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Experimental identification of a stochastic computational model for an uncertain vibroacoustic system

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ABSTRACT

This paper deals with the identification of the dispersion parameters of a stochastic computational model in vibroacoustics.
The vibroacoustic model under consideration [1,2] is made up of a structure (a steel plate connected to an elastic framework on its edges), covered with a sound-insulation layer (such as those used in the automotive industry) and coupled with a bounded acoustic cavity.
The computational mean model consists of a finite element model of the structure [3,4], a simplified model of the sound-insulation layer based on the use of the fuzzy structure theory [5] and a finite element model of the acoustic cavity [4]. A usual reduced mean computational model is constructed using structural modes and acoustic modes. There are both data uncertainties and model uncertainties in the structure and in the simplified model of the sound-insulation layer. These uncertainties are taken into account by using the non-parametric probabilistic approach [6].
Consequently, the stochastic reduced computational vibroacoustic model depends on six dispersion parameters which control the level of uncertainties in the system. A Monte-Carlo simulation is performed coupled with the ordered statistics [7]. Using an experimental basis and an associated reference computational model, the six unknown dispersion parameters are then estimated solving inverse stochastic problems which are formulated as optimization problems. The maximum likelihood method is used coupled with a statistical reduction of the information [8].
The methodology is presented and is validated.

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