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Experiments with Reduced Order Models for 2D turbulent Multiphase Flows XIANYANG CHEN, JIACAI LU, GRETAR TRYGGVASON, Johns Hopkins University — The development of reduced order models for multiphase turbulent flows pose multiple challenges, including a large range of scales, complex evolving interfaces, and the interaction of interface generated vorticity and fluid turbulence. While traditional models usually depend on removing high frequency modes by filtering, in fluid mechanics there is a long tradition of reducing the degrees of freedom by singularization, such as by replacing bubbles and drops by point particles and compact vortices by point vortices. We introduce a formal process called weighted coordinates smoothing to singularize the flow field and apply it to simplify both the interface and the velocity field, for two-dimensional flow. As in other reduced order models for complex flows, it is necessary to account for the effects of processes not fully resolved by adding closure terms and we present our initial attempts to do so, including using artificial neural network to correlate the terms. For the flow field, we compare predictions from an augmented point vortex model with results from a more classical approach where we smooth the flow field and use machine learning to relate the subgrid stresses to the average flow.

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