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Vortex dislocations in the wake of a circular cylinder SERHIY YARUSEVYCH, CHRISTOPHER MORTON, University of Waterloo — Cross flow over complex cylindrical geometries, such as cylinders with discontinuities in diameter, results in non-uniform wake vortex shedding with complex vortex interactions. In the present study, the development of vortex dislocations in the wake of a circular cylinder is investigated. A dual-step circular cylinder geometry is employed, which consists of a large-diameter cylinder placed at the midspan of a small-diameter cylinder. In a uniform flow, wake development depends primarily on the Reynolds number (Re_D), the ratio of the large cylinder diameter (D) to the small cylinder diameter (d), and the aspect ratio of the large cylinder (L/D). Experimental investigations are performed for Re_D=1080, D/d=2, and $0.2 \leq L/D \leq 2.0$ in a water flume facility utilizing flow visualization, laser Doppler velocimetry, and particle image velocimetry. Also, direct numerical simulations are performed for a laminar vortex shedding regime, where, based on previous studies, interactions between large-scale vortical structures are expected to be similar to those observed in turbulent wakes. The results show that the large cylinder induces vortex dislocations that are manifested by half-loop vortex connections forming between consecutive small cylinder vortices. The remaining small cylinder vortices form vortex connections across the wake of the large cylinder. The dislocations occur at a distinct frequency, which decreases with decreasing L/D.

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