3D Topology Optimization in Elasticity Using Level Set Methods

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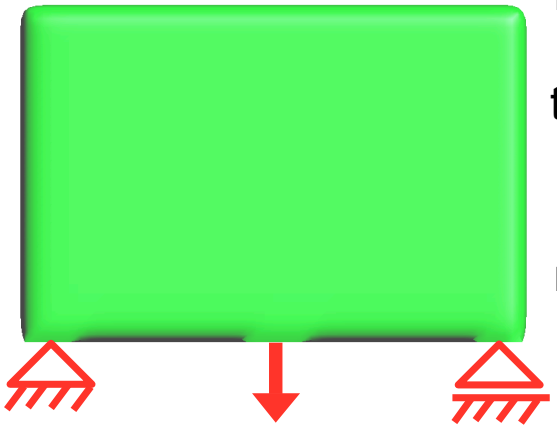
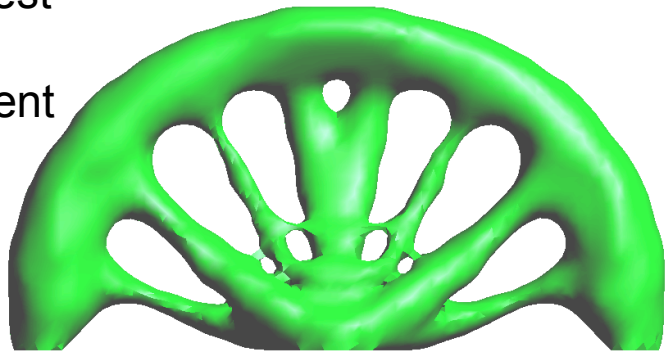
Motivation



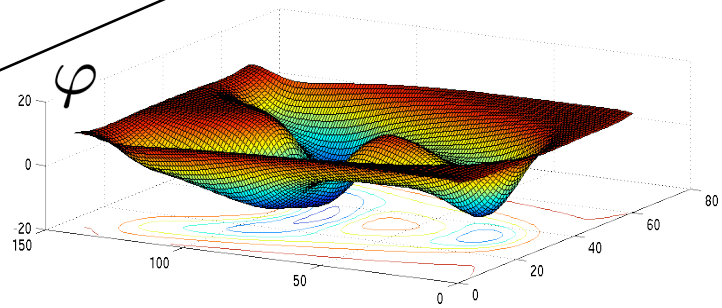
Method of steepest descent using topological gradient

min. compliance



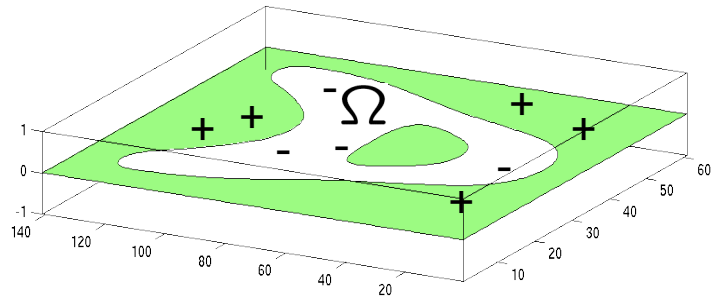
Topology Optimization:
Find an optimal material distribution within a given design space s.t. prescribed constraints (volume, maximal stress, etc.) are not violated.

$J(\Omega, u) \rightarrow \min$
such that
$a(u, v) = f(v) \quad \forall\, v \in V,$
$|V| \leq \text{const.}$

