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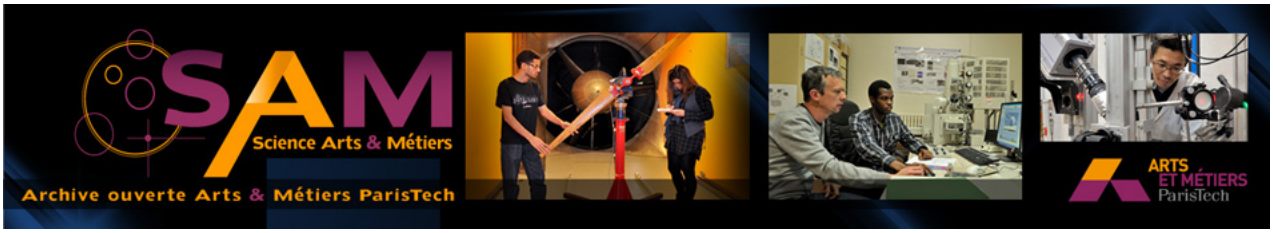

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Vibrations, Shocks and Noise

Dynamic response of viscoelastic multilayers structures using solid-shell finite elements

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Because vibrations often lead to noise and system dysfunction, they are therefore undesirable in many situations. One of the proposed ways developed in the literature to reduce vibrations is the use of sandwich structures with elastic faces and viscoelastic core [1].

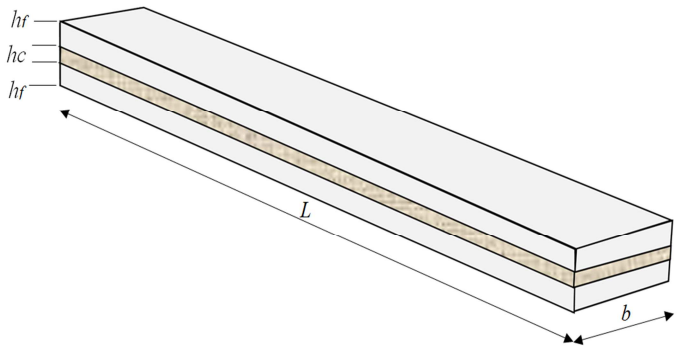

Fig 1: Sandwich beam structure.

To accurately evaluate the damping properties of viscoelastic sandwich structures, a number of kinematic models and numerical methods have been proposed in the literature. In Hu et al. [2], a review and assessment of such approaches have been presented. This review shows that the simplified shell model with zigzag displacement layerwise theories leads generally to accurate solutions. However, some cases have been identified [2], where the proposed thin shell model is not sufficient. Indeed, the latter model guaranties the continuity of the displacements, but the stresses and strains are not accurately evaluated, especially when the layers of the structure have high contrast of stiffness or in terms of the hc/hf ratio (Fig1).

In the above-mentioned situations, an alternative approach could be the use of 3D finite element assemblies, but the number of degrees of freedom will increase significantly.

In structural problems, a linear hexahedral solid-shell element has been developed, on the basis of a 3D formulation, and it has been shown to accurately account for the through-thickness phenomena while maintaining the CPU time at a reasonable level [3, 4].

In this work, the solid-shell concept [4] will be combined with multilayers structures and its capabilities will be assessed through the analysis of dynamic response of viscoelastic sandwich structures. For illustration, some selective applications will be shown.

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