World Academy of Science, Engineering and Technology
International Journal of Civil and Environmental Engineering
Vol:19, No:09, 2025

Euler-Bernoulli's Approach for Buckling Analysis of Thick Rectangular Plates Using Alternative I Refined Theory

Authors : Owus Mathias Ibearugbulem

Abstract : The study presents Euler-Bernoulli's approach for buckling analysis of thick rectangular plates using alternative I refined theory. No earlier study, to the best knowledge of the author, based on the literature available to this research, applied Euler-Bernoulli's approach in the alternative I refined theory for buckling analysis of thick rectangular plates. In this study, basic kinematics and constitutive relations for thick rectangular plates are employed in the differential equations of equilibrium of stresses in a deformable elemental body to obtain alternative I governing differential equations of thick rectangular plates and the corresponding compatibility equations. Solving these equations resulted in a general deflection function of a thick rectangular plate. Using this function and satisfying the boundary conditions of three plates, their peculiar deflection functions are obtained. Going further, the study determined the non-dimensional critical buckling loads of the six plates. Values of the non-dimensional critical buckling load from the present study are compared with those from a three-dimensional buckling analysis of a thick plate. The highest percentage difference recorded for the plates: all edges simply supported (ssss), all edges clamped (cccc) and adjacent edges clamped with the other edges simply supported (ccss) are 3.31%, 5.57% and 3.38% respectively.

Keywords : Euler-Bernoulli, buckling, alternative I, kinematics, constitutive relation, governing differential equation, compatibility equation, thick plate
Conference Title : ICCSEE 2025 : International Conference on Civil, Structural and Environmental Engineering
Conference Location : San Francisco, United States
Conference Dates : September 27-28, 2025