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Structural Uncertainties in RANS Models: Reynolds Stress Transport contra Eddy Viscosity Frameworks[1] AASHWIN MISHRA, WOUTER EDELING, GIANLUCA IACCARINO, Center for Turbulence Research, Stanford University — A vast majority of turbulent flow studies, both in academia and industry, utilize Reynolds Averaged Navier Stokes based models. There are different RANS modeling frameworks to select from, depending on their complexity and computational requirements, such as eddy viscosity based models, second moment closures, etc. While the relative strengths and weaknesses of each modeling paradigm (vis-a-vis their predictive fidelity, realizability, etc) are roughly established for disparate flows, there are no extant comparative estimates on the relative uncertainty in their predictions. In this investigation, we estimate the structural uncertainty inherent to different RANS modeling approaches for select internal flows. This involves comparisons between models conforming to the same framework, and, across different modeling frameworks. We establish, compare, analyze and explicate the model inadequacy for flows such as in parallel, curved, converging and diverging channels for different models. One of the novel facets of this study involves the estimation of the structural uncertainties of established Reynolds Stress Transport models, and, contrasting these against simpler eddy viscosity models.

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