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Effects of actuators and sensors on feedback control of transition in the 2D Blasius boundary layer BRANDT BELSON, CLARENCE ROWLEY, Princeton University, ONOFRIO SEMERARO, KTH Royal Institute of Technology — We examine the effects of different types and positions of actuators and sensors on the performance and robustness of controllers designed to reduce the growth of Tollmien-Schlichting waves in the 2D Blasius boundary layer. We perform direct numerical simulations, and in order to facilitate controller design, we find reduced-order models with the Eigensystem Realization Algorithm. Good performance is obtained with the sensor upstream of the actuator, as in previous work. We categorize this as feedforward control, whereas sensors downstream of the actuator correspond to feedback control. The performance of feedforward controllers can be degraded by disturbances and perturbations, so we examine feedback controllers. The original choice of actuator and sensor results in ineffective feedback controllers (both for H2-optimal and simple classical controllers) due to weakly observable structures and a strict tradeoff between performance and robustness. Another choice of actuators and sensors is better suited for feedback control, and a PI feedback controller with the sensor slightly downstream of the actuator has good performance and robustness. Sensors farther downstream of the actuator cause inherent time delays that limit performance and robustness.

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