Abstract ID 504

ASSESSMENT OF ACTIVE AND PASSIVE SOLUTIONS FOR NOISE AND VIBRATION ATTENUATION IN LIGHTWEIGHT PANELS

Aurelio Araujo[(1)], Jose Madeira[(1)], Paulo Alves[(2)]

[(1)]IDMEC
[(2)]Medway M&R

aurelio.araujo@tecnico.ulisboa.pt, aguilarmadeira@tecnico.ulisboa.pt, paulo.alves@medway.com

Keywords: Noise attenuation, Lightweight panels, Active damping, Passive damping, Optimization

Summary: The generalized introduction of lightweight composites in the transportation industries, while leading to significant weight reductions and consequent energy savings, also contributes to degrade the acoustic performance of these structures when subjected to mechanical or acoustic excitations. Regulations and standards play a key role in the design and manufacture transportation vehicles. Admissible noise levels have been set not only for the external noise generated by the vehicles but also for the internal noise. In order to meet these internal noise level standards, manufacturers need to better address noise issues. Passive damping technologies are nowadays frequently used to control sound and vibration levels by using viscoelastic materials, while active devices such as surface bonded piezoelectric patches can also be effectively used to control these undesired sound and vibration levels in lightweight composite structures. Viscoelastic materials are an efficient way of reducing structural vibrations and providing noise attenuation in the medium to high frequency range, whereas active piezoelectric elements have excellent damping capabilities in the lower frequency ranges. Hence, the combination of passive and active elements may lead to broader control capabilities regarding acoustic emissions. The use of passive viscoelastic treatments for noise and vibration attenuation in the transportation industry is widespread, while the use of active elements has been gaining notoriety in the recent years. Active elements such as piezoelectric patches can take advantage of the sensing and actuation capabilities of these material systems to provide efficient noise and vibration attenuation by using feedback control loops. Alternatively, these active elements may also be used along with shunted electrical circuits, composed of resistors and inductors to dissipate vibrational energy and thus provide the desired noise and vibration attenuation levels. The design of such systems based on the application of viscoelastic and piezoelectric treatments is not a trivial task and an overview of the different approaches that were attempted by researchers in recent years is presented.