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Experimental Investigations of the Flow past Circular Cylinders with Stepwise Discontinuities CHRIS MORTON, SERHIY YARUSEVYCH, University of Waterloo — Circular cylinders with step discontinuities in diameter are often encountered in engineering applications, e.g., finned tube heat exchangers and civil structures. This investigation is focused on wake vortex shedding from cylinders with one or two step discontinuities in diameter along the span. For uniform flow past a single step cylinder, the flow development is dependent on the Reynolds number (Re) and the ratio of the large cylinder diameter (D) to the small cylinder diameter (d), known as the diameter ratio (D/d). For a dual step cylinder, in addition to these two parameters, the aspect ratio of the large cylinder (L/D) is expected to influence vortex dynamics. This study has been performed for Re = 1050, D/d = 2, and a range of aspect ratios from 0.2 to 17. Experimental measurements have been acquired in a water flume facility using laser Doppler velocimetry and flow visualization. The results show that vortex shedding occurs in spanwise vortex cells of constant frequency. Vortex connections form between the spanwise vortices in these cells downstream of the step discontinuities, and vortex dislocations occur at cell boundaries. For a dual step cylinder, the aspect ratio is found to have a profound effect on vortex shedding, resulting in several distinct flow regimes.

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