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Controller Selection and Placement in a Compressible Boundary Layer DANIEL BODONY, MAHESH NATARAJAN, University of Illinois at Urbana-Champaign — A method for estimating the optimal location and type of flow control to use in compressible, turbulent flows is developed. Through linearizing the compressible Navier-Stokes equations about an unstable equilibrium point, the forward and adjoint equations of motion are used to estimate the structural sensitivity of the flow using a generalized "wavemaker" concept. Matrix optimization is used to enhance the structural sensitivity over possible controller types (e.g., mass or energy sources) and locations, with optimal solutions identifying advantageous control strategies. The algorithms and theory are applied to a high-subsonic separating boundary layer appearing in an S-duct and compared with more traditional optimal methods through adjoint-based gradient information. It is found that optimum locations for mass and energy sources are typically located upstream of those momentum sources, and use different physical mechanisms for affecting the flow.

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