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Alternatives to Kelvin-Helmholtz instabilities to control separation bubbles[1] MARK P. SIMENS, U. Politécnica Madrid, JAVIER JIMÉNEZ, U. Politécnica Madrid and CTR, Stanford — We study the control of two-dimensional laminar separation bubbles on a flat plate at low Reynolds numbers, using two-dimensional DNS. A range of steady separation bubbles is obtained varying the pressure gradient. They are forced by a zero-mass flow, oscillatory wall blowing with different perturbation amplitudes and frequencies. The reduction in bubble length as a function of frequency has two minima for sufficient high amplitudes. One of them is related to the Kelvin-Helmholtz instability of the separated boundary layer, while the other, most effective one, is here denoted as the low-frequency regime. In this regime large vortices are created which are not a consequence of an instability of the original bubble. On the contrary the forcing creates an unsteady separation bubble which evolves into a large vortex. These vortices have large radii and attach to the wall due to their self-induced pressure field while convecting across the adverse pressure gradient zone. Scaling relations for the effect of the forcing are proposed and tested.

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