Vibration Analysis of a Beam with Intermediate Flexible Constraints Subject to a Moving Load of Constant Speed

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ABSTRACT

In this study, a hybrid numerical/analytical method that permits the efficient calculation of dynamic characteristics of a beam with intermediate flexible constraints subject to a moving load of constant speed is presented. First, assuming the beam obeying the Euler-Bernoulli beam theory, the equation of motion of the system is derived. By using transfer matrix method, eigensolutions (natural frequencies and mode shapes) of the beam system can be determined. Afterwards, the intermediate flexible constraints subject to a moving load of constant speed is analyzed, and the forced response of the moving load can be obtained by applying the model expansion theory and the orthogonality of the mode shape function. In the results, the dynamic deflection of the intermediate flexible constraints subject to a moving load can be effectively reduced. Moreover, different supporting spring and supporting position have different influences on the dynamic responses of the beam structure. The static and dynamic characteristics of the beam structure were analyzed in this article, and a experimental method was used to validate the theoretical mode.

Keywords : Euler-Bernoulli, transfer matrix, eigensolutions, model expansion theory, orthogonality

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