

Probabilistic Modeling of Fatigue Damage in Steel Box-Girder Bridges Subjected to Stochastic Vehicle Loads

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Keywords: *Fatigue; Steel Bridge; Stochastic Traffic Flow; Response Surface Method; Reliability.*

Abstract

Structural failures caused by fatigue damage of several famous steel bridges lead to a wide concern to international bridge industry, see Wolchuk (2011). The United States and other countries have recommended fatigue load spectrum and the typical vehicle (AASHTO 2007). However, the fatigue problem of existing steel bridges are increasingly prominent, see Pan et al. (2011), because of the increase and randomness of vehicle loads. Therefore, the fatigue damage modeling of steel bridges under the stochastic vehicle load is an important task for the purpose of evaluating safety of steel bridges.

In this paper, the fatigue truck models with deterministic parameters were developed to be a stochastic vehicle load model. In order to solve the time-consuming problems in the finite element analysis, a response surface method was utilized to approximate the function between vehicle axle weight and the equivalent fatigue stresses. A framework was developed for probabilistic fatigue damage modeling of welded connections in steel bridges. Afterwards, the framework was used to study the influence of traffic flow on the fatigue reliability index. The numerical results indicate that: there is a promising application for the stochastic fatigue vehicle load model and the probabilistic model of fatigue damage

References

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