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Eigensolution of rotationally repetitive space structures using a canonical form

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SUMMARY

In this paper, an efficient eigensolution is presented for calculating the buckling load and free vibration of rotationally cyclic structures. This solution uses a canonical form linear algebra that often occurs in matrices associated with graph models. A substructuring method is proposed to avoid the generation of entire matrices. Utilizing the aforementioned method, the geometric stiffness matrix is generated in an efficient time saving manner. Then solution for the eigenproblem is presented for geometric nonlinearity via the canonical form based on the block diagonalization method. In order to confirm the efficiency of the presented method, examples are solved using both the classic and the presented approaches. Comparison of the required computational time for the two methods shows that in the new approach the required computational time is reduced considerably. Copyright © 2009 John Wiley & Sons, Ltd.

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KEY WORDS: block tri-diagonal matrix with corner blocks (BTMCB); decomposition; rotationally repetitive rigid-jointed structures; domes; buckling load; free vibration

1. INTRODUCTION

In spite of considerable advances in computational capability of computers in recent years, efficient ways for more time saving solutions of structures are of great interest. Large eigenvalue problems arise in many scientific and engineering problems. While the basic mathematical ideas are independent of the size of the matrices, the numerical determination of eigenvalues and eigenvectors

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