

# Sensitivity Analysis of elastoplastic Structural Response regarding Geometry and External Loads

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In structural design optimization, the term *design* can stand for different kinds of parameterizations, e.g. shape geometry, topology, material properties or boundary conditions. Combinations of different kinds of design parameters are of special interest in many engineering disciplines. In order to use gradient based methods, e.g. SQP, the computation of response sensitivities regarding all chosen design parameters is required.

An efficient way to compute these sensitivities is the variational approach proposed by Barthold [1], which is based on an enhanced kinematic concept that allows a rigorous separation of structural and physical quantities. This simplifies the computation of analytical gradients on a variational basis and gives the possibility to compute response sensitivities simultaneously to structural analysis within a finite element framework, cf. [2].

We present numerical and algorithmic implementation of variational response sensitivity analysis considering shape geometry and external load parameters as design variables. The arising sensitivities are further examined by means of *Singular Value Decomposition (SVD)*, which gives insight into the *internal structure of sensitivities* as introduced in [3] and incorporated in [4]. The internal structure reveals combinations of chosen design variables with major and minor influence on the structural response. With this additional information, sensitivities can be filtered and the optimization problem can be redefined. Nonlinear elastic-plastic material behavior is considered to widen the range of possible materials, as the approach might be of special interest in the context of forming processes.

## REFERENCES

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