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Optimum design of Hydrokinetic turbine based on Fluid structure interaction analysis[1] NITIN KOLEKAR, ARINDAM BANERJEE, Lehigh University, Bethlehem, PA — Hydrokinetic turbines, unlike conventional hydraulic turbines are zero head energy conversion devices, which utilize the kinetic energy of flowing water for power generation. Though the basic operation is similar to wind turbines, due to denser working media, these turbines are subjected to higher loads and stresses. The present work aims at hydrodynamic design and coupled fluid structure interaction (FSI) analysis for a horizontal axis hydrokinetic turbine. Blade element momentum (BEM) theory is utilized to analyze fluid forces and torque developed on turbine blades. The results of BEM are compared with a detailed three-dimensional computational fluid dynamics (CFD) analysis. The CFD domain is coupled with the structural domain using arbitrary Lagrangian-Eulerian scheme to find stresses in turbine components. A parametric study will be carried out to understand the effect of various parameters like blade pitch angle, flow velocity and RPM on the stresses developed on blades for different blade materials (aluminum and steel). Based on the one-way FSI analysis, the flow conditions and turbine design parameters will be optimized to achieve maximum possible efficiency.

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