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PERFORMANCE OF SELF-POWERED DIGITAL VIBRATION SUPPRESSION WITH A PIEZOELECTRIC TRANSDUCER

Abstract

This paper demonstrates an innovative approach for vibration suppression by using a piezoelectric transducer. The vibration is suppressed by adequately switching an inductive shunt circuit connected to the piezoelectric transducer, such as the method called as SSDI or LR-switching. Surprisingly in our system, the control logic calculation and the switching is performed by a microprocessor that is driven by electric energy converted from mechanical vibration energy. Therefore, this vibration suppression system runs without any power supply. This feature of "self-powered" makes this method advantageous in various applications.

It is known that some analogue circuits can also switch the shunt circuit adequately and suppress the monotone vibration nicely. However, these analogue circuit suppresses multiple-modes vibration less-effectively. To realize an ideal vibration suppression system that is self-powered and effective to multi-vibration, a sophisticated control logic is installed in a micro-processor that is driven by the energy converted from that of mechanical vibration.

This paper presents the detail of our methods and experimentally demonstrates that our new method has much higher performance in suppression multiple-modes vibration compared with traditional methods which could be implemented by an analogue circuit. The experimental data are thoroughly investigated and the effects of some parameters on the performance of our new method are also described.