AN EXPERIMENTAL INVESTIGATION OF THE VIBRATIONS OF A CYLINDER/HEMISPHERE SHELL COMBINATION

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SUMMARY

In recent theoretical studies by Hammel and the present authors, it was shown that a marked reduction in the lowest natural frequency of a shell of revolution, or a combination of shells of revolution, could occur if the constraint on the circumferential displacement at the clamped supporting edges was relaxed. In practice, a clamped edge involving no axial, radial or rotational displacements seems attainable but the situation regarding circumferential displacements is unclear.

As far as the authors are aware, there are no experimental data available which will confirm or disprove the theoretical predictions mentioned above. To remedy the deficiency, the authors have had a machined steel hemisphere/cylinder shell combination made and subjected it to dynamic excitation. The vessel, with a substantial ring at the base has been vibrated and its first few lowest natural frequencies and mode shapes have been measured. The size of the base ring has been decreased in stages and the corresponding frequencies and mode shapes have been measured; the changes in the lowest natural frequencies which are predicted by the theoretical studies are compared with the experimental values. From this comparison, it is ascertained when an edge should be considered as being fixed against circumferential displacements and whether the predicted reduction in frequency is likely to occur in practice.