Abstract Submitted
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Robust Real-Time Solutions of Velocity Fields from Predictive Estimation[1] P. MOKHASI, D. REMPFER, IIT, Chicago — We want to predict 3-D velocity fields in complex geometries with applications to real-time solutions of the contaminant dispersion problem in an urban setting. Proper Orthogonal Decomposition is used to extract a set of optimal basis functions from an ensemble of snapshots. If the temporal coefficients can be computed, then combined with the basis functions one can get a good approximation to the velocity field. In this study, we explore the idea of using scalar measurements near the wall to construct the temporal POD coefficients. We look at the method of Linear Stochastic Estimation (LSE) and compare it to a few other regression methods for its prediction capabilities. Tests show that Principal Component Regression (PCR), and Least-Squares Support Vector Machines consistently outperform LSE in predicting POD coefficients outside the ensemble. We also develop state space equations that govern the short- term evolution of the POD coefficients. Using nonlinear Kalman filtering, we combine the regression methods with the state space equations to generate a robust method that can give accurate predictions in the presence of noisy measurements. The methods are tested on a numerical experiment of a wall- mounted cube in a channel. We demonstrate their effectiveness by predicting complete flow fields using only a handful of pressure measurements with and without noise.

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