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Drag Reduction in a Radially Pulsating Cylinder at Moderate Reynolds Number H. OUALLI, Université des Sciences et de la Technologie, Algeria, H. HANCHI, Ecole Militaire Polytechnique, Algeria, A. BOUABDALLAH, Université des Sciences et de la Technologie, Algeria, R. ASKOVIÇ, Université de Valenciennes, France, M. GAD-EL-HAK, Virginia Commonwealth University —
The early separation and wide wake behind a bluff body are responsible for the large pressure drag. Passive, active and reactive control strategies center for the most part on modulating the wake and its omnipresent Kármán vortices. Here, we numerically investigate the uniform flow around a two-dimensional, radially pulsating circular cylinder at Reynolds number of 300, where, for a constant-diameter cylinder, the three-dimensional instability mode A transitions to mode B. A second-order finite-difference discretization of the unsteady, two-dimensional vorticity–streamfunction equation is used, and time is advanced via a second-order Adams–Bashforth scheme. A Smagorinsky eddy viscosity model is employed for closure. The small-amplitude pulsation of the cylinder changes the dynamics of the Kármán vortex street as well as the secondary vortices. The interplay between the primary and secondary vortices modulates the flow field and results in a dramatic reduction of the total drag. Drag monotonically decreases as the oscillation frequency increases beyond a certain threshold, and thrust is produced at sufficiently high frequency.

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