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Modeling particle-induced turbulence using sparse regression with embedded invariance[1] SARAH BEETHAM, JESSE CAPECELATRO, University of Michigan — Turbulence is ubiquitous in science and industry and is nearly always multiphase. Given current computational capabilities and the wide range of time- and length-scales of industrial systems, direct numerical simulation (DNS) is prohibitively costly. Thus, some degree of modeling must be employed. Current state-of-the-art modeling for turbulent multiphase flows is predominantly based on extensions to single-phase models, making it largely unsuccessful beyond the dilute limit. This eliminates the augmentation of existing models as an option for solving the multiphase closure problem. Our goal is to propose compact, tractable multiphase turbulence closures. Thus, we first derive the exact Reynolds Stress equations for multiphase flows, which identifies the specific terms requiring modeling. To arrive at these closures, we use sparse regression with embedded invariance. In this talk, we demonstrate the promise of this technique for three classes of flow with increasing difficulty: (1) single-phase free shear turbulence, (2) turbulent flow over periodic hills and (3) gas-solid sedimenting flow.

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