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Boundedness proof for a conservative phase-field method discretized by central finite differences[1] SHAHAB MIRJALILI, Stanford University, CHRISTOPHER IVEY, Cascade Technologies, Inc., ALI MANI, Stanford University — It is well known that standard second-order finite differences have desirable conservation properties that are attractive for DNS and LES. However, when it comes to two-phase flow calculations, central differences have often been avoided for the advection operators due to dispersion errors that can lead to boundedness issues and unphysical values for fluid density. We will demonstrate that for a certain conservative phase field equation, given by a second order PDE similar to that of Chiu and Lin (JCP, 2011), it is possible to employ central finite differences and preserve the boundedness of the phase field between the extrema values set at the pure phases. By means of a discrete asymptotic analysis, we will show that the phase field is bounded in a certain region of the discretization parameters space, in which one should operate. When coupled to a finite-difference discretization of the two-phase momentum equation, the resulting method emerges as a viable alternative for two-phase flow calculations given its ease of implementation, parallelizability, low cost, accuracy, conservation and boundedness properties.

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