THE HONG KONG POLYTECHNIC UNIVERSITY
香港理工大學

DEPARTMENT OF APPLIED MATHEMATICS
應 用 數 學 系

The Hong Kong Polytechnic University
Department of Applied Mathematics

Colloquium

Structure-preserving, energy stable numerical schemes for a liquid thin film coarsening model

By

Prof. Cheng WANG
University of Massachusetts Dartmouth

Abstract

Positivity preserving, energy stable numerical schemes are proposed and analyzed for the droplet liquid film model, with a singular Leonard-Jones energy potential involved. Both the first and second order accurate temporal algorithms are considered.

In the first order scheme, the convex potential and the surface diffusion terms are implicitly, while the concave potential term is updated explicitly. Furthermore, we provide a theoretical justification that this numerical algorithm has a unique solution, such that the positivity is always preserved for the phase variable at a point-wise level. Moreover, an unconditional energy stability of the numerical scheme is derived, without any restriction for the time step size. In the second order numerical scheme, the BDF temporal stencil is applied, and an alternate convex-concave decomposition is derived, so that the concave part corresponds to a quadratic energy. In turn, the combined Leonard-Jones potential term is treated implicitly, and the concave part the is approximated by a second order Adams-Bashforth explicit extrapolation, and an artificial Douglas-Dupont regularization term is added to ensure the energy stability. The unique solvability and the positivity-preserving property for the second order scheme are similarly established. In addition, optimal rate convergence analysis is derived for both numerical schemes. A few numerical simulation results are also presented.

Date : 8 December, 2020 (Tuesday)
Time : 10:00-11:00 (Hong Kong Standard Time GMT +8)
Venue : Online Talk via Zoom(Meeting ID: 946 4070 4888)
Speaker: Prof. Cheng WANG, University of Massachusetts Dartmouth
Host: Dr. Qiao Zhonghua, The Hong Kong Polytechnic University
Click to join : https://polyu.zoom.us/j/94640704888

Click to join (Zoom)

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

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