Responses of Beams under Constant Speed Vehicle Loading

武文窕、林海平

E-mail: 364903@mail.dyu.edu.tw

ABSTRACT

Vibration of beam under vehicle loading is a problem in mechanical and civil engineering. This study describes the beam vibration analysis under the action of vehicle loading. The vehicle has constant speed and the beam is assumed to obey Euler-Bernoulli beam theory with simply-supported end conditions. Vehicle is modeled as a quarter-car planar model with a suspended spring and a damper. First, the free responses are considered. The eigensolutions are determined explicitly by using analytical method. Secondly, the forced responses are rendered. Using the model expansion theory, the equations of motion are obtained. Solving these equations, the deflection of the beam and displacement of the vehicle when the vehicle moves on is estimated, respectively. Finally, the analytical calculation is completed by solving the governing differential equations. Moreover, MATLAB program is used to simulate the numerical result. Some numerical results are shown to compare with the analytical results.

Keywords : Euler-Bernoulli、eigensolutions、analytical method、model expansion theory

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