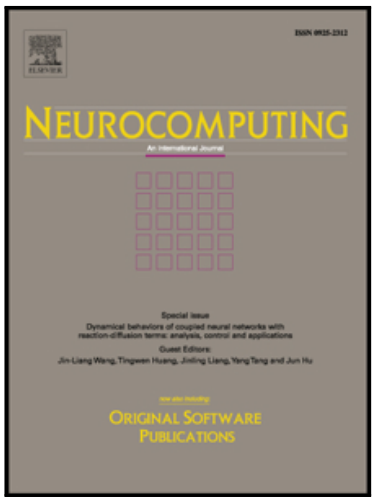

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Online Extreme Learning Machine Based Modeling and Optimization for Point-by-point Engine Calibration

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Abstract

An online extreme learning machine (ELM) based modeling and optimization approach for point-by-point engine calibration is proposed to improve the efficiency of conventional model-based calibration approach. Instead of building hundreds of local engine models for every engine operating point, only one ELM model is necessary for the whole process. This ELM model is firstly constructed for a starting operating point, and calibration of this starting point is conducted by determining the optimal parameters of the model. This ELM model is then re-used as a base model for a nearby target operating point, and optimization is performed on the model to search for its best parameters. With a design of experiment strategy on the best parameters obtained, new measurements from the target operating point can be collected and used to update the model. By repeating the optimization and model update procedures, the optimal parameters for the target point can be found after several iterations. By using the model of this target point as the base model for another nearby operating point and repeating the same process again, calibration for all the operating points can be done online efficiently. The contribution of the proposed method is to save the number of experiments in the calibration process. To verify the effectiveness of the proposed approach, experiments on a commercial engine simulation software have been conducted. Three variants of online ELM are utilized in the model update process for comparison. The