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Vortex evolution behind tandem cylinders under forced vibration
YINGCHEN YANG, University of Texas at Brownsville, TAYFUN AYDIN, ALIS EKMEKCI, University of Toronto — Flow past two circular cylinders in tandem arrangement has been studied experimentally employing the hydrogen bubble visualization technique. The two cylinders had the same diameter ($D = 6.35$ mm), and were subjected to forced in-phase vibration in the cross-flow direction. The Reynolds number based on the cylinder diameter was $Re = 250$. Both the vibration frequency (f_e) and center-to-center pitch ratio (P/D) were varied in certain ranges, whereas the vibration amplitude (A) was fixed at $A/D = 0.25$. The flow visualization resulted diverse and highly-repetitive vortex patterns. They were classified into two typical modes: a low-frequency mode and a high-frequency mode. The difference between the two modes is on the number of vortices formed per vibration cycle. For the low-frequency mode, the number is four; for the high-frequency model, it is two. In both modes, the vortex formation is phase-locked to the cylinder motion. For a specified mode with a fixed vortex number per cycle, the way the vortices evolve in the wake can be somewhat different by changing the vibration frequency and pitch ratio. These affecting factors have been examined in this work, and the associated vortex patterns have been characterized and compared.

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