A lattice spring model for dynamic analysis of damaged beam-type structures under moving loads

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Abstract

A discrete model is presented to study the dynamic behaviour of beam-like structures under moving loads in the presence of surface defects. We utilise the lattice spring model (LSM) to describe the uniform Timoshenko beam supported by a viscoelastic foundation as a one-dimensional (1D) assembly of particles interacting through shear and rotational springs. The forced vibratory response of the system using both the discrete and continuum models has been studied to establish a link between the connecting springs at the discrete level and the elastic properties of the matter at large scale. The effects of edge cracks are also depicted as weak structural links in the lattice model by expressing them in terms of localised loss of bending stiffness and replacing them with lumped massless rotational springs. The total applied loading path in the LSM is divided into a number of subintervals, and thus