Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

An Approach to Reduced-Order Modeling for Flows with Upstream Actuation[1] GUY BEN-DOV, ARNE J. PEARLSTEIN, University of Illinois at Urbana-Champaign — We construct a forced ODE system from the linearized Navier-Stokes and continuity equations, using a proper orthogonal decomposition (POD) in the *frequency domain* and in space. Given any laminar steady flow in a specified domain, superimposing a small (linear) time-dependent flow, forced through some part of the boundary (e.g., by blowing and suction or by synthetic jets) can be used as an actuator to actively control perturbations that may arise in the flow. Using the actuator-driven flow on the upstream boundary as an inlet condition, we compute the impulse response of the linearized PDEs in the frequency domain over a wide range of frequency. The decomposition allows substitution of the resulting modes into the PDEs, and Galerkin projection to ODEs. The approach is demonstrated for the flow over an open cavity at a moderate Reynolds number, where the actuator input is introduced by blowing and suction through a small part of the boundary at the upstream upper part of the cavity.

[1]Supported by AFOSR Grant FA9550-05-1-0411

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Date submitted: 06 Aug 2010 Electronic form version 1.4