工程力学
ENGINEERING MECHANICS
ISSN 1000-4750
CN 11-2595/O3
CODEN GOLIEB
Ei 收录期刊



» 2012, Vol. 29 » Issue (3): 21-26 DOI:



# 基于SAND列式的桁架结构优化问题序列线性规划算法

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# SEQUENTIAL LINEAR PROGRAMMING ALGORITHM BASED ON THE SAND FORMULA FOR TRUSS OPTIMIZATION

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摘要 该文提出了一种基于协同分析和设计列式(即SAND 列式,Simultaneous Analysis and Design)和序列线性规划(Sequential Linear Programming)技术的桁架结构优化新方法。与传统列式下将隐式响应函数(如位移、应力等)于设计变量(如杆件截面积等)处作线性展开的做法不同,以桁架结构为例,该文在SAND 列式下,采用杆件截面积和结构节点位移同时作为设计/分析变量,仅对杆件协调条件这一显式双线性函数予以线性近似并构造LP子问题。通过求解一系列LP子问题,可以得到优化问题的近似最优解。与传统优化列式下的SLP 方法相比,该文方法不仅设计变量运动极限的选取相对容易,而且线性近似的误差可以精确估计。数值算例表明,采用该文算法可以快速、稳定地得到优化问题的近似最优解。

关键词： 结构优化 SAND 列式 序列线性规划 协调条件 运动极限

Abstract： In this paper, a SLP (Sequential linear Programming) algorithm based on SAND (Simultaneous Analysis and Design) formula is proposed. It is different from the traditional practice of a linear expansion of implicit response functions (e.g. displacement, stress etc.) at the designed variable (e.g. cross sectional area of bar members). Taking a truss structure as an example, using SAND formula, with both bar cross sectional areas and node displacements as the design variables, a linear approximation to the compatibility conditions using explicit bilinear function is made and an LP sub-problem is constructed. By solving a series of LP sub-problems, a best approximat solution for this optimization problem can be obtained. Comparing to the SLP algorithm under traditional optimization formula, this method has 2 advantages: The choice of the move limit of the designed variable is easier; the error involved in the linear approximation can be accurately estimated. Worked examples demonstrate that this algorithm is able to obtain the approximate optimized solution to the optimization problem in a fast yet stable manner.

Key words： structure optimization SAND formula sequential linear programming compatibility condition move limit

收稿日期: 2010-06-01;

PACS:

通讯作者: 郭旭

引用本文:

杜剑明,张维声,郭旭. 基于SAND列式的桁架结构优化问题序列线性规划算法[J]. , 2012, 29(3): 21-26.

DU Jian-ming,ZHANG Wei-sheng,GUO Xu. SEQUENTIAL LINEAR PROGRAMMING ALGORITHM BASED ON THE SAND FORMULA FOR TRUSS OPTIMIZATION[J]. Engineering Mechanics, 2012, 29(3): 21-26.

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