ANALYSIS OF IN-LAYER STRAINS IN THE LOW ORDER MITC SHELL ELEMENT

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Abstract

The development of analysis procedures for shell structures represents one of the most challenging tasks of finite element research. Over the last decades much effort has been directed towards this task with impressive advances, but -measured on the desirable features for practical analyses- still not enough success. In recent publications it was shown that the formulation of general shell elements using the method of mixed interpolation of tensorial components (MITC) is effective for general engineering applications. In particular, the MITC4 is a low order formulation that has been employed very successfully to approximate all deformation states of a shell. In this element, formulated in a convected coordinate system, separate interpolations for the shear terms are performed effectively. However, in the bending-dominated case, the improvement of the MITC4 formulation with respect to the performance of the standard bilinear element is more important. In order to overcome this drawback, different treatments for in-layer strains in the membrane state case of a shell can be employed. A new element based on the MITC4 is presented which uses for in-plane strains the interpolation proposed in a quadrilateral 2-D element, the QMITC, instead of evaluating these strains -as in the MITC4 formulation- from the displacements. Numerical results for some test examples are presented and compared.