A NEW ROTATION-FREE TRIANGULAR PLATE ELEMENT WITH SHEAR DEFORMATION EFFECTS

* F. Zárate and E. Oñate

International Center for Numerical Methods in Engineering (CIMNE)
Technical University of Catalonia (UPC)
Gran Capitán, s/n, 08034 Barcelona, Spain
onate@cimne.upc.edu, zarate@cimne.upc.edu, www.cimne.com

Key Words: *Rotation-free triangle, Plate bending, Shear deformation.*

ABSTRACT

The paper describes an extension of the 3-noded rotation-free basic plate triangle (BPT) originally developed for thin plate analysis [1,2] to account for shear deformation effects of relevance for thick plates and composite laminated plates. The nodal deflection degrees of freedom (DOFs) of the original BPT element are enhanced with the two shear deformation angles. This allows to compute the bending and shear deformation energies leading to a simple triangular plate element with 3 DOFs per node. For the thin plate case the shear angles vanish and the element reproduces the good behaviour of the original thin BPT element. As a consequence the element is applicable to thick and thin plate situations without exhibiting shear locking effects. The ingredients for the element
formulation are: a Hu-Washizu mixed functional, a linear interpolation for the deflection and the shear angles and a finite volume approach for computing the resultant stresses and the generalized strains over a patch of elements. The examples presented show the robustness and accuracy of the so called BPT+ element for thick and thin plate problems.

REFERENCES

[1] E. Oñate and F. Zárate, "Rotation-free triangular plate and shell elements", *Int. J. for Num. Meth. in Engng.*, Vol. **47** (1-3), pp. 557-603, 2000.

[2] E. Oñate and F.G. Flores, "Advances in the formulation of the rotation-free basic shell triangle", Comput. Meth. Appl. Mech. Engng., Vol. **194**, 2406-2443, 2005.