Readers' Forum

Brief discussions of previous investigations in the aerospace sciences and technical comments on papers published in the AIAA Journal *are presented in this special department. Entries must be restricted to a maximum of 1000 words, or the equivalent of one* Journal *page including formulas and figures. A discussion will be published as quickly as possible after receipt of the manuscript. Neither the AIAA nor its editors are responsible for the opinions expressed by the correspondents. Authors will be invited to reply promptly.*

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Comment on "Rapid Calculation of the Resonance Frequency for Rotationally Restrained Rectangular Plates"

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THE purpose of this Comment is twofold: first to congratulate Professor Nassar on his important contribution and ingenious approach,[1] and, second, to point out the existence of pertinent literature on the subject which may be of interest to design engineers.

Reference 2 deals with rotationally restrained rectangular plates subjected to a biaxial state of in-plane stress in the case of equal restraints on opposite edges. Approximate but quite accurate and simple frequency equations are derived for some of the lower modes of vibration which are valid for any value of the restraint parameters, applied stresses, and plate geometrical ratio.

Reference 3 constitutes probably the first† successful attempt to provide a closed-form solution for the determination of the fundamental frequency of transverse vibration of thin, rectangular plates with edges possessing different rotational flexibility parameters. The problem is solved by using a very simple polynomial expression which identically satisfies the boundary conditions. A variational formulation is then applied and the frequency equation is generated. It is shown that the results are in excellent agreement with other values obtained by more elaborate procedures.

The approach followed in Ref. 3 has been extended in Ref. 4 to deal with orthotropic plates subjected to a biaxial state of in-plane stress and in Ref. 5 to tackle the case of plates of nonuniform thickness.

It is also interesting to point out that Ref. 3 discusses the possibility of using the proposed approximate method when the plate is subjected to a uniformly distributed $p_0\cos\omega t$-type excitation.

no ref (A) J79-003

References

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[2] Laura, P.A.A. and Romanelli, E., "Vibrations of Rectangular Plates Elastically Restrained Against Rotation Along all Edges and Subjected to a Bi-Axial State of Stress," *Journal of Sound and Vibration*, Vol. 37, 1974, pp. 367-377.

[3] Laura, P.A.A., Luisoni, L. E., and Filipich, C., "A Note on the Determination of the Fundamental Frequency of Vibration of Thin, Rectangular Plates with Edges Possessing Different Rotational Flexibility Coefficients," *Journal of Sound and Vibration*, Vol. 55, 1977, pp. 327-333.

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[5] Laura, P.A.A., Grossi, R. O., and Carneiro, G., "Transverse Vibrations of Rectangular Plates with Thickness Varying in Two Directions and with Edges Elastically Restrained Against Rotation," *Journal of Sound and Vibration*, Vol. 63, 1979, pp. 499-505.

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†It is interesting to point out that this paper was received by the editor of the *Journal of Sound and Vibration* on March 10, 1977, and in revised form on July 6, 1977.

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Reply by Author to P.A.A. Laura

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THE author wishes to express his sincere appreciation for the favorable comments made by Professor Laura. I am particularly pleased that Dr. Laura brings to the readers' attention a number of recent excellent references of practical significance, most of which (his Refs. 3-5) were not possible to include in my paper because they appeared subsequent to the submission of that paper for publication.

Laura et al. (Ref. 3 in Comment), adopted a simple and excellent approach to solve the problem. The accuracy of the resulting approximate formula was, however, determined at the specific cases when the edges are simply supported or clamped. Since the solution is primarily intended for use at intermediate values of elastic rotational restraints, it was highly desirable to determine its accuracy at restraint values other than the "extreme" conditions, perhaps by comparison with some of the data in the literature.[1,2] Now with more results made available it should be a simple matter to ascertain the accuracy of the solution.

References

[1] Carmichael, T. E., "The Vibration of a Rectangular Plate with Edges Elastically Restrained Against Rotation," *Quarterly Journal of Mechanics, Applied Mathematics*, Vol. 12, Pt. 1, 1959, pp. 29-42.

[2] Leissa, W., "Vibration of Plates," NASA SP-160, 1970, pp. 120-121.

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