Identification of dynamic characteristics of uncertain bolted connections in a frame structure

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Parametric identification of structures and their components can be encountered in many engineering problems such as damage assessment or model updating for the control purposes. In the present study the attention is on two approaches to model updating. The first approach is the classical penalty function that minimizes the square norm of the error between experimental and numerical modal data. The second one is a probabilistic Bayesian framework that maximizes the a posteriori probability density function of the unknown parameters based on the experimental data. The main difference between these two approaches is related to the fact that the penalty function methods requires matching of the numerical data with those obtained experimentally. The Bayesian approach is not vulnerable to this problem, but it requires more weighting parameters to be selected. An improper selection of these parameters leads to a worse identification accuracy. In this work, the two approaches are compared using data obtained from experiments on a laboratory-scale frame with highly uncertain bolted connections. 17 uncertain stiffness parameters are to be identified: 16 of them correspond to the bolted connections and one to the Young modulus of the beams. 82 degrees of freedom are measured with the aid of 4 bidirectional accelerometers and roving sensor technique. Experimental modal data used for model updating contain nine mode shapes and the corresponding natural frequencies within the frequency range from 0 to 1 kHz. The research is divided into three steps: (1) model class selection, (2) assessment of the parameter identifiability and (3) updating of the selected model with the aid of both examined model updating methods.

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