Abstract Submitted
for the DFD06 Meeting of
The American Physical Society

Control-oriented models of linearized channel flow using balanced proper orthogonal decomposition[1] MILOS ILAK, CLARENCE W. ROWLEY, Princeton University — We obtain reduced-order models of linearized channel flow using balanced proper orthogonal decomposition (BPOD), and compare these to models obtained from the standard POD/Galerkin method. We consider three-dimensional perturbations of complex structure without modeling each wavenumber separately as has been done in previous works, and show that the BPOD models reproduce the frequency response of the original system much better than standard POD models of the same order. The BPOD models capture the effects of actuation better, especially in cases for which the perturbation generates traveling structures. Very low order models using BPOD better capture the behavior for off-design values of the Reynolds number than standard POD models. We also demonstrate that for a range of single-wavenumber perturbations, low-order BPOD models reproduce the dominant eigenvalues of the full system better than POD models of the same order. These features indicate that the simple, yet accurate BPOD models are a good candidate for developing model-based controllers for channel flow.

[1]Work supported by NSF grant CMS-0347239.

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Date submitted: 04 Aug 2006 Electronic form version 1.4