



復旦大學  
FUDAN UNIVERSITY

Applied Math  
Ph.D. Seminar

**Optimal Convergence of a Fully Decoupled Finite  
Difference Scheme of the Abels-Garcke-Grün  
Model for Incompressible Two-Phase Flows with  
Unmatched Densities**

**Speaker:** Xinyi Du (Fudan University)

**Time:** 2026-03-12, 16:10 to 17:00

**Location:** Rm 1801, Guanghua East Tower

**Advisor:** Wenbin Chen (Fudan University)

**Abstract:** In this talk, we consider the numerical approximation of the Abels-Garcke-Grün model for a binary mixture of two viscous incompressible fluids with unmatched densities and viscosities. The system consists of a Navier-Stokes equation for the volume-averaged fluid velocity and a convective Cahn-Hilliard equation with Flory-Huggins potential for the phase-field variable. Based on the pressure stabilization method and an additional first-order stabilization term to the advective velocity in the Cahn-Hilliard equation, the scheme is fully decoupled and preserves the physical properties, i.e. the positivity-preserving property, which means that the discrete solution of the phase-field always stays in the physical interval  $(-1, 1)$  at a point-wise level, and the unconditional energy stability. Additionally, we perform a detailed optimal rate convergence analysis and derive error estimates. Numerical results are presented to validate the convergence rate and energy stability.