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Large-eddy simulation of turbulent flow past tri-frame configurations of hydrokinetic turbines in an open channel[1] SAURABH CHAWDHARY, St. Anthony Falls Laboratory, Department of Mechanical Engineering, University of Minnesota, XIAOLEI YANG, CRAIG HILL, MICHELE GUALA, FOTIS SOTIROPOULOS, St. Anthony Falls Laboratory, Department of Civil Engineering, University of Minnesota — An effective way to develop arrays of hydrokinetic turbines in streams and tidal sites is to arrange them in tri-frame configurations, where three turbines are mounted together at the apexes of a triangular frame. Turbines mounted on a tri-frame can serve as the building block for rapidly deploying multi-turbine arrays. We employ large-eddy simulation (LES) to understand wake interactions of turbines mounted on tri-frame configurations and develop design guidelines for field deployment. We employ the computational framework of Yang et.al. (2013) to simulate the flow past turbines with the turbines modeled as actuator lines. The computed results are compared with experiments conducted at the Saint Anthony Falls Lab (SAFL) in terms of mean flow and turbulence characteristics. The flow fields are analyzed to elucidate the mechanisms of turbine interactions and wake evolution in tri-frame configurations and to develop design guidelines for maximizing the combined power output while reducing structural loads due to turbulent fluctuations.

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