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Symmetry breaking in vortex-induced vibration of a rotating cylinder BANAFSHEH SEYED-AGHAZADEH, YAHYA MODARRES-SADEGHI, University of Massachusetts, Amherst — Vortex-induced vibration (VIV) of a flexibly-mounted circular cylinder, free to oscillate in the crossflow direction with imposed rotation around its axis, is studied experimentally. In particular, the influence of asymmetry that is introduced into the system by the forced rotation of the cylinder is considered. The rotation rate, α, defined as the ratio of the surface velocity and free stream velocity, was varied from 0 to 2.6 in small steps. The amplitudes and frequencies of oscillations as well as the flow forces were measured in a Reynolds number range of Re=350-1000. The maximum amplitude of oscillation was found to be limited to values less than a diameter of the cylinder at high rotation rates. Also the lock-in range was found to become narrower at higher rotation rates and finally the oscillation ceased beyond α =2.4. Vortex shedding pattern was found to change from 2S and 2P shedding (two single and two pairs of vortices shed per cycle of oscillation) for a non-rotating cylinder to P shedding (one pair of vortices shed in a cycle of oscillations) for the rotating cylinder. Also, the phase difference between the flow forces and displacement of the cylinder in the crossflow direction was influenced as the rotation rate was increased. At high reduced velocities the phase difference decreased from 180 degree for a non-rotating cylinder to values close to 90 degree for a rotating cylinder.

Banafsheh Seyed-Aghazadeh
University of Massachusetts, Amherst

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