

## Combined Topology and Shape Optimization with the DSC method for Stress Constraint Problems

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### Abstract

The combination of topology and shape optimization based on the Deformable Simplicial Complex (DSC) [1] has been recently applied in 2D and 3D structures to minimize the compliance [2, 3], where the optimized topology and the smooth shape can be specified explicitly and efficiently. In the present work, the method will be investigated for stress constraint optimization problems, which is a significant but more challenging application due to the “singularity” phenomenon and local nature. Since DSC represents the geometry with the well-shaped triangular elements, the Finite Element Analysis can be performed directly on the same mesh. Consequently, the present optimization scheme can handle stress constraints in both topology and shape optimization conveniently, as shown in the numerical examples.

[1] M.K. Misztal, J.A. Bærentzen, Topology adaptive interface tracking using the deformable simplicial complex. *ACM Transactions on Graphics* 31 (3):No. 24, 2012.

[2] A.N. Christiansen, J.A. Bærentzen, M. Nobel-Jørgensen, N. Aage, O. Sigmund, Combined shape and topology optimization of 3D structures. *Computers and Graphics (0): Shape Modeling International* 2014.

[3] A.N. Christiansen, M. Nobel-Jørgensen, N. Aage, O. Sigmund, J.A. Bærentzen, Topology optimization using an explicit interface representation. *Structural and Multidisciplinary Optimization* 49(3):387-399, 2014.