Title: Design and Control of a Maneuvering Marine Hydrokinetic Cycloturbine

Abstract:

A marine hydrokinetic (MHK) cycloturbine is a renewable electric power generation system used in rivers or tidal environments. MHK cycloturbines have foils oriented perpendicular to the flow in a paddlewheel configuration, and use the lift from these foils to produce power. Due to the high cost associated with MHK operation and maintenance, a novel MHK system that can self-deploy is designed, with propulsion and control mechanisms similar to a cyclorotor aircraft. This design employs four stacked counter-rotating turbines, which is determined to provide the best vehicle control and performance. Additionally, the vehicle fatigue is decreased and the vehicle’s acoustic signature underwater is reduced by design of a novel acoustic controller. This controller specifically reduces the tonal noise at blade rate frequency. Experimental work includes testing of a Subscale Demonstrator (SSD) in a Reverant Tank facility to aid in the design and validation of a robust controller.