Dyniewicz, B.; **Bajer, C. I.**; **Kuttler, K. L.**; **Shillor, M.**
Vibrations of a Gao beam subjected to a moving mass. (English) Zbl 07155286
Nonlinear Anal., Real World Appl. 50, 342-364 (2019).

Summary: This paper models, analyzes and simulates the vibrations of a nonlinear Gao beam that is subjected to a moving mass or a massless point-force. Such problems arise naturally in transportation systems such as trains or trams. The dynamics of the system as the mass or the force move on the beam are investigated numerically in the cases when the vibrations are about a buckled state, and in the cases when the mass is positive or vanishes. The simulations are compared to those of the Euler-Bernoulli linear beam and the differences are highlighted. It is seen that the linear beam may be used only when the loads are small, while the Gao beam allows for moderate loads. The simulations are based on a time-marching finite elements algorithm for the model that has been developed and implemented. The results of representative and interesting computer simulations are depicted. The existence of weak solutions of the model is established using a variational formulation of the problem and results about variational set-inclusions.

MSC:

74H45 Vibrations in dynamical problems in solid mechanics
74K10 Rods (beams, columns, shafts, arches, rings, etc.)
74H20 Existence of solutions of dynamical problems in solid mechanics
74S05 Finite element methods applied to problems in solid mechanics

Keywords:

time-marching finite element scheme; existence; weak solution; variational set-inclusion theory

Full Text: DOI

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