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Online Sensor Fault Diagnosis for Structural Health Monitoring Based on Meta-learning

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ABSTRACT

In this paper, a novel online sensor fault diagnosis approach based on meta-learning is proposed for structural health monitoring. The proposed method has a good model generalization under a small training data and presents efficient diagnosis and estimation of four typical sensor faults. First, a one-dimension convolutional neural network (1D CNN) is designed to detect and locate faulty sensors. By optimizing the globally initial parameters of the 1D CNN with a meta-learning training strategy, general sensor fault features can be acquired to achieve fast and accurate detection and localization of potential faulty sensors. After detection and localization of the faulty sensors, an online updating algorithm based on dual Kalman filter is used to simultaneously estimate the severity of sensor faults and structural states. A numerical bridge example subjected to ground excitations of different spectral intensity is discussed to demonstrate the efficacy of the proposed method. The results show that the proposed method is an efficient scheme in sensor fault diagnosis for structural health monitoring.

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