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Periodic fluctuations of streamwise vortices in inertia-dominated intersecting flows[1] NOA BURSHTEIN[2], ESPCI Paris, KONSTANTINOS ZOGRAFOS, School of Engineering, University of Liverpool, AMY Q. SHEN, Okinawa Institute of Science and Technology Graduate University., ROBERT J. POOLE, School of Engineering, University of Liverpool, SIMON J. HAWARD, Okinawa Institute of Science and Technology Graduate University. — In the proximity of stagnation points, flow instabilities arise at relatively low Reynolds number, $Re \sim O\ (10-100)$, resulting in the formation of vortices that can evolve time-periodic patterns. These flows are well studied where the stagnation point is downstream of a bluff body and the resulting vortices are in the spanwise direction (e.g. the von Kármán vortex street). However, they are less understood in intersecting flows, where the resulting vortices are stretched in the streamwise direction. In this work, quantitative flow velocimetry measurements and 3D numerical simulations, are used to characterize steady vortical flow fields at two intersecting rectangular channels with different degrees of confinement, determined by the channel aspect ratio (depth: width), α. By tuning the parameters α and Re, we control the number of vortices in the steady flow field, their relative rotation direction and vortex core structure. These features will determine the onset parameters and dynamics of time-periodic fluctuations. The dimensionless description of our findings can be applied in various scales, for control over vortex-induced vibrations that harm structures such as bridges, buildings, wind turbines and pipes in terrestrial and marine environments.

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