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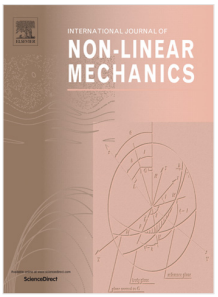

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Transition sets analysis based parametrical design of nonlinear metal rubber isolator

Huijie Yu[1], Xiuting Sun[1, 2*], Jian Xu[2], Shu Zhang[2]

1 School of Mechanical Engineering, University of Shanghai for Science and Technology, Shanghai, PRC

2 School of Aerospace Engineering and Applied Mechanics, Tongji University, Shanghai, PRC

* Email: sunxiuting@usst.edu.cn

Abstract

This research proposes the parametrical design of Metal Rubber (MR) isolation platform based on the investigation of nonlinear vibration properties under different types of excitation. Based on the mechanical model established by experiments, the restoring force of the isolation platform is proposed as a nonlinear function in consideration of the stiffness nonlinearity and Coulomb friction of metal wires. Then, the perturbation method is utilized to solve the steady states whose local stability is studied by singularity theory. The main results obtained by singularity theory show that there are five different types of vibration property, and the critical conditions for the transformation of different vibration properties are defined by transition sets. For impact excitation, the optimum structural parameters are obtained based on the vibration dissipation time via nonlinear backbone analysis; for periodic excitation, the optimum structural parameters are determined according to multiple standards including the bandwidth for effective isolation, bandwidth for multi-steady states, resonance peak and displacement transmissibility in high frequency band etc. The vibration performances for optimum structural parameters are verified by dynamical experiments. In conclusion, this paper carries out a novel sight of choosing optimum parameters, and therefore provides the