UNIVERSITI TEKNOLOGI MARA

# THE INVESTIGATION OF THE DYNAMIC BEHAVIOUR OF A COMPLEX STRUCTURE USING THE WAVE-BASED SUBSTRUCTURING METHOD

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# ABSTRACT

Analysing the dynamic properties of a complex structure with a large number of substructures frequently leads the modal analysts to carefully select the appropriate methods for the optimal balance between the economics and accuracy of the analysis. The aim of this study was to investigate the capability of the wave-based substructuring (WBS) method in determining the dynamic behaviour of a structure having a large number of coupling interfaces of the substructures. The finite element method (FEM) and experimental modal analysis (EMA) were used for the investigation. Two different models of the structure which are full finite element (FE) and WBS based reduced order were developed and used for the determination of the natural frequencies and mode shapes of the structure. The measurement of the dynamic behaviour of the structure was carried out under free-free boundary conditions using an impact hammer and roving accelerometers. It was found that the recommended relative threshold value to be use for Singular Value Decomposition (SVD) in 2D modelling is 1e-5 and 1e-6 for 3D modelling. The comparisons of the results between the full FE, WBS method and test models revealed that the use of WBS method has led to a dramatic reduction in the expenditure of computational time by an average of 85% faster than the full FEM while still maintaining a satisfactory level of accuracy. This indicates that the WBS method can be used economically and efficiently for the determination of dynamic behaviour of a large complex structure with large size of interface nodes.

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