



**The Center for Control, Dynamical Systems, and Computation
University of California at Santa Barbara
Fall 2008 Seminar Series
Presents**

**Reduced-order models for fluids, using approximate
balanced truncation and dynamically scaling modes**

**Clancy Rowley
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Friday, October 10, 2008 3:00-4:00pm Webb 1100

Abstract:

This work addresses model-reduction techniques for fluids, using several variants of the standard Proper Orthogonal Decomposition (POD) method. In the first variant, we use POD as an approximation of balanced truncation, using adjoint simulations to quantify the dynamical importance of different flow states. We illustrate the method on a number of examples, including a 3D linearized channel flow, and the separating flow over an airfoil at large angles of attack, and we show that this method significantly outperforms standard POD, producing low-order models that have much greater accuracy for a given number of modes. In the second variant, we present reduced-order models of a temporally evolving shear layer, using POD modes that scale in space as the shear layer spreads. Using this approach, very low-order models (4 complex modes) capture much of the relevant nonlinear behavior over a wide range of shear layer thicknesses. We conclude with some open questions and challenges for POD-based reduced order models.

About the Speaker:

Prof. Clancy Rowley is an Associate Professor in the Mechanical and Aerospace Engineering department at Princeton University. He received his undergraduate degree from Princeton in 1995, and his doctoral degree from Caltech in 2001, both in Mechanical Engineering. He returned to Princeton in 2001 as an Assistant Professor and was appointed Associate Professor in 2007. His research interests lie at the intersection of dynamical systems, control theory, and fluid mechanics, and focus on reduced-order models suitable for analysis and control design.
