Magnetic-Strung NES with Energy Harvesting: Theoretical and Experimental Study of a New Concept of Nonlinear Vibrations Absorber.

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ABSTRACT

In the last decade nonlinear vibrations absorbers, usually known as Nonlinear Energy Sinks (NESs), have been object of several studies in the field of Nonlinear Dynamics [1] and have led to the investigation of various experimental devices [2].
This work illustrates the theoretical design and experimental realization of a new type of Nonlinear Energy Sink. The mass of the Magnetic-Strung NES is a magnet which is linked to the primary system by means of two strings working transversally whose pretension is adjustable. The restoring elastic force of the strings is modulated thanks to the magnetic force applied by two magnets suitably located on the primary mass. This way, depending on the distance of the additional magnets, either a purely cubic force or a more complex shaped force leading to a bi-stable configuration may be reached.The NES' efficiency as an absorber is studied on a harmonically forced 1 degree-of- freedom primary system. The Target Energy Transfer (TET) from the primary system towards the NES is experimentally observed as well as different response regimes like the Strongly Modulated Response.Moreover, the energy harvesting [3] from the vibrating energy of the NES is investigated: the NES mass, made up of a magnet, oscillates into a coil and subsequently creates an electric current. Thus, the vibrating energy of the primary mass is absorbed by the NES and finally converted into electric energy.

References

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