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模态综合的直接变换法

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Direct Transformation Method for Mode Synthesis

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摘要

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摘要

基于固定界面模态综合的Craig-Bampton方法, 提出了模态综合的直接变换方法, 该法在形式上更简洁, 适用于大规模动力学系统的模态分析和动力学模型减缩。对采用直接变换法模态综合过程的计算误差做了分析, 给出了计算误差界, 阐明了模态综合后总体结构的固有频率与子结构保留主模态个数之间的关系。针对子结构界面自由度太大的情况, 提出了直接变换法的部分算法, 不需组集系统总刚度、总质量矩阵, 仅在子结构的基础上完成系统的减缩。计算实例表明该算法的有效性及计算的稳定性。

关键词: 模态综合法 有限元法 动力学模型减缩 特征值 误差界 子空间迭代法

Abstract:

Based on Craig-Bampton's fixed-interface mode synthesis method, a direct transformation method for mode synthesis is put forward in the article. This method is much simpler than the methods in current use and can be applied to large scale complex structure mode synthesis or dynamic model condensations. The error with the proposed method is analyzed and the error bound is derived. The relationship between the frequencies of the overall synthesized structure and the number of the remaining principal modes of the substructures is formulated. In order to avoid the treatment of large degrees of freedom on the substructure interfaces, a partitioned algorithm for the direct transformation method is established. In the method the processes of the assembling of the whole stiffness and mass matrices are not needed and the model condensations are only performed on the substructures. Examples are given in the end of the article to show the effectiveness and the stability of the proposed method.

Keywords: mode synthesis method finite element method dynamic model condensation eigenvalue error bounds subspace iterative method

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