$$N_x(k_x/a)^2 + N_y(k_y/b)^2 = -D_x(k_x/a)^4$$

$$-2H(k_xk_y/ab)^2 - D_y(k_y/b)^4$$

For the case $N_y = 0$,

$$\gamma_x^2 = -(D_y/k_x^2 D_x)(k_ya/b)^4$$

Consequently, the edge effect associated with an edge $x =$ constant degenerates, and the method cannot be used to estimate uniaxial buckling loads.

Dickinson computed buckling loads for the case of hydrostatic in-plane loading, $N_x = N_y$. For this case

$$\gamma_x^2 = [(k_xk_ya/b)^2 + (H/D_x)(2-D_y/H)(k_ya/b)^4]$$

$$/[k_x^2 + (k_ya/b)^2]$$

and

$$\gamma_y^2 = [(k_xk_yb/a)^2 + (H/D_y)(2-D_x/H)(k_xb/a)^4]$$

$$/[(k_xb/a)^2 + k_y^2]$$

Therefore, the edge effect is not degenerate if neither D_x/H nor D_y/H exceeds 2, which is precisely the largest value of these parameters for which Dickinson reported numerical results.

References

[1] Dickinson, S.M., "Bolotin's Method Applied to the Buckling and Lateral Vibration of Stressed Plates," *AIAA Journal*, Vol. 13, Jan. 1975, pp. 109-110.

[2] Bolotin, V.V., "An Asymptotic Method for the Study of the Problem of Eigenvalues for Rectangular Regions," *Problems of Continuum Mechanics*, Society of Industrial and Applied Mathematics, Philadelphia, Pa., 1961, pp. 56-68.

Reply by Author to W.W. King

S.M. Dickinson*
*The University of Western Ontario,
London, Ontario, Canada*

THE author is in agreement with the comments of Professor King on the fact that the edge effect method, as proposed by Bolotin, is not universally applicable to the vibration and buckling of plates under uniaxial or biaxial in-plane loads involving compression. This is due to the possibility of the edge correction terms, those involving exponents of γ_x or γ_y, becoming oscillatory. The author became aware of this problem shortly after the publication of the Note under discussion.[1] He has since established, however, that if a modified version of the edge effect method (originally proposed by Vijayakumar[2] and Elishakoff[3] is used, then problems for which γ_x and/or γ_y are real or imaginary can be treated satisfactorily.

A Technical Note[4] on the application of the modified edge effect method to the buckling and vibration of in-plane loaded plates, in which is included an example for which an edge correction term would become oscillatory, has already been submitted to the Journal.

References

[1] Dickinson, S.M., "Bolotin's Method Applied to the Buckling and Lateral Vibration of Stressed Plates," *AIAA Journal*, Vol. 13, Jan. 1975, pp. 109-110.

[2] Vijayakumar, K., "A New Method for Analysis of Flexural Vibration of Rectangular Orthotropic Plates," *Journal of the Aeronautical Society of India*, Vol. 23, No. 4, 1971, pp. 1974-204.

[3] Elishakoff, I.B., "Vibration Analysis of Clamped Square Orthotropic Plate," *AIAA Journal*, Vol. 12, July 1974, pp. 921-924.

[4] Dickinson, S.M., "Modified Bolotin's Method Applied to Buckling and Vibration of "Stressed Plate," *AIAA Journal*, Vol. 13, Dec. 1975, to be published.