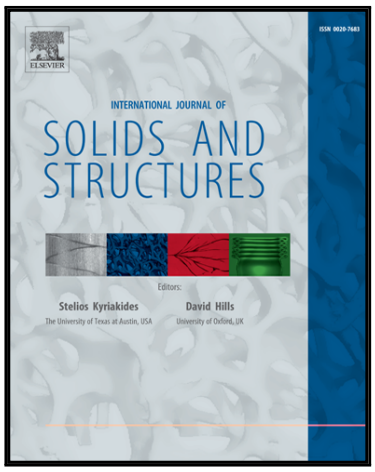

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Vladimir Stojanović , Predrag Kozić , Marko D. Petković

PII: S0020-7683(16)30376-6
DOI: 10.1016/j.ijsolstr.2016.12.010
Reference: SAS 9396

To appear in: *International Journal of Solids and Structures*

Received date: 13 January 2016
Revised date: 21 September 2016
Accepted date: 13 December 2016

Please cite this article as: Vladimir Stojanović , Predrag Kozić , Marko D. Petković , Dynamic instability and critical velocity of a mass moving uniformly along a stabilized infinity beam, *International Journal of Solids and Structures* (2016), doi: 10.1016/j.ijsolstr.2016.12.010

Dynamic instability and critical velocity of a mass moving uniformly along a stabilized infinity beam

Vladimir Stojanović[1*], Predrag Kozić[1], Marko D. Petković[2]

[1]*Department of Theoretical and Applied Mechanics, Faculty of Mechanical Engineering, University of Niš, A. Medvedeva 14, 18000 Niš, Serbia*

[2]*Department of Computer Science, Faculty of Sciences and Mathematics, University of Niš, Višegradska 33, 18000 Niš, Serbia*

Abstract

The paper considers two problems of dynamic instability. The first problem is a constant vertical force moving along an axially compressed infinite rail complex beam system, which comprises an axially compressed infinity beam elastically connected to another beam on an elastic foundation with a different stiffness. The second problem is the uniform motion of a mass subjected to a constant vertical force along an axially compressed beam on a viscoelastic foundation, where it is assumed that the beam and mass are in continuous contact. The main theoretical contribution of the paper lies in the new determined stability conditions with regard to the critical, maximally allowed, velocity, as well as the critical force of the system. The paper shows the stability regions and the importance of using another stabilizing beam in the cases when the axial force exceeds the new determined value. It is proven that at lower mass velocities, the system acts stably as in the case of the classical model of a single beam on an elastic foundation. The first part of the paper is based on the analytical methods used to determine critical values of velocity and critical values of force, while the second part of the paper, which deals with the stability of vibrations of a moving mass subjected to a constant vertical force, employs the following methods: D-decomposition method, Laplace integral transform, Fourier integral transform, and contour integration method.

Keywords: Double-supported system; Critical velocity; Axial force; Harmonic vibrations; Instability; D-decomposition method;

*) Corresponding Author Tel: +381 18 500 634.
E-mail addresses: kozicp@yahoo.com (P. Kozić),stojanovic.s.vladimir@gmail.com (V. Stojanović), dexterofnis@gmail.com (M. Petković)