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Design optimization of a vaneless "fish-friendly" swirl injector for small water turbines AJITH AIRODY, SEAN D. PETERSON, University of Waterloo: Department of Mechanical and Mechatronics Engineering — Small-scale hydro-electric plants are attractive options for powering remote sites, as they draw energy from local bodies of water. However, the environmental impact on the aquatic life drawn into the water turbine is a concern. To mitigate adverse consequences on the local fauna, small-scale water turbine design efforts have focused on developing "fish-friendly" facilities. The components of these turbines tend to have wider passages between the blades when compared to traditional turbines, and the rotors are designed to spin at much lower angular velocities, thus allowing fish to pass through safely. Galt Green Energy has proposed a vaneless casing that provides the swirl component to the flow approaching the rotor, eliminating the need for inlet guide vanes. We numerically model the flow through the casing using ANSYS CFX to assess the evolution of the axial and circumferential velocity symmetry and uniformity in various cross-sections within and downstream of the injector. The velocity distributions, as well as the pressure loss through the injector, are functions of the pitch angle and number of revolutions of the casing. Optimization of the casing design is discussed via an objective function consisting of the velocity and pressure performance measures.

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