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Secondary instability analysis of pre-transitional streaks in boundary layers M.J. PHILIPP HACK, TAMER ZAKI, Imperial College London — In the presence of free-stream vortical disturbances, laminar boundary layers develop streamwise-elongated perturbations of high amplitude, commonly known as Klebanoff streaks. The regions of shear surrounding these primary structures provide the potential for the growth of secondary instabilities which ultimately initiate bypass transition. By means of linear analysis, we examine the secondary instability which precedes the formation of turbulent spots. The base state is extracted from direct numerical simulations of the bypass process. The simulation setup is similar to the work of Jacobs & Durbin (2001), where transition is triggered by broadband free-stream vortical forcing. The velocity field therefore includes a spectrum of streaks with different structures and amplitudes. The stability analysis can nevertheless identify the streaks which indeed develop secondary instabilities and break down to turbulence. The predictions of linear theory, in particular the instability wavelength and phase speed, are compared to the streak instabilities recorded in the DNS of the full bypass process.

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