

Simultaneous topology and material optimization

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Abstract. A general setting for simultaneous topology and material optimization of an elastic body with different regularization methods is presented. The linear elastic material tensor is parametrized either using the tensor entries directly, different material laws (e.g. orthotropic material laws described by physical constants) or homogenized microstructures. For the purpose of topology optimization, each of these material parametrizations is multiplied with a topological design variable. The presented setting provides for an independent use of well known regularization techniques (density filters, slope constraints) for each type of design parameter. While the used regularization methods are already established using a single design type (e.g. density variable in topology optimization), a combined and variable use is not found in the literature. Existence of solutions and convergence of an associated finite element scheme can be proven.

Finally, numerical results are shown for a number of parametrizations ranging from a class of general orthotropic materials to homogenized materials obtained from parametrized microstructures.