Abstract Submitted
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Machine Learning-Assisted Predictions of Turbulent Separated Flows over Airfoils[1] ANAND PRATAP SINGH, Univ of Michigan - Ann Arbor, SHIVAJI MEDIDA, Altair Engineering Inc., KARTHIK DURAISAMY, Univ of Michigan - Ann Arbor — RANS based models are typically found to be lacking in predictive accuracy when applied to complex flows, particularly those involving adverse pressure gradients and flow separation. A modeling paradigm is developed to effectively augment turbulence models by utilizing limited data (such as surface pressures and lift) from physical experiments. The key ingredients of our approach involve Inverse modeling to infer the spatial distribution of model discrepancies, and Neural networks to reconstruct discrepancy information from a large number of inverse problems into corrective model forms. Specifically, we apply the methodology to turbulent flows over airfoils involving flow separation. When the machine learning-generated model forms are embedded within a standard solver setting, we show that much improved predictions can be achieved, even in geometries and flow conditions that were not used in model training. The usage of very limited data (such as the measured lift coefficient) as an input to construct comprehensive model corrections provides a renewed perspective towards the use of vast, but sparse, amounts of available experimental datasets towards the end of developing predictive turbulence models.

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