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Model-Based Estimation of Vortex Shedding in Unsteady Cylinder Wakes JIWEN GONG, JASON MONTY, SIMON ILLINGWORTH, The University of Melbourne — This work considers single-sensor based estimation of vortex shedding in cylinder wakes at $Re = 100$ in simulations and at $Re = 1036$ in experiments. A model based on harmonic decomposition is developed to capture the periodic dynamics of vortex shedding. Two model-based methods are proposed to estimate time-resolved flow fields. First, Linear Estimation (LE) which implements a Kalman Filter to estimate the flow. Second, Linear-Trigonometric Estimation (LTE), which utilizes the same Kalman Filter together with a nonlinear relationship between harmonics of the vortex shedding frequency. LTE shows good performance and outperforms LE in reconstructing vortex shedding. Physically this suggests that, at the Reynolds numbers considered, the higher harmonic motions are slave to the fundamental frequency.

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