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A NARROW-BAND GRADIENT-AUGMENTED LEVEL SET METHOD FOR INCOMPRESSIBLE TWO-PHASE FLOW

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The level set method implicitly tracks the location of an interface by representing it as the zero contour of a scalar level set function that is evolved on the entire computational domain. It has become a popular choice in simulating fluid problems, because advection of the level set function takes place on an Eulerian grid, is relatively straightforward to code, and preserves topology changes of the interface with no additional effort. The gradient-augmented level set method developed by Nave *et al.* [1] improves the level set method by evolving both the level set function and its gradient values in a fully coupled fashion. Advantages of the method include better accuracy, reduced volume loss, sub-grid resolution of the interface, and an optimally local stencil (consisting of only a single grid cell). We have adapted this method for use in multiphase fluid simulations by interpolating the fluid velocity and introducing a reinitialization procedure that preserves the gradient information. In addition, the method is carried out only along a narrow band surrounding the interface, reducing computational effort while preserving the advantages of the gradient-augmented method.

Numerical results show excellent agreement with an analytical solution and available experimental data. A new experimental benchmark is introduced, using data gathered in a wedge-driven 9-meter wave tank. Numerical comparisons with the standard level set method reveal superior volume conservation. The method has recently been coupled with a variation of the gradient-smoothing technique introduced in Bøckmann *et al.* [2] and implemented in a box-structured adaptive mesh refinement (AMR) framework. Preliminary results of these extensions are also presented.

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