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机械工程

光滑节点域有限元法

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摘要:

本研究采用与有限元法(finite element method, FEM)相对照的方式,论述了光滑节点域有限元法(node-based smoothed finite element method, NS-FEM)节点域的形成方式,光滑应变矩阵的求解步骤以及光滑有限元形函数的计算方法。利用matlab对典型算例进行编程分析,结果表明NS-FEM计算刚度矩阵偏软,位移和应变能为解的上限,应力、应变和应变能具有良好的计算精度且不会产生体积锁定现象等。

关键词: 有限元法 光滑节点域有限元法 光滑节点域 光滑应变矩阵 光滑有限元形函数

Node-based smoothed cells based on finite element method

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Abstract:

The new theories of node-based smoothed finite element method (NS-FEM) were discussed by means of comparison with the traditional finite element method (FEM), which proposed formation of the node-based smoothed cells, computational methods of the smoothed strain matrix and the shape functions for NS-FEM. The analyses of typical examples were conducted by matlab, and the results showed that the NS-FEM's calculation of stiffness matrix was softer than FEM's, and the displacement and strain energy were the upper limit of solution. Meanwhile, there were higher accuracy of numerical solutions for stress, strain and strain energy, and it would not produce volume lock phenomenon.

Keywords: finite element method node-based smoothed finite element method node-based smoothed cells smoothed strain matrix shape functions for smoothed finite element method

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