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VIBRATION REDUCTION IN COMPOSITE PLATE STRUCTURES USING CONSTRAINED LAYER DAMPING AND MULTIOBJECTIVE OPTIMIZATION

Jose Aguilar Madeira, jaguilar@dem.ist.utl.pt
ISEL and IDMEC - Instituto Superior Tecnico, Universidade de Lisboa, Portugal

Aurelio Araujo, aurelio.araujo@ist.utl.pt
IDMEC - Instituto Superior Tecnico, Universidade de Lisboa, Portugal

Cristóvão Manuel Mota Soares, cristovao.mota.soares@ist.utl.pt
LAETA-IDMEC, Portugal

Carlos Alberto Mota Soares, carlosmotasoares@dem.ist.utl.pt
IDMEC - Instituto Superior Tecnico, Universidade de Lisboa, Portugal

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Passive damping is an important mechanism for reducing noise and vibration and improving fatigue and impact resistance of structures. Material damping can be easily incorporated into laminated structures in the form of viscoelastic layers and constrained layer damping (CLD) is one of the most commonly employed methods to suppress the undesirable vibration in lightweight applications, including aerospace structures. These damping treatments usually assume the form of patches that are bonded to the surface of the structures being especially adequate for treatments applied to in-service structures. These patches consist of a viscoelastic material with a thin constraining layer of an elastic material. Considering that the addition of weight to a lightweight structure is undesirable, a trade-off between added mass and vibration reduction must be achieved. In this work we propose a methodology for obtaining the optimal distribution of the CLD treatments in plate structures that simultaneously minimizes the added mass and maximizes the modal damping in a given frequency range of interest. The problem is solved using the Direct MultiSearch (DMS) solver for multiobjective optimization problems which does not use any derivatives of the objective functions. A finite element model developed for sandwich plates with viscoelastic core and anisotropic laminated face layers is used along with the complex modulus approach where the frequency dependent properties of the viscoelastic material are incorporated using fractional derivative material laws. Trade-off Pareto optimal fronts are obtained and the results are analysed and discussed.