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Nonlinear flow control based on a low dimensional approximation of the Navier-Stokes equation[1] RUDIBERT KING, Measurement and Control Group, Berlin University of Technology, Germany, BERND R. NOACK, Hermann Foettinger Institute, Berlin University of Technology, Germany, OLIVER LEHMANN, Measurement and Control Group, and Hermann Foettinger Institute, Berlin University of Technology, Germany, MAREK MORZYSKI, Institute of Combustion Engines, Poznan University of Technology, Poland, GILEAD TADMOR, Department of Electrical and Computer Engineering, Northeastern University, Boston, USA — Nonlinear control design is shown to be a critical enabler for robust model-based supression of a flow instability. The onset of oscillatory vortex shedding is chosen as a well investigated benchmark problem of flow control. A low-dimensional POD Galerkin model is adopted from earlier studies of the authors as a control-oriented fluid flow representation. Several strategies of nonlinear controller design are employed, both, to the Galerkin model and to the flow via a direct numerical simulation of the Navier-Stokes equations (NSE). Examples are input-output linearization, Lyapunov-based, backstepping, LPV-type controlles, etc., and physically motivated controllers. Whereas the first test-bed is easily mastered by the formal methods, the application to the NSE is more critical, due to robustness issues.

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