An Inverse Identified Method for the Spatial Distribution of Dynamic Loads

***J. Liu, K. Li, and X. Han**

State Key Laboratory of Advanced Design and Manufacturing for Vehicle Body, College of Mechanical and vehicle Engineering, Hunan University, Changsha City 410082, P. R. China

*Corresponding author: liujie@hnu.edu.cn

The distributed dynamic loads acted on the structure are generally difficult to be directly measured. So it is necessary to develop some inverse methods for the spatial distribution identification of the dynamic load through the structural responses. In this paper, both distributed functions and time history of the loads are simultaneously estimated based on the knowledge of structure responses at only few measured pointed. This procedure assumed that the spatial and time functions of the load are separate. The spatial distribution of the loads can be distributed using a series of known based functions, such as orthogonal polynomial. The time history of the Green's responses of these based functions can be easily obtained using FEM method. The structure response for the load with spatial based function and arbitrary time function can be expressed as a form of convolution integral. The continuous convolution is then temporally discretized. With the linearity and time-invariant suppositions, the total response can be treated as a linear superposition of the response of each based function. So the identification of distributed dynamic loads can be translated to the identification of the multi-source loads, and the time history of each load is similar. With measured responses containing noise, the improved regularization operator is adopted to overcome the ill-posedness of load identification and to obtain the stable and approximate solutions of certain inverse problems. Numerical examples demonstrate the efficiency and accuracy of the proposed method.

Keywords: Load identification, Distributed dynamic load, Orthogonal polynomial, Regularization, Inverse problem