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# ON THE CHARACTERIZATION OF REGULARIZATION ERRORS INTRODUCED BY THE ONE-FLUID FORMULATION IN THE DNS OF MULTIPHASE FLOWS

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**Abstract.** Most available multiphase flow solvers resort to numerical methods based on the one-fluid approach which consists in introducing averaged quantities in one or several cells around the position of the interface. Understanding the consequences of this regularization procedure is important in order to develop numerical methods able to reduce discretization errors and the design of novel Adaptive Mesh Refinement Methods to obtain grids that reduce the numerical errors. In this talk we will theoretically discuss the influence of an arbitrary regularization procedure in the continuum limit in problems where both the solution of the sharp interface and its corresponding regularized problem can be analytically computed. In general, we show that the error introduced by any the regularization can be decomposed into an outer problem and an inner problem that imposes jump conditions for the error and the error flux in the outer region. Although the harmonic mean is shown to be exact in the outer regions for one-dimensional problems, the optimal choice of the averaging rule is shown to be problem dependent for multidimensional flows. Interestingly, the model proposed is shown to reproduce well the numerical errors observed for a variety of problems related to the solution of the Poisson equation and also the Navier-Stokes equations, where the introduction of an artificial regularization length modifies the growth rate of classical instabilities.


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