

VIBRATION ANALYSIS OF STRINGER
STIFFENED SANDWICH PANELS

by

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ABSTRACT

The transfer matrix method has been developed for determining natural frequencies and mode shapes of rectangular sandwich plates with two opposite edges simply supported and other two edges of arbitrary end conditions. The elements of the state vector have been expressed as functions of transverse displacement. Transfer matrix relating state vectors at two parallel edges of the plate has been formulated.

Free vibrations of stringer stiffened rectangular sandwich panels with edges perpendicular to stringers simply supported and other two edges of arbitrary end conditions have been studied. Field and point transfer matrices transferring state vectors across bay and stringer of the panel have been derived. Overall transfer matrix of the panel has been obtained and frequency determinants for various boundary conditions have been evaluated. Natural frequencies and mode shapes for sandwich plates and various stringer stiffened sandwich panels have been reported. Effect of increasing number of bays and the effect of variation of stringer spacing on distribution of natural frequencies have been studied.

The nature of free wave motion in infinite periodic sandwich panel has been used to relate the state vectors at two ends of a periodic element. A matrix eigenvalue problem has been developed to determine wave propagation constants and wave propagating zones. Locating the standing waves, natural frequencies for a finite periodic sandwich panel have been determined. Natural frequencies of such panels by wave propagation and transfer matrix methods have been compared. Effect of variation of transverse and rotational stiffness of stringer, shear and geometrical parameters of panel, on wave propagation zones have been studied.

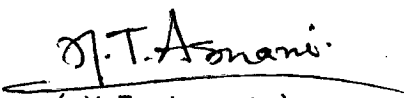
Experimental work has been carried out to verify theoretical results for sandwich plates and stiffened sandwich panels.

Transfer matrix technique has been extended to study vibration response of stringer stiffened sandwich panels with viscoelastic core subjected to sinusoidally varying line and point excitations. The transfer matrix relating state vectors at extreme edges of the panel is formulated by introducing impressed force. Resonant frequencies found from response curves have been compared with earlier reported results.

CERTIFICATE

This is to certify that the thesis entitled "Vibration Analysis of Stringer Stiffened Sandwich Panels" being submitted by Mr. Niranjana Kavi to the Indian Institute of Technology, Delhi for the award of the degree of 'Doctor of Philosophy' in Mechanical Engineering is a record of bonafide research work carried out by him. He has worked under my guidance and supervision and has fulfilled the requirements for the submission of this thesis which has reached the requisite standard.

The results contained in this thesis have not been submitted in part or in full to any other University or Institute for the award of any degree or diploma.


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