

Abstract Submitted
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Control of streaks induced by free-stream turbulence in incompressible boundary layers: application to a linear model¹ GEORGE PAPANAKIS, LIANG LU, Imperial College London, PIERRE RICCO, University of Sheffield — Active wall-transpiration control of streaks generated within an incompressible boundary layer due to free-stream turbulence is examined. The flow model is based on the linearised unsteady boundary-region (LUBR) equations. The effect of free-stream turbulence appears as explicit forcing of these equations, given by an analytic expression, which is obtained by asymptotic matching with the far field conditions. The presence of the forcing term necessitates the reformulation of the control problem and the re-derivation of its solution. The objective cost function that is minimised comprises the weighted energy of the streak and the actuation. It is shown that the control signal consists of two components, a feed-back part (that depends on the state vector) and a feed-forward part. Explicit equations that provide these two components are derived. The developed method is efficient and has modest memory requirements. Computations with different wavenumbers in the wall normal direction demonstrates the significant effect of forcing for the same initial conditions. The effect of actuation on the perturbation energy and vorticity fields is examined.

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