

A Neuro-Fuzzy Inference System for Sensor Monitoring

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Abstract

A neuro-fuzzy inference system combined with the wavelet denoising, PCA (principal component analysis) and SPRT (sequential probability ratio test) methods has been developed to monitor the relevant sensor using the information of other sensors. The parameters of the neuro-fuzzy inference system which estimates the relevant sensor signal are optimized by a genetic algorithm and a least-squares algorithm. The wavelet denoising technique was applied to remove noise components in input signals into the neuro-fuzzy system. By reducing the dimension of an input space into the neuro-fuzzy system without losing a significant amount of information, the PCA was used to reduce the time necessary to train the neuro-fuzzy system, simplify the structure of the neuro-fuzzy inference system and also, make easy the selection of the input signals into the neuro-fuzzy system. By using the residual signals between the estimated signals and the measured signals, the SPRT is applied to detect whether the sensors are degraded or not. The proposed sensor-monitoring algorithm was verified through applications to the pressurizer water level, the pressurizer pressure, and the hot-leg temperature sensors in pressurized water reactors.