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Stability analysis without numerics: analytic approximations to the pseudospectra of linear operators in fluid mechanics SCOTT DAWSON, Illinois Institute of Technology — The pseudospectra of a linear dynamical system determine the extent to which, and nature by which, disturbances to the system at a given frequency can be amplified. In practice, pseudospectral analysis (or equivalently, input-output or resolvent analysis) proceeds by computing leading singular values and vectors of the associated discretized operator. This talk will describe a methodology by which the pseudospectra of linear differential operators can instead be closely approximated by prescribed analytic functions. The methodology utilizes results and intuition from wavepacket pseudospectral theory to assume a general form of optimal pseudospectral modes, from which specific mode shapes and growth factors may be obtained by solving a low-dimensional optimization problem for a small number of unknown parameters. This method gives substantial computational savings over standard numerical approaches, and produces accurate results across regimes relevant to real flows. In particular, in such regimes the difference between numerically computed solutions and analytic approximations are typically much smaller than ϵ for the ϵ-pseudospectrum. We will further discuss connections to other nonmodal stability tools, such as optimal transient energy growth analysis.

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