Fatigue life prediction of centrifugal fan blades in the ventilation cooling system of the high-speed-train

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Abstract

The centrifugal fan blades of the high-speed train ventilation and cooling system are subjected to cyclic loading which will shorten the life of fan blades. It could cause an accident of the high-speed-train in service. In this study, a modified method based on the nominal stress method was proposed and developed for the fatigue life prediction of centrifugal fan blades. The finite element model was firstly used to analyze the mode and the stress of fan blades based on the typical material property. The fatigue life was predicted based on the physical curve, using the Miner's cumulative damage rule to calculate total damage. In order to verify the effectiveness of this method, the experimental tests were conducted on fan blades using a fatigue bench system, which were the typical structure of the ventilation cooling system of the high-speed-train. The damage mechanisms of blades was deduced from the fracture fractographs. The ventilation good correlation was achieved between the prediction model and the actual experimental results, testifying the practicability and effectiveness of this proposed method. Thus, the research result can reduce the probability of accidents caused by the fan blade damage and improve the reliability of the ventilation cooling system of the high-speed train.

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