Abstract Submitted
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Suppression of Wake Vortices Using Periodic Cross-Section Variations A. BOUABDALLAH, Université des Sciences et de la Technologie Houari Boumediene, Algiers, Algeria, H. OUALLI, A. BENLAHNACHE, Y. MENAD, École Militaire Polytechnique, Algiers, Algeria, M. GAD-EL-HAK, Virginia Commonwealth University, Richmond, Virginia, USA — Vortices in the wake of blunt bodies are responsible for significant portion of the drag. An active flow control strategy is designed to inhibit the shedding of such vortex structures. A numerical study is conducted to investigate the effect of periodic cross-section variations on the shed vortices. We use an LES scheme with a Smagorinsky–Lilly subgrid model. The two-dimensional body sinusoidally changes its cross-section from circular to elliptic. The amplitude varies in the range of 5–100% of the nominal cylinder's diameter, and the oscillation frequency varies in the range of 0.2–10 times the cylinder's natural shedding frequency. The von Kármán vortex street is most sensitive to the cross-section variations at a Reynolds number of 3,740. At this Re, the boundary layer is subcritical, and the wake is predominately bidimensional. The flow exhibits a cascade of bifurcations identified by the shifting of the shedding mode. When the flow control strategy is optimized, as much as 65% drag reduction is achieved, which is a direct result of the shedding mechanism inhibition. An experimental validation of this result is forthcoming.

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