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Dynamic analysis of vehicle-bridge interaction system with uncertainty

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Summary

This paper presents the probabilistic dynamic analysis of vehicle-bridge interaction systems. The bridge's and vehicle's parameters are considered as random variables as well as the road surface roughness is modeled as random process. A quarter-car model is used to represent a moving vehicle and the bridge is treated as an Euler-Bernoulli beam. From the equation of motion for the vehicle-bridge coupling system, the expressions for mean value and standard deviation of bridge response are developed by using the random variable's functional moment method. The effects of the individual system parameters and the road surface roughness on the bridge response are investigated. Monte-Carlo simulation method is used to verify the approach presented in this paper. The effectiveness of the proposed method is also demonstrated by numerical examples.