

Editorial

Electromagnetic Techniques for Vibration Damping and Isolation

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Electromagnetic devices for vibration damping and isolation are becoming a real alternative to traditional mechanical vibration and isolation methods. Performance of new magnetic materials in combination with optimization tools allows the development of efficient and tunable vibration damping and/or isolation techniques. Moreover, damping and isolation by electromagnetic means can be clean and environmentally friendly since there is no need of using fluids; thus, they can be applied in clean, harsh, and/or extreme temperature environments such as space, aerospace, electric vehicles, and microfabrication industries. Nevertheless, there are still critical issues to be solved like optimization of masses, performance, and cost, ageing of the devices, reduction of external electromagnetic interferences, or frequency tuning.

The aim of this special issue was to collect research articles on electromagnetic devices for vibration damping and isolation in civil and mechanical engineering applications. Articles describing original theoretical research as well as new experimental results have been gathered. The research results were product oriented; i.e., it must consider the requirements of a particular application and demonstrate significant, unique, or economically differential factors in respect to other techniques for a particular application.

This special issue has attracted more than ten submissions from researchers from all around the world. Five of them have been accepted and included in this special issue of *Shock and Vibration* journal. The selection of the high-level papers was conducted as a rigorous peer-review process by the international, well-recognized experts in the appropriate fields presented in each paper. Thus, each manuscript has been evaluated as single, original work. Special attention to the applicability and market competitiveness of the devices has been considered.

In the article “Multiphysics Model of an MR Damper including Magnetic Hysteresis” by M. Kubík and J. Goldasz, researchers analysed and modelled the two primary sources of hysteresis acting on a magnetorheological (MR) damper: hydro(mechanical) hysteresis, which can be related to flow dynamic mechanisms, and magnetic hysteresis which is an inherent property of ferromagnetic materials forming the magnetic circuit of the actuators. In the paper, the authors present a hybrid multiphysics model of a flow-mode MR actuator which considered both types of hysteresis. The model relies on the information which can be extracted primarily from material datasheets and engineering drawings, and it was verified against measured data. Moreover, they use the model in a parameter sensitivity study to

examine the influence of magnetic hysteresis and other relevant factors on the output of the actuator.

The article submitted by E. Palomares et al. entitled “Modelling Magnetorheological Dampers in Preyield and Postyield Regions” presents a review of different magnetorheological damper models used, which includes characterisation, modelling, and comparison. The analyses cover the behaviour from preyield to postyield regions of the MR fluid. The performance of the different models was assessed by means of experimental tests and simulations in a simple and straightforward semiactive control case study. The results obtained proved that most models usually fail in predicting accurate low-velocity behaviour (before iron chains yield), and this may lead to bad estimations when used in control schemes due to modelling errors and chattering.

The third paper describes an active mount that combines a passive rubber mount and an electromagnetic actuator which has been examined for use in naval shipboard equipment. The design specification of an active mount such as required force, displacement, and frequency characteristics is identified for the self-excited pump system, and then an electromagnetic actuator active mount is designed considering the shape of the passive rubber mount and shock resistance. From the results of applying the proposed electromagnetic active mount, a vibration reduction of about 20 dB for the motor equipment was observed for the excited frequency components of 1600 rpm and its two harmonic components. This interesting article is entitled as “Experimental Approach to Active Mounts Using Electromagnetic Actuator and Rubber with Consideration of Shock Resistance for Naval Shipboard Equipment,” and it was submitted by Y. Shin et al.

The review article on “Passive Electromagnetic Devices for Vibration Damping and Isolation” by E. Díez-Jiménez et al. summarizes an interesting type of electromagnetic dampers. Passive electromagnetic devices present good damping capacity, lower cost, null power consumption, and higher reliability. In this review, advantages and drawbacks were highlighted in addition to application fields and technology readiness level of most recent developments. Besides, a general introductory section relates the present key considerations that any engineer, electrical or mechanical, needs to know for a deep comprehension and correct design of this type of devices.

The last published article is entitled “Energy Dissipation Mechanism and Control Model of a Digital Hydraulic Damper” by C. Wang et al. In this article, a digital hydraulic damper was described. This device can adjust the whole buffering capacity to be adaptable to the impacting load on time during the buffering process. In this paper, the mechanism of energy dissipation in the digital hydraulic damper and the whole damping process are studied. Based on an energetic dissipation model, the control of the process was given, which laid a theoretical foundation for detailed structural design and control optimization.

We hope that this special issue updates scientific evidences in electromagnetic techniques for vibration damping

and isolation, contributing to an adequate scientific and industrial dissemination of the topic.

Conflicts of Interest

The editors declare that they have no conflicts of interest.

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