

Ehrenstein, Uwe; Gallaire, François

On two-dimensional temporal modes in spatially evolving open flows: the flat-plate boundary layer. (English) [Zbl 1073.76027](#)

J. Fluid Mech. 536, 209-218 (2005).

Summary: Temporal linear stability modes depending on two space directions are computed for a two-dimensional boundary-layer flow along a flat plate. The spatial structure of each individual temporally stable mode is shown to be reminiscent of the spatial exponential growth of perturbations along the flat plate, as predicted by local analyses. It is shown using an optimal temporal growth analysis, that an appropriate superposition of a moderate number of temporal modes gives rise to a spatially localized wave packet, starting at inflow and exhibiting transient temporal growth when evolving downstream along the plate. This wave packet is in qualitative agreement with the convectively unstable disturbance observed when solving the Navier-Stokes equations for an equivalent initial condition.

MSC:

[76E05](#) Parallel shear flows in hydrodynamic stability

[76D10](#) Boundary-layer theory, separation and reattachment, higher-order effects

[76M20](#) Finite difference methods applied to problems in fluid mechanics

Cited in **51** Documents

Keywords:

spatial exponential growth; wave packet

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