World Academy of Science, Engineering and Technology
International Journal of Materials and Metallurgical Engineering
Vol:16, No:05, 2022

Passive Attenuation with Multiple Resonator Rings for Musical Instruments Equalization

Authors : Lorenzo Bonoldi, Gianluca Memoli, Abdelhalim Azbaid El Ouahabi

Abstract : In this paper, a series of ring-shaped attenuators utilizing Helmholtz and quarter wavelength resonators in variable, fixed, and combined configurations have been manufactured using a 3D printer. We illustrate possible uses by incorporating such devices into musical instruments (e.g. in acoustic guitar sound holes) and audio speakers with a view to controlling such devices tonal emissions without electronic equalization systems. Numerical investigations into the transmission loss values of these ring-shaped attenuators using finite element method simulations (COMSOL Multiphysics) have been presented in the frequency range of 100– 1000 Hz. We compare such results for each attenuator model with experimental measurements using different driving sources such as white noise, a maximum-length sequence (MLS), square and sine sweep pulses, and point scans in the frequency domain. Finally, we present a preliminary discussion on the comparison of numerical and experimental results.

Keywords : equaliser, metamaterials, musical, instruments
Conference Title : ICEMASCM 2022 : International Conference on Engineering Metamaterials and Active, Smart, and Controllable Metamaterials
Conference Location : London, United Kingdom
Conference Dates : May 26-27, 2022