

AVVISO DI SEMINARIO

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Aula IP – Dipartimento ICEA
Complesso di Ingegneria di Via Marzolo 9

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An efficient primal-dual interior point method for large-scale truss layout optimization problems

Abstract

Truss layout optimization problems are often formulated by using a ground structure approach where a set of nodes is distributed in the design domain and all the possible interconnecting bars are generated. The main goal is then to determine the optimal cross-sectional areas of these bars and obtain the minimum weight structure that is able to sustain a given set of applied loads.

However, such consideration of the full connectivity of the nodes results in a large number of bars making the optimization problems computationally challenging for solution techniques. We solve the problems using a primal-dual interior point (IP) method where we employ several novel techniques to deal with the large size of the problems.



The first step is to use a column generation procedure where the optimal solution of the large original problem is obtained by solving a sequence of smaller restricted master problems. However, after performing a few column generation iterations, the size of the restricted master problems grows and the problems still challenge standard IP solvers.

Therefore, we additionally exploit the algebraic structure of the problems and reduce the normal equations originating from the interior point algorithm to much smaller linear equation systems. We apply the preconditioned conjugate gradient method to solve these reduced linear systems. A special purpose preconditioner based on the mathematical properties of the problem is designed. The efficiency and robustness of the method is supported with several numerical experiments.

This is a joint work with Alemseged Weldeyesus.