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LETTERS TO THE EDITOR

COMMENTS ON "VIBRATIONAL ANALYSIS OF MASS LOADED PLATES AND SHALLOW SHELLS BY THE RECEPTANCE METHOD WITH APPLICATION TO THE STEELPAN"

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A recent work by Achong [1] presents a vibration analysis of mass loaded plates and shallow shells by using the receptance method. In the analysis, a technique is developed for computing transverse mode amplitudes from experimental values of the fundamental frequencies of mass-loaded systems.

The frequency equation is written in terms of mode shapes as follows [1]:

$$\left(\frac{\omega_0}{\omega}\right)^2 = 1 + \left\{\sum_{j=1}^{N} \mu_j W_0^2(\xi_j)\right\} \Big/ \left\{2\int_0^1 W_0^2(\xi)\xi \, \mathrm{d}\xi\right\}, \tag{1}$$

where $\mu_j = M_j/M_p$ is a normalized loading ratio corresponding to the concentrated mass M_j, with M_p being the mass of the plate. A related expression to equation (1) is also mentioned in reference [1],

$$\frac{1}{\omega^2} = \sum_{j=1}^{N}\left(\frac{1}{\omega_j^2}\right) - (j-1)\frac{1}{\omega_0^2}, \tag{2}$$

which is used for plates carrying multiple masses at various locations [2].

A further study by Low and Chai [3] finds that the change in the strain energy should be incorporated in the multi-mass model, especially for cases of large masses, in order to predict well the natural frequency of the complete system from those of the component systems. An improved expression is then suggested to replace equation (2),

$$\frac{1}{\omega^2} = \frac{k_0^*}{k^*}\sum_{j=1}^{N}\left(\frac{k_j^*/k_0^*}{\omega_j^2}\right) - (j-1)\frac{1}{\omega_0^2}, \tag{3}$$

where k is the corresponding stiffness [3].

Also found in their recent work for loaded beams is that the effect of axial constraints is quite pronounced for thinner beams with a high slenderness ratio [4]. The same finding can be applied to thin plates and shells.

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For the cases with large masses, it is believed that equation (3) is to be applicable to the method developed in reference [1], except that equation (1) needs to be modified as the estimated parameter $\langle W_0^2 \rangle (= (1/A) \int_A W_0^2 \, \mathrm{d}A)$ is based on the mode shape of unloaded plates [1].

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