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On the numerical optimization of multi-load spatial Michell trusses using a new adaptive ground structure approach

Tomasz Sokół[1] and George I. N. Rozvany[2]

[1] Warsaw University of Technology, FCE, Poland, t.sokol@il.pw.edu.pl;
[2] Budapest University of Technology and Economics, DSM, Hungary, .rozvany@t-online.hu;

Abstract

In this paper a new method of solving large-scale linear programming problems related to Michell trusses, generalized to multiple load conditions and three-dimensional domains, is proposed. The method can be regarded as an extension of the adaptive ground structure methods developed recently by the first author. In the present version both bars and nodes can be switched between active and inactive states in subsequent iterations allowing significant reduction of the problem size. Thus, the numerical results can be attained for denser ground structures giving better approximation of exact solutions to be found. The examples of such exact solutions (new 3D Michell structures), motivated by the layouts predicted numerically, are also presented and can serve as benchmark tests for future methods of numerical optimization of structural topology in 3D space.

Keywords: 3D michell structures; multiple load cases; adaptive ground structure method; linear programming; active set and interior point methods; new exact solutions for structural topology optimization.