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Nonlinear spacing and frequency effects of an oscillating cylinder in the wake of a stationary cylinder Z. ZHENG, XIAOFAN YANG, Kansas State University — Nonlinear responses to a transversely oscillating cylinder in the wake of a stationary upstream cylinder are studied theoretically by using an immersed-boundary method. It is found that flow around the two cylinders varies with different spacing between the two cylinders and the oscillation frequency of the downstream cylinder. As known in a stationary tandem-cylinder system, there exist the "vortex suppression regime" (VS) and the "vortex formation regime" (VF). These two regimes are divided by a critical spacing. When the downstream cylinder is forced to oscillate at a fixed amplitude but different frequency, different flow patterns appear in each of the regime. On the other hand, at the same oscillating frequency but different spacing, the response state (lock-in, transient or non-lock-in) changes. While each state has periodic or quasi-periodic behaviors, nonlinear responses appear. All of the analyses are based on vorticity contours, time histories of the velocities in the near wake regions, spectral analyses, and related phase portraits.

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