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**Global optimal disturbances using time-steppers** ANTONIOS MONOKROUSOS, LUCA BRANDT, DAN S. HENNINGSON, Linne Flow Centre, KTH Mechanics — The global linear stability of boundary-layer flows subject to three-dimensional disturbances is studied by means of Lagrange optimization. We consider the optimal initial condition leading to the largest growth at finite times and the optimal harmonic forcing leading to the largest asymptotic response (pseudo-spectrum). Both optimization problems are solved using a Lagrange multiplier technique, where the objective function is the kinetic energy of the flow perturbations and the constraints involve the linearised Navier-Stokes. Whereas the computation of optimal initial condition is known in the time-stepper context, the formulation of the optimal forcing problem is novel. The approach proposed here is particularly suited to examine convectively unstable flows, where single global eigenmodes of the system do not capture the downstream growth of the disturbances. For spanwise wavelengths of the order of the boundary layer thickness finite-length streamwise vortices exploit the lift-up mechanism to create streaks. For long spanwise wavelengths the Orr mechanism combined with the amplification of oblique wave packets are responsible for the disturbance growth. The latter mechanism is found to be dominant for the relatively long computational domain and high Reynolds number considered here. The use of matrix-free methods enables us to extend the present framework to any geometrical configuration.

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