of Wells turbines can substantially improve the turbine efficiency while slightly delaying the turbine starting point. The optimum blade pitch angle depends on airfoil geometry and turbine solidity. Up to 2.3% increase in NACA 0021 turbine efficiency and 6.3% improvement of AOP efficiency are achieved by optimizing the blade pitch angle. Self pitch control is feasible for improving Wells turbine efficiency, especially with the application of inlet guide vanes.