OPTIMAL DYNAMIC ABSORBERS WITH PIEZOELECTRIC PROPERTIES FOR FRACTIONALLY DAMPED BEAMS

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Abstract. In this contribution the dynamic properties of a system composed of a beam with multiple dynamic absorbers attached to it are investigated. The beam is modelled as a continuous system with infinite number of degrees of freedom and the absorbers are modelled as point masses connected viscoelastically to the beam. Structural damping is modelled with the use of non-integer order derivatives. To each absorber a piezoelectric bimorph beam is attached, which adds piezoelectric properties to the absorbers and enables energy harvesting from beam vibrations. In this study the optimal mass, number, disposition and electrical properties of these compound absorbers are sought, for the case of a harmonic excitation force acting on the beam. The governing equations are derived through the use of Hamilton's variational principle, and solved by applying the Galerkin spatial discretisation. Frequency response functions are determined analytically, while in the time domain the equations are solved in quadratures, by the use of Newmark's iterative procedure. The presented methodology has a potential for application to a wide variety of engineering problems, including energy harvesting from bridge vibrations, which example is provided in this study.

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