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An EnKF-based Flow State Estimator for Airfoils at High Angles of Attack ANDRE FERNANDO DE CASTRO DA SILVA[1], TIM COLONIUS[2], California Institute of Technology — Robust flow estimation from available measurements remains a major obstacle to successful flow control applications. Although several estimation methodologies have been developed in the past decades, the high dimensionality of fluid systems renders many of them computationally intractable. In this work, we employ the Ensemble Kalman Filter (EnKF) and the two-dimensional incompressible Navier-Stokes equations to estimate the state of the flow past a NACA 0009 airfoil at high angles of attack and moderate Reynolds number. The pressure distribution on the airfoil and the velocity field in the wake, both randomized by synthetic noise, are sampled as measurement data. In order to evaluate the relative importance of each sensor location to the estimate correction, their influence fields (also known as representers) are analyzed. The performance of the estimator is then assessed for different choices of ensemble size, noise levels, and number/location of sensors.

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