Experimental Modelling of Structural Dynamics by Spatial Matrix Identification with Additional Constraints of Test Structure's Uniformity and Symmetry

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Abstract

Modal curve fitting methods have been popular as a major experimental identification in the field of structural dynamics over last thirty decades. But, the modal parameters obtained by such a method are not available so flexibly for various simulations of structural modification. For example, it is difficult theoretically to simulate the dynamic behavior of the structure in case of changing boundary conditions from those at the modal testing of the structure.

The author proposed the spatial matrix identification method as an alternative approach more than one decade ago. This method expresses the dynamic characteristics of a test structure in the form of spatial matrices, which are a set of mass, stiffness and damping matrix. The identification algorithm is a kind of optimization with a number of equal constraint equations. The constraint equations are automatically formulated according to the physical principle such as no strain and no stress all over a structure under arbitrary rigid-body motion.

In this paper, the author presents the additional installation regarding test structure's uniformity and symmetry to the set of constraint equations. The effect is investigated by the identifications using measured frequency response functions of three basic test objects. One is a uniform thin iron beam with the length of 0.292 meter and the square cross-section of 0.01 x 0.01 meter for its bending vibration into a transversal direction. The second is a rectangular aluminum plate whose size is 0.343 x 0.048 meter with the thickness of 0.0026 meters. The last one is an actual ski board.