Crack identification in elastically restrained vibrating rods

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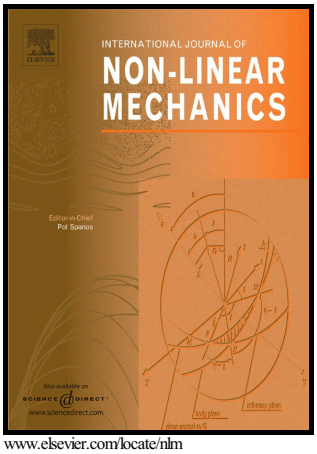

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Abstract

In this paper we consider the problem of identifying an open crack in a longitudinally vibrating rod with smooth variable profile by minimal eigenfrequency data. The crack is assumed to be open during vibration and it is modelled by an elastic spring acting along the beam axis. Most, if not all, the results available in the literature for this inverse problem refer to ideal end conditions, that is the rod is either under free or supported end conditions. As an example of almost optimal result, it is known that the knowledge of the fundamental (positive) natural frequency of the rod under free-free and cantilever end conditions allows for the unique determination of the crack, without any restriction on the damage severity. In this paper we show that the analysis of the analogous crack identification problem for rods under elastically restrained end conditions leads to different results and that, in general, the knowledge of the fundamental frequency belonging to two spectra associated to different end conditions is not sufficient for the uniqueness of the solution. The method we used to solve the inverse problem is of constructive type and it is based on general properties of