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Low Order Empirical Galerkin Models for Feedback Flow Control GILEAD TADMOR, CDSP, Northeastern University, BERND NOACK, HFI, Tecgnical University Berlin — Model-based feedback control restrictions on model order and complexity stem from several generic considerations: real time computation, the ability to either measure or reliably estimate the state in real time and avoiding sensitivity to noise, uncertainty and numerical ill-conditioning are high on that list. Empirical POD Galerkin models are attractive in the sense that they are simple and (optimally) efficient, but are notoriously fragile, and commonly fail to capture transients and control effects. In this talk we review recent efforts to enhance empirical Galerkin models and make them suitable for feedback design. Enablers include 'subgrid' estimation of turbulence and pressure representations, tunable models using modes from multiple operating points, and actuation models. An invariant manifold defines the model's dynamic envelope. It must be respected and can be exploited in observer and control design. These ideas are benchmarked in the cylinder wake system and validated by a systematic DNS investigation of a 3-dimensional Galerkin model of the controlled wake.

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