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Letter to the Editor

Comments on "Buckling behavior of a graphite/epoxy composite plate under parabolic variation of axial loads"

The writers wish to compliment the authors of this interesting paper, which covers an important topic in elastomechanics [1].

It is not clear from the paper what type of external loading (boundary condition) generates a stress resultant N_x defined in the paper by their Eq. (4) [1]:

$$N_x = N_0\left(1 - 6\frac{x}{a} + 6\frac{x^2}{a^2}\right). \tag{1}$$

On the other hand, using this expression, the authors integrate the "equilibrium equations of plate theory" and obtain very simple and convenient expressions for the stress resultants N_y and N_{xy}:

$$N_y = -\frac{6N_0}{\beta^2}\frac{y}{b}\left(1 - \frac{y}{b}\right), \tag{2}$$

$$N_{xy} = -\frac{3N_0}{\beta}\left(1 - 2\frac{x}{a}\right)\left(1 - 2\frac{y}{b}\right), \tag{3}$$

where $\beta = a/b$.

Admittedly these expressions do satisfy the plate equilibrium equations (which are equilibrium equations of plane stress in the mathematical theory of elasticity)

$$\frac{\partial\sigma_x}{\partial x} + \frac{\partial\tau_{xy}}{\partial y} = 0, \tag{4a}$$

$$\frac{\partial\tau_{xy}}{\partial x} + \frac{\partial\sigma_y}{\partial y} = 0. \tag{4b}$$

However, the aforementioned polynomial expressions do not constitute a unique solution. One must satisfy the compatibility condition for plane stress [2,3]:

$$\frac{\partial^2\gamma_{xy}}{\partial x\partial y} = \frac{\partial^2\varepsilon_x}{\partial y^2} + \frac{\partial^2\varepsilon_y}{\partial x^2}. \tag{5}$$

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Unfortunately, the expression for N_x, N_y and N_{xy} do not satisfy the compatibility equation and this occurs for:

- isotropic plates,
- orthotropic plates,
- plates of generalized anisotropy.

For the last two situations, the stress resultants will probably turn out to be dependent on the constitutive parameters.

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