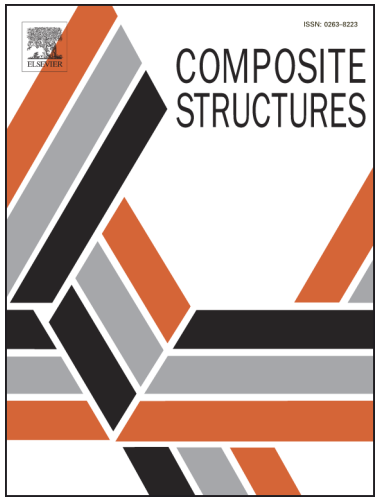

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Elasticity Solutions of Simply Supported Laminated Cylindrical Arches Subjected to Thermo-loads

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Abstract: According to the exact thermo-elasticity theory, the elasticity solution of the simply supported laminated arches subjected to thermo-loads was investigated. An analytical method was present to solve the stress and displacement fields in the arches. Firstly, the general solutions of temperature, displacement and stress fields in single-layered simply supported arch were obtained by solving the heat conduction equation and the elasticity equations in the polar coordinates system, respectively. Then, the temperature, displacements and stresses between the outer surface and the inner surface of the arched layer were derived. Based on the continuity of temperature, heat flux, displacements and stresses on the interface of two adjacent layers, the relationships of temperature, displacement and stress between the outermost surface and the innermost surface of the laminated arch were recursively generated by using the transfer matrix method. The unknown coefficients in the solutions were uniquely determined by the use of the outermost surface and the innermost surface conditions of the arch. The distributions of temperature, displacements and stresses in the arch were got by substituting the unknown coefficients back to the recurrence formulae and the solutions for every layer. The convergence of the solutions was checked with respect to the number of the terms of series. Comparing the results with those obtained from the finite element method, the correctness of the present method was verified. Finally, the effects of surface conditions, arch thickness, layer number and material properties on the distributions of temperature, displacements and stresses in the arch were discussed in detail.

Keywords: layered arch; temperature; stress; transfer matrix; elasticity solution