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Fully Nonlinear Global Modes and Transition to Turbulence in Open Flows

Jean-Marc Chomaz

LadHyX, École Polytechnique, France

The fully nonlinear theory of global modes in open flows, proposed in recent analyses of amplitude equations, is extended to the case of Navier–Stokes equations using direct numerical simulations. The basic flow under consideration is in a first time, a parallel wake in a finite domain generated by imposing the wake profile at the inlet boundary and by adding a body force to compensate the basic flow diffusion. The link between the global bifurcation, the absolute or convective nature of the local linear instability, and the theory of speed selection for the front separating an unperturbed domain of the flow from a fully saturated solution is elucidated. New scenarii involving secondary absolute instability are proposed and compared to the dynamics of mixing layers simulations conducted in the same spirit as for the wake.

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