Exact Vibration Frequencies of Segmented Axisymmetric Shells

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ABSTRACT

Axisymmetric shells are commonly used in all fields of engineering and their dynamic characteristics are of great importance in their overall performance. Such shell can by cylindrical, conical, spherical, and in general with curved generators. Segmented shells are shells that are built of several pieces that form together an axisymmetric shell with a joint axis. The exact values of frequency for segmented shells are not known in general. The analysis of segmented shells is usually done using the finite element method that requires many elements for accurate results. An alternative approach for the analysis is to use the exact dynamic stiffness matrices for each segment for assembly of the complete structure dynamic stiffness matrix. The dynamic stiffness matrix includes in it the inertia effects and is derived exactly from the differential equations of motion. Each segment is modeled using one element. The assembly is done as in the finite element method. The natural frequencies of vibration are found as the values of frequency that cause the dynamic stiffness matrix of the structure to become singular. Numerical results will be given and compared to approximate solutions by other methods.