Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Full field inversion: A tool to diagnose and improve closure models[1] ANAND PRATAP SINGH, KARTHIK DURAISAMY, Univ of Michigan - Ann Arbor — Existing single-point closure models of turbulence are inaccurate in complex flows. The errors inherent in these models cannot be rectified by modifying parameters in the model – it is rather the functional form of the model that is in question. In this work, full-field inversion is used to infer the functional form of modeling discrepancies. The inference process is driven by Bayesian inversion applied to data from Direct Numerical and Large Eddy simulations and experimental measurements. A physics-constrained approach is used to regularize the heavily ill-posed problem. It is to be noted that the full-field inversion involves extreme-scale optimization and Hessian computations. Efficient surrogate-enhanced adjoint techniques are employed to obtain the maximum aposteriori estimate and covariance of the inferred functions. The procedure is applied in a number of problems involving adverse and favorable pressure gradients and separation. The extracted information is used as part of a data-driven inversion/machine learning framework to improve closure models.

[1]This work was supported by the NASA Aeronautics Research Institute under the Leading Edge Aeronautics Research for NASA (LEARN) fund.

Anand Pratap Singh
Univ of Michigan - Ann Arbor

Date submitted: 01 Aug 2015 Electronic form version 1.4