Design of Electro-Viscoelastic Sandwich Panels for Noise Reduction

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ABSTRACT

Structures in the transportation industry should be optimized for cost, weight, vibration and noise attenuation, which are important competitiveness issues nowadays. In this framework, sandwich composite panels may represent an optimized solution for both sound radiation and structural vibration for most frequency ranges. Viscoelastic materials are an efficient way of reducing structural vibrations and providing noise attenuation, which allied to piezoelectric elements may lead to broader control capabilities regarding acoustic emissions.

The use of commercial software programmes allows for an acceleration in the design cycles, but due to some limitations in these codes when dealing with material viscoelastic behaviour combined with piezoelectric elements, it is sometimes necessary to develop user codes that can overcome these limitations [1].

This paper addresses vibration and noise reduction in laminated sandwich plates using both viscoelastic and piezoelectric elements, using the capabilities of the commercial software programme ANSYS. In the low frequency range, noise and vibration damping is accomplished through either feedback control laws, applied to piezoelectric patches bonded to the surfaces of the sandwich panels or passive RL damping circuits. For higher frequency ranges, damping is obtained from viscoelastic materials that are used as the core of the sandwich panels. The sound transmission characteristics of the panels are evaluated by computing their radiated sound power, using the Rayleigh integral method [2]. Optimization of thicknesses, fibre orientation of the composite layers and location of the piezoelectric patches is also conducted for minimization of weight and radiated sound power.

Results are presented to illustrate the performance of the optimized sandwich panels in terms of weight and noise reduction efficiency.

REFERENCES

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