ECOLE DOCTORALE
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ED 468

Vous êtes cordialement invités à la soutenance de la thèse de

Giuseppe Pennisi

Jeudi 17 novembre 2016 à 14h00

A l'Institut Clément Ader, 3 rue Caroline Aigle, 31000 Toulouse
salle Clément Ader

Passive vibration control by using Nonlinear Energy SInk absorbers. Theoretical study and experimental investigations

Résumé

Passive vibration control methods using linear dampers have been largely studied and investigated, and they have nowadays a broad range of applications.
However, linear dampers are efficient when tuned to the specific frequency to control but present substantial limitations when applied to primary systems with uncertainties on the modal parameters or to systems having a natural frequency that may vary with external forcing.
In this thesis the vibration mitigation in mechanical systems by means of a Nonlinear Energy Sink absorber is studied.
The phenomenon governing the physics of this kind of device is referred to as Targeted Energy Transfer and it consists in an irreversible energy transfer from the primary system to the NES where the energy is then dissipated. This energy transfer may occur over a broad range of frequencies with no need for the NES to be tuned to a specific one.
The dynamics of a first type of NES called Vibro-Impact Nonlinear Energy Sink (VI-NES) is experimentally investigated via a harmonically forced single-degree-of-freedom linear oscillator to which a VI-NES is attached. A Targeted Energy Transfer from the LO towards the VI-NES is experimentally observed and a significant reduction of the primary system's resonance peak is obtained. The system is analytically studied by means of the Multiple Scales method and the nonlinear behavior experimentally observed is theoretically explained.
The second type of NES presented is the Magnetic-Strung NES with energy harvesting. This study adds the energy harvesting aspect to the research on nonlinear vibration absorbers. The system consists in a harmonically forced single-degree-of-freedom linear oscillator to which the MS-NES is applied. The type of nonlinearity used can be shaped thanks to a magnetic force aptly introduced, allowing the NES to have several possible configurations. The resulting system is an electro-mechanical system in which the vibration energy of the primary system is absorbed by the NES and subsequently partially dissipated by the viscous damping and partially converted into electrical power.
The numerical and experimental studies analyze the performances of the MS-NES both as an energy absorber and as an energy harvester.
Finally, ideas and perspectives arising from this study are discussed and future work directions are provided.

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Mots-Clés:
vibrations, nonlinear dynamics, passive control, Nonlinear Energy Sink, experimental dynamics

Etablissement d'inscription: ISAE

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