11th World Congress on Computational Mechanics (WCCM XI)
5th European Conference on Computational Mechanics (ECCM V)
6th European Conference on Computational Fluid Dynamics (ECFD VI)
July 20–25, 2014, Barcelona, Spain

APPLICATION OF SECOND-ORDER ALGORITHMS TO TOPOLOGY OPTIMIZATION PROBLEMS

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Key words: *topology optimization, large-scale optimization, constrained optimization.*

Topology optimization is a rapidly expanding research field due to its significant application to structural design. Advances in additive manufacturing technologies are allowing designers to explore new complex designs based solely on performance specifications rather that manufacturability limitations. These latest advances in manufacturing technologies have motivated the need to improve existing topology optimization algorithms [1]. New optimization algorithms that are suited for large-scale constrained topology optimization are needed.

In this work we perform a numerical study of the effectiveness of second-order optimization algorithms to solve topology problems. First-order and second-order derivative operators are derived for both reduced-space and full-space implementations. These operators are necessary for an accurate and efficient implementation of the topology optimization problem. For the reduced-space approach, both trust-region and line-search Newton conjugate gradient algorithms are utilized. For the full-space approach, a matrix-free trust-region sequential quadratic programming algorithm [2] is utilized.

Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energys National Nuclear Security Administration under contract DE-AC04-94AL85000.

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