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Advances and Challenges in Modeling Interfacial Flows

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Interfacial flows are multi-material flows comprised of two or more immiscible materials demarcated by interfaces. They are encountered in several applications of interest to the Department of Energy. Examples of applications include materials processing (e.g. casting), inertial confinement fusion and solvent extraction. We are interested in the development of accurate numerical methods to simulate with high-fidelity interfacial flows. For such simulation, the position of the interface and interface physics need to be predicted as part of the solution of the flow equations. One of the many techniques is known as the volume tracking method. It is a pure Eulerian method that represents the interface with volume fraction and intrinsically ensures mass conservation. In this talk, I will describe several advances that have been made over the past 25 years and discuss remaining challenges in the context of the volume tracking method.