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An experimental study of flow past a rotationally oscillating cylinder. SANJAY KUMAR, CARLOS LOPEZ, The University of Texas at Brownsville, OLIVER PROBST, Instituto Tecnologico y de Estudios Superiores de Monterry, Mexico, DAVOOD ASKARI, YINGCHEN YANG, The University of Texas at Brownsville — Flow past a circular cylinder executing sinusoidal rotary oscillations about its own axis is studied experimentally. The experiments are carried out at Re = 185, oscillation amplitudes varying from $\pi/8$ to π, and forcing frequency ratios varying from 0 to 5. It is found that the phenomenon of lock-on occurs in a forcing frequency range which depends not only on the oscillation amplitude but also the downstream location from the cylinder. The experimentally measured lock-on diagram in the forcing amplitude and frequency plane is presented at various downstream locations ranging from 2 to 23 diameters. The upper limit of the lock-on forcing frequency band depends strongly on the downstream location whereas the lower limit is fairly insensitive. The far field wake decouples, after the lock-on at higher forcing frequencies and behaves more like a regular Karman vortex street from a stationary cylinder with a vortex shedding frequency mostly lower than the one from a stationary cylinder. The dependence of circulation values of shed vortices on the forcing frequency revealed a universal decay curve independent of forcing amplitude beyond forcing frequency of ~ 1.0.

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