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Towards Generalizable Data-driven Turbulence Model Augmentations VISHAL SRIVASTAVA, KARTHIK DURAISAMY, University of Michigan, Ann Arbor — Reynolds Averaged Navier Stokes (RANS) models are based on a mix of physical and phenomenological ideas. Once a model structure is fixed, calibration is typically based on a few canonical flows, and as a result, models are often insufficiently accurate in many general applications. Data-driven techniques present the possibility of more accurate models of complex flows, though generalizability and robustness of such models is an open issue and the topic of the work. We address data-augmented turbulence models with a focus on enforcing consistency of the augmentations with the underlying modeling environment using integrated inference and learning. Further, the augmentation is constrained to satisfy uncompromisable physical laws (such as frame invariance) and known relationships (such as preserving the law of the wall in the large Reynolds number limit). These constraints are either imposed directly at the inference step or implicitly enforced by construction. Sample results are presented for equilibrium and non-equilibrium wall-bounded turbulent flows.

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