K.Jaboviste, E.Sadoulet-Reboul, N.Peyret, C.Arnould, E.Collard, G.Chevallier, 2019, On the compromise between performance and robustness for viscoelastic damped structures, *Mechanical Systems and Signal Processing,* 119: 65–80.

Highlights

- The study aims at comparing the damping efficiency of two viscoelastic materials in an uncertain temperature context.
- The damping efficiency is numerically computed using a specific complex eigenvalue analysis applied on the finite element model of a steel frame structure.
- Two different adequate rheological models are introduced depending on the behavior of the materials, and the proposed models take into account the temperature dependency.
- The info-gap theory is used to evaluate the modal damping performances in an uncertain temperature context when no statistical information on the temperature evolution is available.
- It is shown that the best material choice changes according to the horizon of uncertainty on temperature.

Abstract Viscoelastic materials are commonly used for passive treatment in many applications. They exhibit a specific behavior depending on frequency and temperature, and thus damping performances can strongly vary in an uncertain environment for which these materials can be used far from their optimal nominal value. The problem studied in this paper is the compromise to find between damping efficiency and robustness to lack-of-knowledge when using structure with viscoelastic components. This question is illustrated on a damper made of a steel frame, considering two kinds of viscoelastic materials: the tBA-PEGDMA which is a viscoelastic material that exhibits very good performances but a very sensitive behavior according to frequency and temperature, and the silicone rubber SI 965 which is less efficient but whose behavior is less frequency- and temperature-dependent than the tBA-PEGDMA. In order to evaluate the performances, a complex eigenvalue analysis is performed on the finite element model of the damper, with different rheological material models. In a very original way, the temperature is introduced in the 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 the two considered 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.

Keywords Robustness, Info-gap, Viscoelasticity, Damping, Vibrations.

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