New formulation of quasi-conforming method: A simple membrane element for analysis of planar problems

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New formulation of quasi-conforming method: a simple membrane element for analysis of planar problems

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Abstract

The basic idea of quasi-conforming method is that the strain-displacement equations are weakened as well as the equilibrium equations, and the weighted weakened strains are approximated by element nodal displacement parameters. In this paper, a new formulation of quasi-conforming method is presented. The element formulation starts from initial assumed stress, and the strain can be derived by using the constitutive equations. Then the stress-function matrix is treated as the weighted function to weaken the strain-displacement equations. Finally, appropriate interpolation functions are chosen to calculate strain integration. As an example, a 4-node quasi-conforming plane element with drilling degrees of freedom is formulated. The formulation of the element is simple and concise, and the element is immune to the distorted mesh, which can be used to the mesh shape degenerates into a triangle or concave quadrangle. Numerical benchmark examples have suggested that the new model possesses excellent precision.

Keywords: quasi-conforming, finite element method, fundamental analytical solutions

1. Introduction

The plane quadrilateral element is a simple and widely used element, which plays an important role in engineering analysis. Isoparametric finite element family are the most popular models used in various numerical analyses. However,

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