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Feedback control of transition in boundary layer ONOFRIO SEMERARO, SHERVIN BAGHERI, LUCA BRANDT, DAN S. HENNINGSON, Linne' Flow Centre, KTH Mechanics - Stockholm (SWE) — We study the use of feedback control for the delay of laminar-turbulent transition in boundary layer. The mitigation of three-dimensional wavepackets of streaks and Tollmien-Schlichting waves is investigated numerically. The dynamics is studied from an input-output point of view: a set-up of spatially localized inputs (external disturbances and actuators) and outputs (sensor for the estimation and objective functions) is introduced for the control design. Sensors and actuators are distributed in arrays near the wall, spanning the homogeneous spanwise direction. Reduced-order models of the Navier-Stokes equations including the inputs and outputs, obtained via balanced truncation, are used to design an LQG controller. The controller provides an optimal signal that minimizes the amplitude of the perturbation downstream. Using a limited number of sensors and actuators (about 10-20 elements), the linear controller reduces substantially the energy growth of the instabilities arising in the boundary layer flows. In the final contribution, the mitigation of finite-amplitude perturbations in nonlinear simulations and the delay of the laminar-turbulent transition will be addressed.

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