



基于共旋坐标法的带刚臂平面梁元非线性分析

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CO-ROTATIONAL FORMULATION FOR NONLINEAR ANALYSIS OF PLANE BEAM ELEMENT WITH RIGID ARMS

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摘要

为解决平面梁元在相交处可能存在的刚性连接问题, 根据带刚臂平面梁元在受力后的运动和变形特点, 该文基于共旋坐标法推导出两端带任意刚臂的平面梁元的切线刚度矩阵显式表达式, 给出了不平衡力的精确全量算法, 并提供了详细的计算步骤。利用该文的研究成果编制了程序, 对无刚臂和有刚臂的平面梁结构进行了几何非线性分析。计算结果表明: 这种非线性单元列式的正确性和非线性求解过程的收敛性, 实用价值较强。

关键词: [刚臂](#) [平面梁元](#) [几何非线性](#) [共旋坐标法](#) [切线刚度矩阵](#)

Abstract:

In order to solve the problem of rigid anchor connection when using plane beam element, an exact expression of non-linear tangent stiffness matrix is derived for the plane beam element with rigid arms by using co-rotational procedure and variational method and considering the characteristic movement and deformation under forces. The precise algorithm of unbalanced forces is proposed, the detailed calculation procedure is presented, and a computer program is developed. Geometric nonlinear analyses for plane beam structures with and without rigid arms are carried out to verify the reliability and computational efficiency of the proposed element formulation. The new element can be used in plane beam structures.

Key words: [rigid arm](#) [plane beam element](#) [geometric nonlinear](#) [co-rotational procedure](#) [tangent stiffness matrix](#)

收稿日期: 2011-03-14;

PACS: [TU311.3](#)

通讯作者: 邓继华

引用本文:

邓继华, 邵旭东. 基于共旋坐标法的带刚臂平面梁元非线性分析[J]. 工程力学, 2012, 29(11): 143-151.

DENG Ji-hua, SHAO Xu-dong. CO-ROTATIONAL FORMULATION FOR NONLINEAR ANALYSIS OF PLANE BEAM ELEMENT WITH RIGID ARMS[J]. Engineering Mechanics, 2012, 29(11): 143-151.

链接本文:

<http://gclx.tsinghua.edu.cn/CN/10.6052/j.issn.1000-4750.2011.03.0123>

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