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STOCHASTIC MODEL IDENTIFICATION OF A BOLTED JOINT FOR THE ROBUST CHARACTERISATION OF THE VIBRATIONAL BEHAVIOUR OF LIGHT ASSEMBLED STRUCTURES

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Assembled structures involve non-linear phenomena, as contact or friction, localised at each joint interface. In addition, sources of uncertainties are mainly responsible for deviation between the effective behaviour of the structure and results from deterministic simulations. This work aims to provide a pragmatic approach to robustly characterise the vibrational behaviour of an assembled structure considering the variability of parameters of the joints. This approach would be useful for robust design of solutions, such as solutions for damping vibrations, dedicated to assembled structures and taking into account the variability of the real behaviour of each joint.

The proposed approach is made of three steps. First, a "just sufficient" nominal model of a bolted joint is defined. This model aims to take into account the influence of the joint on the dynamical behaviour of the overall structure. This model is then adapted using a probabilistic approach to take into account the variability of the real behaviour of each joint. The parameters of the joint model are then modelled as Gamma distributed random variables (according to the maximum entropy principle). Finally, the parameters of this new stochastic model are identified on the basis of the maximum likelihood principle. A straightforward non-intrusive approach referred as the Stochastic Model Reduction (SMR) approach [1] is used to simulate the vibrational behaviour of the structure. The variability of a real structure is investigate experimentally and used as references in this identification process.

The identified joint model is then used to characterise the vibrational behaviour of a multi-bolted structure. Although the "just sufficient" nominal model (on which the stochastic model is based) seems to be sensitive to the bolt tightening procedure, the proposed approach allows to tackle the variability of the real structure using a pragmatic and straightforward procedure.

REFERENCES

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