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Nonlinear Dynamics of Pinned-Pinned Cylinders in Axial Flow

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It is known that cylinders with supported ends subjected to high enough axial flow develop divergence and at higher flow coupled-mode flutter, as shown experimentally and confirmed by linear theory. Also, the same dynamics is predicted by linear theory for the closely related problem of a pipe conveying fluid, but in this case post-divergence flutter has never been observed; its nonexistence was confirmed by nonlinear theory. The problem of the cylinder in flow is re-examined in this paper by means of weakly nonlinear theory. It is shown that post-divergence flutter does exist, but not as an instability of the trivial equilibrium, but as a Hopf bifurcation emanating from the divergence solution. For high enough flow, interesting dynamics follow, including quasiperiodicity and chaos. Reasons for the different dynamics with internal and external flow are explored.

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