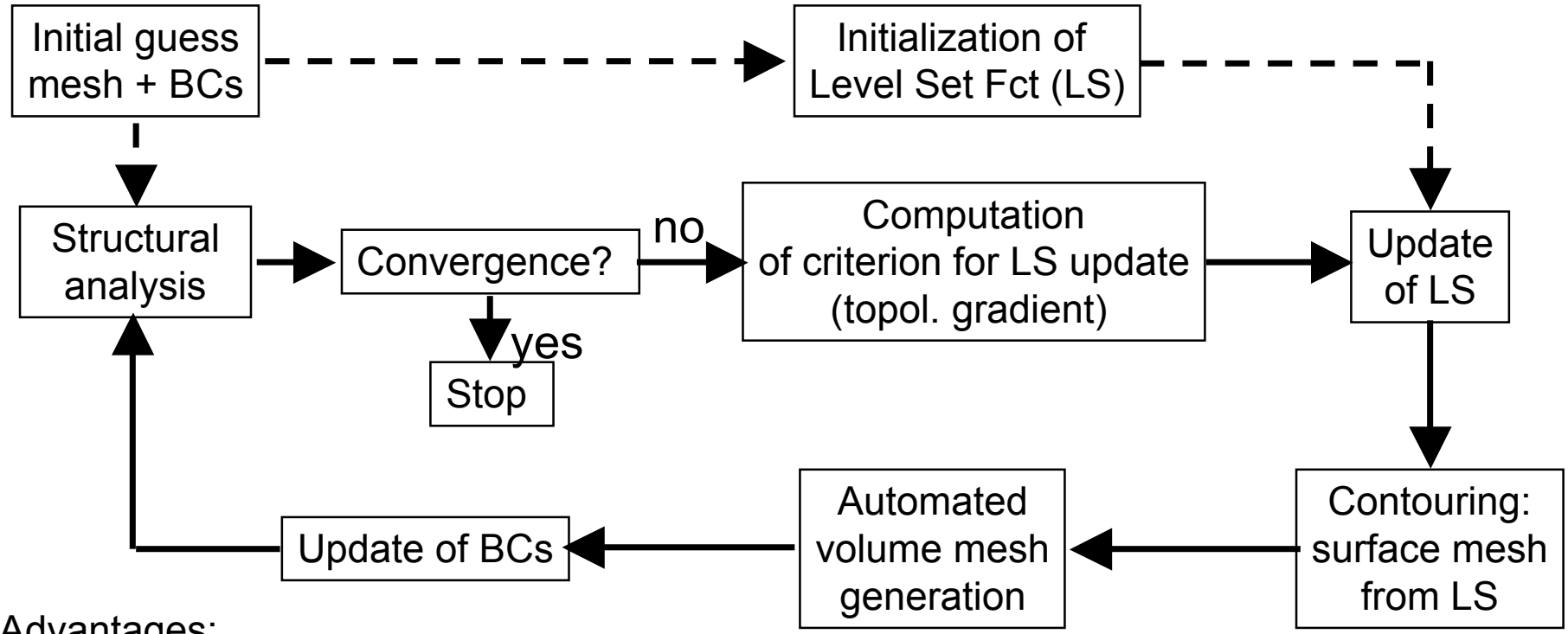


Level Set Method:
Represent boundary as zero level set of a function

$\varphi: \Omega_{DS} \rightarrow \mathbb{R}$



Algorithm: Topology Optimization using Level Set



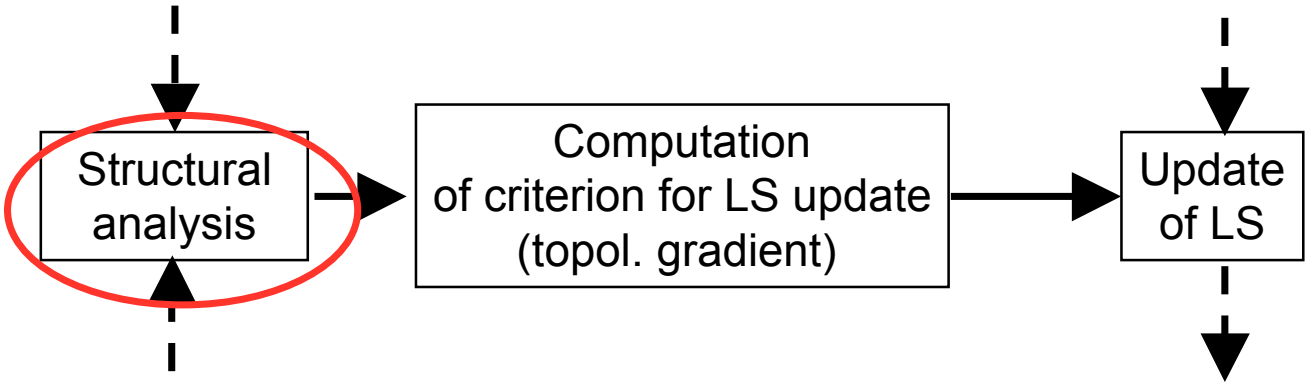
Advantages:

- Remeshing: adaptive discretisation for structural analysis
- Complete FE model in each iteration (needed for simulation of casting process)

Disadvantages:

- Remeshing: costly, stability?
- Interpolation errors in update of BCs

Benefits from the Special Radon Semester



- Crucial point: structural analysis. Introduction of an error
- Influence of this error on the topological gradient and the update of the level set function?

⇒ ERROR ESTIMATION is the basis for investigation of precision of level set update

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