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Elastoplastic and Nonlinear Analysis of Functionally Graded Axisymmetric Plate-Shell Structures

José S. Moita[1], Aurélio L. Araújo[2], Cristóvão M. Mota Soares[3], Carlos A Mota Soares[4]

[1] IDMEC, Instituto Superior Técnico, Universidade de Lisboa
Av. Rovisco Pais,1 - 1049-001, Lisboa, Portugal
jmoita50@gmail.com

[2] IDMEC, Instituto Superior Técnico, Universidade de Lisboa
Av. Rovisco Pais,1 - 1049-001, Lisboa, Portugal
aurelio.araujo@tecnico.ulisboa.pt

[3]IDMEC, InstitutoSuperiorTécnico, Universidade de Lisboa
Av. Rovisco Pais,1 - 1049-001, Lisboa, Portugal
cristovao.mota.soares@tecnico.ulisboa.pt

[4]IDMEC, InstitutoSuperiorTécnico, Universidade de Lisboa
Av. Rovisco Pais,1 - 1049-001, Lisboa, Portugal
carlos.mota.soares@tecnico.ulisboa.pt

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ABSTRACT

In this work is presented the formulation for static bending analysis of functionally graded axisymmetric plate-shell type structures under mechanical loading, and considering different material behaviour. Thus, linear, geometric and material nonlinear, as well as combined material and geometric nonlinear analysis are performed. The implemented model is based on a simple conical frustum finite element with 2 nodes, and 3 degrees of freedom per node, which includes shear deformation effects, Zienkiewics et al. [1]. This model shows to be extremely efficient in the analysis of axisymmetric plate-shell structures subjected to axisymmetric mechanical loading. The used reduced numerical integration procedure is essential for its success when applied to thin shells.
The formulation accounts for the calculation of displacements and through-thickness stress distribution. The solutions for some illustrative examples involving variation of volume fractions are obtained, and the results are presented, and compared with numerical alternative models, and discussed.

REFERENCES

[1] O.C. Zienkiewics, J. Bauer, K. Morgan, and E. Onate. A simple and efficient element for axisymmetric shells. *International Journal for Numerical Methods in Engineering*, 11, pp. 1545 - 1558, 1977.