

**COLLOQUIUM**  
**UNIVERSITY OF PITTSBURGH**  
**FRIDAY FEBRUARY 13, 2009**  
**704 THACKERAY HALL**  
**4:00 P.M.**

**PROFESSOR JEFF BORGGAARD**  
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**VIRGINIA TECHNICAL UNIVERSITY**

**BUILDING ACCURATE REDUCED-ORDER MODELS**  
**OVER PARAMETER RANGES**

**ABSTRACT:** Reduced-order models for fluids are important for analysis or in applications where repeated simulations are required. The standard method for building reduced-order models combines a basis selection strategy, such as the proper orthogonal decomposition (POD), and model construction, typically through Galerkin projection. However, the model may be inaccurate when used “off-design” (at parameter values different from those used to generate the basis). This talk investigates the use of POD sensitivity vectors to improve the accuracy and dynamical system properties of the reduced-order models for problems with varying parameters. In this study, we consider flow past a cylinder that exhibits vortex shedding. Flow sensitivities (derivatives of the flow variables with respect to the parameter of interest) are used to compute POD sensitivity vectors. Two strategies for utilizing these POD sensitivity vectors are included in this study: expand the POD basis by adding the corresponding POD sensitivity vectors or extrapolate the POD basis functions to those for nearby parameter values. Numerical studies test the accuracy of the basis to represent the flow and the accuracy of the resulting reduced-order models over a large range of parameter values.

**Refreshments served at 3:30 p.m.**  
**in the Math Dept. COMMON ROOM, Thackeray 705**