Enhancement of a Dynamic Vibration Absorber by means of an Electromagnetic Shunt Damper

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ABSTRACT

In this study, we address the topic of the reduction of structural vibrations by means of an electromagnetic shunt damper (EMSD) made up of a voice coil actuator (VCA) with an electronic circuit. The classical resistive and resonant shunt solutions are studied [1]. The main goal of this paper is to estimate the damping performance of shunts [2] combined with a tuned mass damper (TMD), in the case of forced vibrations, for an arbitrary resonant elastic host structure. The analogy between mechanical damper and EMSD is reminded [3]. Two architectures, that differs with the placement of the EMSD with respect to the TMD, are tested. It is shown that the EMSD enhances the vibration control for a specific combination of TMD and EMSD. If the TMD parameters cannot be changed, the performance of vibration reduction is affected by one free parameter: the Electromagnetic Coupling Factor (EMCF). This factor conditions the optimal mitigation of a mechanical vibration mode. Experiments are proposed and a good agreement with the theoretical model is obtained, validating it. For these experiments, a digital signal processor (DSP) generates the EMSD (the tuning parameters depend on the VCA and the DSP itself as well). A cantilever beam with a mass clamped at its free end serves as the TMD, whose tuning parameters include the bending stiffness and the clamped mass.

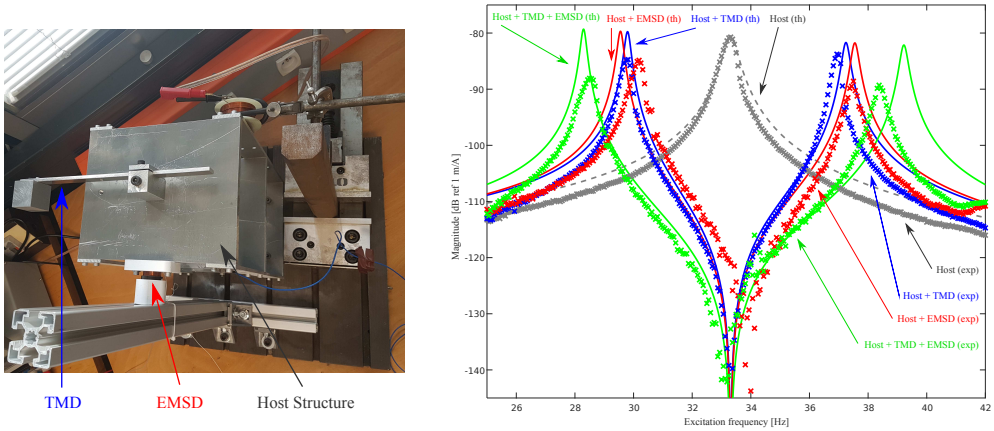

FIG. 1: Experimental setup of the host structure (On the left) and Frequency Response Functions associated to a combination with the TMD and/or the resonant EMSD (On the right).

REFERENCES

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