Mechanical Engineering Thesis Defense

Predicting Volume of Fluid Interfaces with Neural Networks

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Abstract

Computing the fluid phase interfaces in multiphase flow is a challenging area ofresearch in fluids. The Volume of Fluid, Level Set Methods are a few algorithmsthat have been developed on reconstructing the multiphase fluid flow interfaces accurately.The thesis work focuses on exploring the ability of neural networks to predictmultiphase interfaces using data driven approach with the neural networks.The neural network model has Volume of Fluid Interface (VOFI) stencils as aninput, and it predicts a circle radius representing a phase interface as an output ofthe network. The VOFI stencils are generated for randomly varying circle radii andcenters within a 1x1 domain using an open VOFI library. Predicted circle radius fromthe neural network is used to reconstruct the VOFI stencils.L norm error metric is implemented to assess the error in the neural networkmodel by comparing the predicted VOFI stencils from the neural network with theactual VOFI stencils from the VOFI library. Parametric space search study is doneon the neural network hyper-parameters to optimize the model parameters to havecloser VoF fluid interface values predictions.

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