

CRUNCH Seminars at Brown, Division of Applied Mathematics

Friday - March 11, 2022

**Solving Allen-Cahn and Cahn-Hilliard Equations using
the Adaptive Physics Informed Neural Networks**

Colby Wight, Pacific Northwest National Laboratory

Phase field models, in particular, the Allen-Cahn and Cahn-Hilliard type equations, have been widely used to investigate interfacial dynamic problems. Designing accurate, efficient, and stable numerical algorithms for solving the phase field models has been an active field for decades. In this talk, we focus on using the deep neural network to design an automatic numerical solver for the Allen-Cahn and Cahn-Hilliard equations by adopting the physics informed neural network (PINN). We propose various techniques that add to the approximation power of the PINN. We propose to embrace the adaptive idea in both space and time and introduce various sampling strategies, such that we are able to improve the efficiency and accuracy of the PINN on solving phase field equations. In addition, the adaptive PINN has no restriction on the explicit form of the PDEs, making it applicable to a wider class of PDE problems, and shedding light on numerical approximations of other PDEs in general.