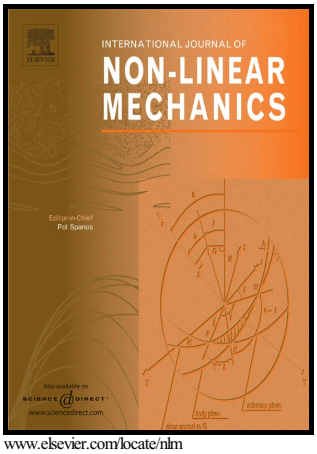

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Vibration energy harvesting from impulsive excitations via a bistable nonlinear attachment

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This paper is in honor of the 70th birthday of Profs. Giuseppe Rega and Fabrizio Vestroni

Abstract

A vibration-based bistable electromagnetic energy harvester coupled to a directly excited primary system is examined numerically. The primary goal of the study is to investigate the potential benefit of the bistable element for harvesting broadband and low-amplitude vibration energy. The considered system consists of a grounded, weakly damped, linear oscillator (LO) coupled to a light-weight, weakly damped oscillator by means of an element which provides both cubic nonlinear and negative linear stiffness components and electromechanical coupling elements. Single and repeated impulses with varying amplitude applied to the LO are the vibration energy sources considered. A thorough sensitivity analysis of the system's key parameters provides design insights for a bistable nonlinear energy harvesting (BNEH) device able to achieve robust harvesting efficiency. This is achieved through the exploitation of three BNEH main dynamical regimes; namely, periodic cross-well, aperiodic (chaotic) cross-well, and in-well oscillations.

Keywords: energy harvesting, negative stiffness, bistability, low-energy impacts, non-linear dynamics

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