

A Multi-Mesh Adaptive Finite Element Approximation to Phase Field Models

X. Hu¹, R. Li², and T. Tang³

Abstract: In this work, we propose an efficient multi-mesh adaptive finite element method for simulating the dendritic growth in two- and three-dimensions. The governing equations used are the phase field model, where the regularity behaviors of the relevant dependent variables, namely the thermal field function and the phase field function, can be very different. To enhance the computational efficiency, we approximate these variables on different h -adaptive meshes. The coupled terms in the system are calculated based on the implementation of the multi-mesh h -adaptive algorithm proposed by Li (J. Sci. Comput., pp. 321-341, 24 (2005)). It is illustrated numerically that the multi-mesh technique is useful in solving phase field models and can save storage and the CPU time significantly.

AMS Classification: 65M20, 65N22, 80A22

Keywords: Multi-mesh, local refinement, adaptive finite element, phase field.

¹ Department of Mathematics, Zhejiang University
Hangzhou 31027, China
huxl98@yahoo.com.cn

² CAPT, LMAM & School of Mathematical Sciences, Peking University
100871, Beijing, China
rli@math.pku.edu.cn

³ Department of Mathematics, Hong Kong Baptist University
Kowloon Tong, Kowloon, Hong Kong
ttang@math.hkbu.edu.hk