Application of Machine Learning for Prediction of Critical Heat Flux

Abstract:

Parametric trends of CHF with respect to pressure, mass flux and equilibrium quality are studied under different conditions and why nu-SVM can well map the relation of pressure and mass flux to CHF is explored. Two numerical experiments are respectively conducted for the investigation of experimental efforts reduction by using nu-SVM: (1) the nu-SVM trained by evenly-distributed data points can provide a good CHF correlation with pressure and mass flux at specific qualities for the rest of CHF data points if a certain percentage of data used for training is reached and the model trained only by dozens of data points is able to present a good parametric trend of pressure and mass flux to CHF, which helps the conceptual design of thermal hydraulics systems of subcooled boiling; (2) accurate nu-SVM based CHF extrapolation from low pressure to high pressure conditions leaves us a single choice, to make the pressure of training CHF datasets very close to the high pressure of the prediction target, otherwise several CHF data points measured under high pressures are needed to train nu-SVM with low pressure CHF datasets and equilibrium quality is required less than or equal to -0.30. The numerical experiment results illustrate that SVM model can have a good performance both in CHF prediction and experiment results analysis.

Bio:

Mingfu He graduated from Chengdu University of Technology with a bachelor degree of nuclear engineering in 2015. Then he worked in the key lab of nuclear technology affiliated with China Academy of Engineering Physics as a data analyst in nonintrusive radiation measurement and unique signatures identification for special nuclear materials by May 2017. In August 2017, he started the Ph.D. pursuit in UNM and worked on the application of machine learning techniques to nuclear accident diagnosis under Prof. Lee's instructions. He loves multi-physic and multi-scale simulation to nuclear reactor physics and thermohydraulics and safety analysis of nuclear reactor systems by machine learning algorithms.