THERMAL POSTBUCKLING ANALYSIS OF THIN UNIFORM SQUARE PLATES ON WINKLER FOUNDATION - EFFECT OF USE OF GREEN'S STRAIN-DISPLACEMENT RELATIONS

G. Venkateswara Rao
(Formerly) Department of Mechanical Engineering
Vardhaman College of Engineering
Shamshabad, Hyderabad-501 218, India
Email : hydrao1944@yahoo.co.in

B. Ravi
Department of Mechanical Engineering
Sreenidhi Institute of Science and Technology
Gatkesar, Hyderabad-501 301, India

A.V.S.S.K.S. Gupta
Professor
Department of Mechanical Engineering
JNTUH, Kukatpally
Hyderabad-500 085, India

Abstract

A new simple formulation is developed in this paper, to predict the realistic thermal postbuckling behavior of the square plates, on Winkler foundation. If the plate is subjected to a uniform temperature rise, and also undergoes large deflections, mechanical equivalent inplane compressive, and tensile loads are developed, with the condition of the inplane immovability of the normal edge displacements of the plate. The nature of the distribution of these inplane compressive and tensile loads are similar, but have different magnitudes, which act along the x- and y- directions of the plate. The use of the Green's nonlinear strain-displacements relations, which do not impose any restriction on the magnitude of the large deflections, to predict the realistic thermal postbuckling loads. The thermal postbuckling results of the plates obtained from this formulation, are validated indirectly, as the corresponding results are not available in the literature, with those of the columns without the elastic foundation. For the non-zero values of the foundation parameter, the present numerical results of the plates, with respect to the central deflection, show the proper physical trends of the nonlinearity, and demonstrate the simplicity of the present formulation.

Keywords: Thermal buckling; Thermal post-buckling; Square plate; Column; Winkler foundation; Green's strain-displacement relations

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