

Fatigue Crack Detection Of Lifting-Lug Using Deep-Learning

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For a metallic engineering component, a fatigue crack detection is important to prevent a sudden failure of the structure. Fatigue crack detection method is proposed by using a deep-learning, which is a long short-term memory network (LSTM). If a fatigue crack occurs, the nonlinear interaction of a low frequency pumping wave (LF) and a high frequency probing wave (HF) creates nonlinear responses at the sum and difference of the input frequencies. The deep-learning network is trained to learn the nonlinear components of the measured ultrasonic data. Then, a fatigue index is proposed based on predicted ultrasonic data using the trained network and measured ultrasonic data. Finally, a fatigue crack is detected based on the fatigue index. The proposed method is validated using a lifting-lug structure of an anchor system for an underwater offshore structure, and the performance is evaluated. The proposed fatigue crack detection method is associated with the following advantages: (1) Reference free damage detection method based on deep-learning, (2) Online training of deep-learning without requiring training datasets, (3) Fatigue crack detection without any user-defined threshold, and (4) Improved performance under noise interference.