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Investigating wake topology of a single step cylinder with tomographic PIV SERHIY YARUSEVYCH, University of Waterloo, SINA RAFATI, FULVIO SCARANO, TU Delft — Wake vortex shedding from a single step cylinder is investigated experimentally using Tomographic Particle Image Velocimetry (TOMO PIV). The model geometry is comprised of two circular cylinders of different diameters joined concentrically. Experiments are conducted in a low-speed wind tunnel for a range of cylinder diameter ratios $1.14 \leq D/d \leq 2.67$ and Reynolds numbers $2000 \leq Re_D \leq 5000$. The employed TOMO PIV system consists of six CCD cameras subtending an arc and an Nd:YAG laser. LaVision DaVis 8 is used for image acquisition and processing. For the range of parameters investigated, turbulent vortex shedding occurs in the single-step cylinder wake. The difference in diameters leads to a variation in vortex shedding frequency, producing complex three-dimensional vortex interactions in the wake region downstream of the step. The use of TOMO PIV enables quantitative visualization and analysis of the attendant intricate vortex dynamics. Vortex filaments are visualized by the Q-criterion, and the topology of recurring vortex patterns is investigated. Reduced order modeling is used to identify dominant vortex interactions, providing added insight into the wake development. The results are used to reconstruct salient topological features of the near wake region and to investigate the effect of diameter ratio and Reynolds number on the wake topology.

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