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Laminar flow separation subject to control by zero-net-mass-flux jet OLAF MARXEN, Univ of Surrey, RAJAT MITTAL, TAMER ZAKI, Johns Hopkins University — The flow around slender bodies at moderate Reynolds numbers often features a laminar separation bubble. Convective amplification of small-amplitude perturbations leads to the formation of two-dimensional large-scale vortices that are shed from the bubble. These perturbations can be triggered through a zero-net-mass-flux actuator in order to control the bubble size and shedding frequency. Using data from Navier-Stokes simulations for the flow around a canonical airfoil-like geometry, it is found that linear modes with intermediate frequencies exhibit strongest convective amplification caused by Kelvin-Helmholtz instability. Forcing at these frequencies is most effective. For low frequencies, the front part of the bubble still diminishes due to the interaction of a vortex that starts from the actuator with the wall. This vortex transiently amplifies downstream due to the Orr mechanism. Actuation at high frequencies leads to visible, amplified instability waves in the shear layer, but is not effective in reducing the size of the bubble.

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