

**The Hong Kong Polytechnic University  
Department of Applied Mathematics**

**Colloquium**

**An efficient algorithm for the flow-coupled anisotropic dendritic crystal model**

**By**

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University of South Carolina**

**Abstract**

We consider numerical approximations of the flow-coupled anisotropic phase-field dendritic crystal growth model. This is a highly complex coupled nonlinear system consisting of the anisotropic Allen-Cahn equation, the heat equation, and the Navier-Stokes equation. Through the combination of a novel EIEQ approach based on the “zero-energy-contribution” feature satisfied by the coupled nonlinear terms, we develop an efficient numerical scheme with linearity, decoupled structure, unconditional energy stability, and second-order time accuracy. In the process of obtaining a full decoupling structure and maintaining energy stability, the introduction of two auxiliary variables and the design of two auxiliary ODEs play a vital role. The unconditional energy stability of the scheme has been strictly proved, and the detailed implementation process is given. Through several numerical simulations of 2D and 3D dendritic crystal growth examples, we verify the effectiveness of the developed algorithm.



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**Date: 23 June 2022 (Thursday)**

**Time: 10:00-11:00 (Hong Kong Standard Time GMT +8)**

**Venue: Online Talk via Zoom (Meeting ID: 913 9738 8392)**

**Speaker: Prof. Xiaofeng Yang, University of South Carolina**

**Host: Prof. Zhonghua Qiao, The Hong Kong Polytechnic University**

**Click to join:**

<https://polyu.zoom.us/j/91397388392?pwd=NHIUdTFwYWpwRHIEMHhla3BRekFTUT09>

**\*\*\* ALL ARE WELCOME \*\*\***

For enrolment, please send your name and email to [wai-yan.moon@polyu.edu.hk](mailto:wai-yan.moon@polyu.edu.hk) on or before 22 June 2022