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Dynamic Response of a Timoshenko Beam Subjected to a Moving Load on a Foundation with Hysteretic Damping

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Abstract **-** For many studies concerning foundation, such as rails and pavements, the mechanism for energy dissipation within a foundation is considered only to be by viscous behaviour. It is generally considered however that dissipation of energy in soil-type foundations takes place, in the main, due to internal friction damping, known as hysteretic damping. Also quite often the simpler Euler-Bernoulli beam formulation is used, hence excluding the effects of shear rigidity and radius of gyration of the beam. In this work by the use of the Timoshenko beam formulation these effects are included as it the use of a two-parameter hysteretic damped foundation. The investigation includes when the beam experiences a moving load with constant or harmonic amplitudes. Hamilton's principle is used to formulate the two governing equations when are then transformed into two algebraic equations by uncoupling and the use of a double Fourier transform w.r.t. moving space and time. The beam deflection is obtained using inverse fast Fourier transform and the solutions obtained are compared with bot Winkler and Pasternak foundation results found in the literature. Calculations are made which investigate the effect of the spatial distribution of the loading and the effects of the beam and foundation properties on the deflected shape, the maximum displacement, critical frequency and the velocity. The results can be used to assess performance and safety aspects of railway and highway structures.

Keywords**:** Timoshenko beam, moving load, hysteretic damping, vibrations.