

Prediction of the Loss of Feed Water Fault Signatures Using Machine Learning Techniques

Abstract

Fault diagnosis occurrence and its precise prediction in nuclear power plants are extremely important in avoiding disastrous consequences. The inherent limitations of the current fault diagnosis methods make machine learning techniques and their hybrid methodologies possible solutions to remedy this challenge. This study sought to develop, examine, compare, and contrast three robust machine learning methodologies of adaptive neurofuzzy inference system, long short-term memory, and radial basis function network by modeling the loss of feed water event using RELAP5. The performance indices of residual plots, mean absolute percentage error, root mean squared error, and coefficient of determination were used to determine the most suitable algorithms for accurately diagnosing the loss of feed water transient signatures. The study found out that the adaptive neurofuzzy inference system model outperformed the other schemes when predicting the temperature of the steam generator tubes, the radial basis function network scheme was best suited in forecasting the mass flow rate at the core inlet, while the long short-term memory algorithm was best suited for the estimation of the severities of the loss of the feed water fault.