Abstract

Vibration is a phenomenon that is commonly used in technology, e.g., in musical instruments or resonant circuits. However, vibration may also be a side effect of working machinery devices or household appliances, which is associated with discomfort and, in extreme situations, with negative impact on human health. Thus, the methods for vibration reduction are employed, i.e. passive, semi-active, and active.

In this dissertation smart materials are applied for reduction of the vibrations in a road vehicle and a device casing with the size of a typical household appliance. Semi-active methods are mainly used, however, in some cases passive and active methods are also investigated to compare the efficiency of different solutions.

The vibration generated by a device enclosed inside the casing can be reduced using many approaches varying from the use of additional damping material layers to active reduction with the use of electrodynamic exciters. In the presented research a semi-active approach with piezoelectric elements attached on a single panel front wall of casing is investigated. The proper dissipation of the absorbed mechanical energy may increase the efficiency of vibration damping.

The use of a double-panel structure instead of a single panel may reduce the propagation of the vibration outside the casing. Moreover, the additional coupling elements mounted between the panels can provide improvement of the efficiency of vibration reduction. In this dissertation a new type of electromagnetic coupling element is presented and validated. This element placed as a link between the panels allows to achieve the reduction of maximal and mean values of the transmitted vibration energy.

The road vehicles are equipped with suspension to improve comfort and safety during the driving. The most popular solutions are passive systems, while semi-active and active suspensions are usually available in premium cars. The presented results were obtained during the experiments performed for the semi-active suspension based on magnetorheological (MR) dampers. The different approach in estimation of the velocity of the suspension using linear variable differential transformer (LVDT) sensors is also presented.