Abstract Submitted
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A multi-mesh lattice Boltzmann scheme for modeling solidification microstructure MOHAMMAD HASHEMI, AMIRREZA HASHEMI, University of Akron, Akron, MOHSEN ESHRAGHI, California State University, Los Angeles, SERGIO FELICELLI, University of Akron, Akron — A multi-mesh lattice Boltzmann (LB) scheme is developed for modelling dendritic growth during solidification of binary alloys. Different physical phenomena including: mass transport, fluid flow, and heat transfer are involved in solidification, which are solved using the lattice Boltzmann method. Considering the difference in the length scales, a separate grid is introduced for each physical model to enhance the stability and computational performance of the method. Since the solutal boundary layer is very thin, a finer mesh is required near the interface to accurately simulate the transport phenomena. To address this problem, a non-uniform mesh is considered within each model. A conservative treatment was employed between neighbouring mesh blocks to ensure the continuity of mass, energy, and momentum. The multi-mesh model developed in this work is several times faster than the conventional unigrid LB models and offers a much better stability. Considering the high computational demands of the micro-scale simulations, the model can be employed as an efficient tool for simulating microstructural evolution during solidification.

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