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Eigenspace perturbations for structural uncertainty estimation of turbulence closure models[1] LLUIS JOFRE, AASHWIN MISHRA, GIANLUCA IACCARINO, Stanford University — With the present state of computational resources, a purely numerical resolution of turbulent flows encountered in engineering applications is not viable. Consequently, investigations into turbulence rely on various degrees of modeling. Archetypal amongst these variable resolution approaches would be RANS models in two-equation closures, and subgrid-scale models in LES. However, owing to the simplifications introduced during model formulation, the fidelity of all such models is limited, and therefore the explicit quantification of the predictive uncertainty is essential. In such scenario, the ideal uncertainty estimation procedure must be agnostic to modeling resolution, methodology, and the nature or level of the model filter. The procedure should be able to give reliable prediction intervals for different Quantities of Interest, over varied flows and flow conditions, and at diametric levels of modeling resolution. In this talk, we present and substantiate the Eigenspace perturbation framework as an uncertainty estimation paradigm that meets these criteria. Commencing from a broad overview, we outline the details of this framework at different modeling resolution. Thence, using benchmark flows, along with engineering problems, the efficacy of this procedure is established.

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