Robust design of damping devices constitued of viscoelastic materials

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Abstract

The proposed work aims to provided tools the design of damping devices constitued of viscoelastic materials parts. A strategy is thus proposed to take into account the behavior of viscoelastic materials in different types of simulations: modal analysis, frequency response or temporal response. To achieve this goal, a generalized Maxwell model is introduced, and a dynamic model of the damper is written in an original form. To reduce the cost of calculation, this orignal formulation is associated with a model reduction strategy. Moreover, as the viscoelastic materials are very sensitive to temperature variations, this parameter is introduced in the generalized Maxwell model to investigate its influence on the modal damping. In this context, and using the developed methodologies, a robustness study is performed using the info-gap theory to evaluate the modal damping performances for two viscoelastic materials in an uncertain temperature environment. It is shown that the best design choice in terms of viscoelastic behavior really depends on the degree of lack-of-knowledge: robust and better performances can be obtained while quantifying the horizon of uncertainty

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