Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Optimal control of an asymptotic model of flow separation UBAID QADRI, PETER SCHMID, Imperial College London, LFC-UK TEAM — In the presence of surface imperfections, the boundary layer developing over an aircraft wing can separate and reattach, leading to a small separation bubble. We are interested in developing a low-order model that can be used to control the onset of separation at high Reynolds numbers typical of aircraft flight. In contrast to previous studies, we use a high Reynolds number asymptotic description of the Navier–Stokes equations to describe the motion of motion of the fluid. We obtain a steady solution to the nonlinear triple-deck equations for the separated flow over a small bump at high Reynolds numbers. We derive for the first time the adjoint of the nonlinear triple-deck equations and use it to study optimal control of the separated flow. We calculate the sensitivity of the properties of the separation bubble to local base flow modifications and steady forcing. We assess the validity of using this simplified asymptotic model by comparing our results with those obtained using the full Navier–Stokes equations.

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Date submitted: 03 Aug 2015 Electronic form version 1.4