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Development and validation of vibroacoustic models of irregular plates

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Abstract

Irregularly shaped cover plates used in automotive gearboxes receive vibration energy generated by meshing gears, resonantly amplify and radiate sound at many frequencies. To reduce the vehicle noise levels, a metal–plastic–metal composite plate with a constrained viscoelastic layer may be utilized. Due to the complex nature of the structure, nonuniform material properties and bolted boundary conditions, it is difficult to develop vibroacoustic models. Hence, two simplified covers must be studied first: a stamped steel cover with identical geometry and nonuniform material properties and a modified flat cover which simplifies the geometry while providing uniform material properties including thickness. Each cover is studied with free and bolted boundary conditions. A new model of the bolted connection is described and implemented. Finite element and boundary element models for each cover are developed and validated based on the experimental modal analysis and sound directivity results.

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