

ACOUSTICS2008/2312

Damping of a device with piezoelectric materials and negative capacitance electrical circuits

Christian Granger^a, Anne-Christine Hladky^b and Jean-Claude Debus^a

^aIEMN, 41 boulevard Vauban, 59046 Lille, France

^bIEMN, UMR CNRS 8520, avenue Poincaré, BP 60069, 59652 Villeneuve d'Ascq, France

In this paper, the damping of a device is obtained by a transfer of the vibratory energy into electrical energy and then into thermal energy (dissipation in an electrical resistance). The transfer is carried out by using piezoelectric materials (PZT piezoelectric plates, macro fibre composite MFC) and it is improved by charging the piezoelectric materials by an electrical circuit having a negative capacitance impedance. Two devices are considered : a clamped plate, which is an academic case, and a large aluminium plate (0.85m*0.78m*2mm). The optimal position and the geometry of the ceramics are determined using an analytical method and a numerical method with the help of the ATILA finite element code. The equivalent electrical circuit of the device is conceived. Damping of the device charged by the electrical circuits is measured using a laser vibrometer. Damping can be performed on a given frequency range, covering several bending modes, by using several ceramics on the plate and several external electrical circuits, connected to the active material. Finally, tests in an anechoic chamber show the efficiency of the device for the reduction of the noise transmitted through the plate.