

Hybrid Probabilistic Interval Dynamic Analysis of Vehicle-Bridge Interaction System with Uncertainties

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Abstract:

The hybrid probabilistic interval dynamic analysis of vehicle-bridge interaction system with a mixture of random and interval properties is studied. The vehicle's parameters are modeled as interval variables and the bridge's parameters are considered as random variables. A half car model is used to represent a moving vehicle and the bridge is modeled as an Euler-Bernoulli beam. The random interval moment method is employed in the dynamic analysis of vehicle-bridge coupling system. The expressions for the mean value and standard deviation of the random interval bridge response are developed, and the midpoint and interval width of the first two statistical moments are then determined. Examples are used to illustrate the effectiveness of the presented method. Hybrid simulations combining direct simulations for interval variables and Monte-Carlo simulations for random variables are implemented to validate the computational results. The effects of individual system parameters on the bridge response are also investigated.

Key words: Vehicle-bridge interaction system, probabilistic interval analysis, random interval moment method, random interval dynamic response.