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Structural Sensitivity for Estimating Actuator and Sensor Placement for Flow Control[1] MAHESH NATARAJAN[2], JONATHAN FREUND[3], DANIEL BODONY[4], University of Illinois at Urbana-Champaign — A control strategy is developed for the modification of the growth rates of global modes. The method is based on an analysis of the structural sensitivity of the baseflow, which uses the forward and adjoint global modes of the steady baseflow to estimate effective locations of actuation. Linear feedback is used to modify the eigenstructure of the linearized system for reduction/stabilization of amplification rates using different control-feedback pairs. This procedure provides an assessment of the effectiveness of different modes of actuation and different quantities to sense. The method is demonstrated for the case of a separated boundary layer in a Mach 0.7 diffuser and the eigensystem senstivity to perturbation is evaluated for different cases. An error analysis of the predicted and computed eigenvalues as a function of the control amplitude establishes the limit of applicability of the linear description. Direct numerical simulations demonstrate the efficacy of a linear feedback controller based on mass injection with density feedback.

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