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Fluid-Structure Interaction Study of Fluid Flow past Marine Turbine Blade Designed by Using Blade Element Theory and Momentum Theory

Authors : Abu Afree Andalib, M. Mezbah Uddin, M. Rafiur Rahman, M. Abir Hossain, Rajia Sultana Kamol

Abstract : This paper deals with the analysis of flow past the marine turbine blade which is designed by using the blade element theory and momentum theory for the purpose of using in the field of renewable energy. The designed blade is analyzed for various parameters using FSI module of Ansys. Computational Fluid Dynamics is used for the study of fluid flow past the blade and other fluidic phenomena such as lift, drag, pressure differentials, energy dissipation in water. Finite Element Analysis (FEA) module of Ansys was used to analyze the structural parameter such as stress and stress density, localization point, deflection, force propagation. Fine mesh is considered in every case for more accuracy in the result according to computational machine power. The relevance of design, search and optimization with respect to complex fluid flow and structural modeling is considered and analyzed. The relevancy of design and optimization with respect to complex fluid for minimum drag force using Ansys Adjoint Solver module is analyzed as well. The graphical comparison of the above-mentioned parameter using CFD and FEA and subsequently FSI technique is illustrated and found the significant conformity between both the results.

Keywords : blade element theory, computational fluid dynamics, finite element analysis, fluid-structure interaction, momentum theory
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