Abstract Submitted
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Linear and nonlinear ensemble filtering of low-order aerodynamic models[1] MATHIEU LE PROVOST, University of California, Los Angeles, RICARDO BAPTISTA, YOUSSEF M. MARZOUK, Massachusetts Institute of Technology, JEFF D. ELDREDGE, University of California, Los Angeles — The control of lightweight aircraft during strong gust encounters requires a robust flow estimator. However, this is challenging due to the unknown nature of the perturbations and the limited measurements. Darakananda et al. used a stochastic Ensemble Kalman filter (sEnKF) to update an ensemble of inviscid vortex models with surface pressure readings. The sEnKF is only one algorithm to construct the linear update of the prior ensemble in the analysis step of the ensemble Kalman filter (EnKF). The linear transformation of the sEnKF is estimated by independently perturbing each observation. This creates sampling errors and degrades the filter performance. We look at better filters to tackle harder filtering problems with stronger perturbations and fewer sensors. We correct the deficiency of the sEnKF with the ensemble transform Kalman filter (ETKF) that exactly reproduces the ideal covariance propagation equation of the Kalman filter. However, the EnKF is an intrinsically biased estimator for nonlinear problems since the analysis step assumes a Gaussian environment. Thus, we explore nonlinear updates of the prior ensemble built on measure transport (Spantini et al.). We demonstrate the ETKF and the nonlinear ensemble filter on several aerodynamic flows with strong disturbances.

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