Scaling of the Modal-Response of a Simply-Supported Rectangular Plate

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ABSTRACT:

Actual military equipment is often not available for shock-response testing, for such reasons as cost, equipment availability, personnel availability, or time. If testing can be conducted on scaled-down models, whether of the full equipment or of equipment subsections, the results might be usable to approximate the shock response of the full-scale equipment, provided that appropriate scaling relationships can be developed. This paper develops scaling relationships for thin rectangular plates in simple support, subject to transverse point-shock loads, under the assumptions of linearity, homogeneity, and geometric similarity of the plate faces. The plates are also assumed to have the same respective modal damping ratios, for corresponding modes. It is found that simple scaling factors exist, between corresponding modal frequencies, and between corresponding damped modeshapes. Further, via suitable discretization, these factors can be used to provide simple scaling relationships between the shock response of points on a scaled-down plate and that of corresponding (scaled) points on the scaled-up plate.

KEY WORDS: shock, vibration, plate, model scaling

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