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Influence of diameter ratio and aspect ratio on wake development of a dual step cylinder[1] SERHIY YARUSEVYCH, CHRIS MORTON, University of Waterloo — A dual step cylinder is composed of a large diameter cylinder (D) attached to the mid-span of a small diameter cylinder (d). In a uniform cross flow, vortex shedding occurs from the small cylinder, above and below the large cylinder. The characteristics of the shed vortices are similar to those found in the wake of a uniform circular cylinder. However, wake characteristics of the large cylinder are influenced significantly by the geometric parameters of the model, namely, the ratio between the large and small cylinder diameters (D/d) and the large cylinder aspect ratio (L/D). The present work investigates the flow past dual step cylinders for Re_D = 2100, $0.2 \leq L/D \leq 3$, and $1.33 \leq D/d \leq 2.67$. Experiments have been completed in a water flume facility employing Laser Doppler Velocimetry (LDV) and Particle Image Velocimetry (PIV) systems, as well as hydrogen bubble flow visualization. The results show that the following three distinct large cylinder wake topologies can be observed for the investigated ranges of L/D and D/d: (i) shedding of uniform spanwise vortices, (ii) shedding of highly deformed three-dimensional vortices, and (iii) no distinct vortex shedding. Complex vortex interactions taking place in the wake of the large cylinder are investigated for the identified flow regimes.

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