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Geometric Sensitivity Analysis of Low-Dimensional Galerkin Models IMRAN AKHTAR, JEFF BORGGAARD, Interdisciplinary Center for Applied Mathematics, Virginia Tech — Reduced-order models have a number of practical engineering applications where low-dimensional approximations are required. For example, analysis and control of unsteady flows over a parameter range. The standard method for building reduced-order models for these applications combines the proper orthogonal decomposition (POD) and Galerkin projection. However, the model may be inaccurate when used "off-design" (at parameter values not used to generate the POD). This talk investigates the use of POD sensitivity vectors to improve the accuracy and dynamical system properties of the reduced-order models to problems with *geometric parameters*. In this study, we consider flows past an elliptic cylinder for various major axes. Flow sensitivities (derivatives of the flow variables with respect to this geometric parameter) 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 geometric 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.

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