

Probability Assessment Of Bridge Fatigue Life Based On Loading Of Influence Line By Elaborate Stochastic Traffic Flow

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Stochastic traffic flow, as a type of repeated load, can cause serious high-cycle fatigue damage to bridges. To evaluate the reliability of the fatigue performance of key bridge components under stochastic vehicle loads, a prediction and evaluation method for the fatigue life of bridges based on elaborate statistical analysis of traffic flow and strain influence line identification is established in this paper. Firstly, combining with the results of statistical analysis, a classification method of vehicle operating state based on cluster analysis was proposed, and on this basis, an elaborate simulation model of stochastic traffic flow which was more consistent with the actual traffic conditions was realized. Secondly, the actual bridge strain influence line inverted by the fatigue detail measured strain data is used instead of the traditional finite element model to load the stochastic traffic flow, and the stress time history under the stochastic traffic flow considering different vehicle operating conditions is calculated, and respectively use the Monte Carlo method and the first-order second-moment method to predict fatigue life. Finally, a real bridge is taken as an example to verify the effectiveness and necessity of the proposed method. The analysis result shows that considering the elaborated random traffic flow simulation that distinguishes the actual operating state of the vehicle, the fatigue life prediction analysis result is significantly shortened. Compared with the analysis results of the traditional finite element model, the loading result of the influence line is more consistent with the actual stress condition of the bridge, while avoiding the huge calculation cost caused by repeated calls to the finite element program. This method will give reasonable prediction and analysis results for the fatigue life of the bridge, and provide a scientific basis for fatigue design, maintenance and reinforcement.