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Particle image and acoustic Doppler velocimetry analysis of a cross-flow turbine wake BENJAMIN STROM, STEVEN BRUNTON, BRIAN POLAGYE, Univ of Washington — Cross-flow turbines have advantageous properties for converting kinetic energy in wind and water currents to rotational mechanical energy and subsequently electrical power. A thorough understanding of cross-flow turbine wakes aids understanding of rotor flow physics, assists geometric array design, and informs control strategies for individual turbines in arrays. In this work, the wake physics of a scale model cross-flow turbine are investigated experimentally. Three-component velocity measurements are taken downstream of a two-bladed turbine in a recirculating water channel. Time-resolved stereoscopic particle image and acoustic Doppler velocimetry are compared for planes normal to and distributed along the turbine rotational axis. Wake features are described using proper orthogonal decomposition, dynamic mode decomposition, and the finite-time Lyapunov exponent. Consequences for downstream turbine placement are discussed in conjunction with two-turbine array experiments.

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