Abstract Submitted
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Structural changes of laminar separation bubbles induced by global linear instability[1] DANIEL RODRIGUEZ, California Institute of Technology, VASSILIS THEOFILIS, School of Aeronautics, Universidad Politecnica de Madrid — Global modal linear instability analysis considers three- dimensional disturbances superimposed upon (essentially non- parallel) two- or three-dimensional basic flows. Here two- dimensional (BiGlobal) analysis of laminar separation bubbles embedded in a flat-plate boundary layer is performed. Results obtained show the presence of a stationary three-dimensional eigenmode, which is unstable for a finite range of spanwise wavenumbers, while the same steady basic flow is stable against two-dimensional disturbances of the Kelvin-Helmholtz/Tollmien- Schlichting class. Critical-point theory shows that 2D flow is "structurally unstable" and the presence of any 3D disturbance, like the aforementioned global mode will alter the complete topological description regardless of the disturbance amplitude. Critical-point theory is used here in order to characterize the different topological bifurcations exerted by global instability on the steady laminar two-dimensional bubble: a spanwise modulation of the separated region appears, eventually leading to the breakdown of the recirculation region into independent cellular structures, highly resemblant to the patterns observed experimentally on stalled airfoils.

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Daniel Rodriguez
California Institute of Technology

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