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Analytical solution to a mixed boundary value elastic problem of a roller-guided panel of laminated composite. (English) Zbl 1271.74077

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Summary: This study presents an analytical solution to elastic field in a roller-guided panel of symmetric cross-ply laminated composite material. The mixed boundary value two-dimensional plane stress elasticity problem is formulated in terms of a single displacement potential function. This reduces the problem to the solution of a single fourth order partial differential equation of equilibrium as the other equilibrium equation is satisfied automatically. The solution is obtained in terms of an infinite Fourier series. To present some numerical results, a panel of glass/epoxy laminated composite is considered and different components of stress and displacement at different sections of the panel are presented graphically. To justify the present analytical solution, it is compared with the finite element solution obtained by using the commercial software ANSYS. It is found that the two solutions agree well with each other. This ensures that the formulation developed in this study, based on the displacement potential approach, can be used to obtain analytical solution of an elastic field in structural elements of laminated composite under any mode of boundary conditions prescribed in terms of either stress, displacement or any combination of these.

MSC:

74G05 Explicit solutions of equilibrium problems in solid mechanics

74E30 Composite and mixture properties

Cited in 1 Document

Keywords:

analytical solution; symmetric laminated composite; elasticity; panel; mixed boundary condition; displacement potential

Software:

ANSYS

Full Text: [DOI](#)

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