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Dynamic characteristics and stability of vibrations of a high speed complex bogie system

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Abstract

This paper studies the stability of vibrations of a complex bogie system moving along a high order shear deformable infinity beam on a viscoelastic foundation. The complex bogie system is modeled as a system of three elastically connected elements similar to the model of high-speed trains. Two cases of connection between the bogie elements are considered: the traditional and the one proposed here that includes the allowed transverse displacement between the elements. Stability conditions are determined and discussed for both types, along with the important advantages of the proposed model. Identical supports are modeled as a system of springs and dashpots attached to the bars on the one side, which interact with the beam through the concentrated masses on the other side. It is assumed that the masses and the beam are always in contact. The paper analyzes the case when the complex bogie system exceeds the minimum phase velocity of waves in the beam, which may lead to the vibration of the system making it unstable. The instability regions are found for the complex bogie system by applying the principle of argument, contour integration and D-decomposition method.

Keywords: Dynamic stability; D-decomposition method; Principle of argument.

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