Quick and highly precision modal analysis method for all types of structural modifications

Jianjun He[1,*], Jiaoyu Li[1]

[1] School of Automobile and Mechanical Engineering, Changsha University of Science and Technology, Changsha, China

*Corresponding author

Abstract. Modal analysis is widely used to investigate the dynamic characteristics of all types of structures. For finite element models, iterative solvers are needed to precisely calculate eigenpairs or frequency and vibration mode. However, in cases such as large-scale analysis or reanalysis studies, or optimization design of huge structure, computational cost may become too time consuming. This paper focus on the quick structural modal analysis based on the multiple approximate reanalysis operations. Basing on the stiffness and mass matrix of the analytical structures, a high precision and efficiency eigensolution are generated by the proposed modal analysis method (the PRDII method, the Pseudo Random Double Inverse Iteration method), which is combined the pseudo random number initialization, DII (Double Inverse Iteration) strategy with the double Rayleigh-Ritz analysis. The large scale numerical examples show that actual computational saving of the proposed method is higher than 75% with sufficient precision, and also show that the proposed modal analysis method is suitable for highly precision and efficient modal computation of all types of structural modifications.

Keywords: modal analysis; multiple approximate reanalysis; the pseudo random number initialization, all types of structural modifications