An acoustic pressure-based method for load identification in coupled structural-acoustic system with non-probabilistic uncertain variables

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Abstract

This paper presents a novel pressure-based method applying load identification to acoustic-structure interaction (ASI) system. The method relies on regularization method and non-probabilistic method. Forward problem of identification is established through Green's kernel function. Discrete form of this function is given and provided to depict the convolution relationship among three aspects: acoustic pressure response, load and corresponding unit-pulse response functions. Measured acoustic pressure and dynamic load acted on structure are all expressed as functions of time in ASI system. Considering that unavoidable noise existed in measured pressures can result in the ill-posedness of load reconstruction, a novel regularization method namely hybrid truncated singular value decomposition (HTSVD) method is addressed to ensure the well-posedness. Moreover, owing to the widespread uncertainties in ASI system, two non-probabilistic models containing ellipsoid model and interval model are utilized to transform the uncertain models. In these non-probabilistic models, the bounds rather than the precise probability distributions of uncertain parameters are only required. Further, accuracy of these two kinds of models is also compared. Finally, several numerical examples are investigated to verify the effectiveness of the present methods.

Keywords: Load identification; Pressure-based, Acoustic-structure interaction; HTSVD; Non-probabilistic uncertainty