

A Software Sensor Using a Black Box Modeling Method

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Abstract

In this paper, a software sensor using a black box modeling method has been developed to monitor existing hardware sensors. The black box modeling is accomplished by a fuzzy inference system that is equipped with an automatic design algorithm that automates the selection of the input signals to the fuzzy inference system and its fuzzy rule generation including parameter optimization. The proposed software sensor was applied to monitoring the feedwater flowrate. The feedwater flowrate is measured by Venturi meters in most current pressurized water reactors (PWRs). These meters can decrease the thermal performance of nuclear power plants because the feedwater flowrate can be over-measured because of their fouling phenomena that make corrosion products accumulate in the feedwater flow meters due to long-term operation. The proposed software sensor was verified by using the numerical simulation data of MARS code for Kori nuclear power plant unit 1 and also, the real plant data of Yonggwang nuclear power plant unit 3. In a result using the numerical simulation data, the relative two-sigma errors are 0.11% and the relative maximum error is 0.22%. In another result using the real plant data, the relative two-sigma errors are 0.65% and the relative maximum error is 2.73%. These errors are so small that the proposed method can be applied successfully to validate and monitor the existing feedwater flow meters.