

Introduction to Part II

Shape and Topology Optimization

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This part contains several results of recent research in shape and topology optimization. It consists of the following three independent sections:

Sergio Conti, Benedikt Geihe, Martin Rumpf, and Rüdiger Schultz combine, in *Two-stage stochastic optimization meets two-scale simulation*, a two-scale model in elastic shape optimization with a stochastic framework. The microstructured material to be optimized is composed of an elastic material with geometrically simple perforations located on a regular periodic lattice, whose parameters depend on the macroscopic position.

Helmut Harbrecht and Johannes Tausch review, in *On shape optimization with parabolic state equation*, their results on numerical methods for the efficient solution of shape optimization problems with parabolic state equation. For a specific parabolic shape optimization problem, both the shape calculus and the discretization by means of a modern space-time multipole method are demonstrated. For comparison reasons, also the related stationary shape optimization problem is considered.

Luise Blank, M. Hassan Farshbaf-Shaker, Harald Garcke, Christoph Rupprecht, and Vanessa Styles present, in *Multi-material phase field approach to structural topology optimization*, how to formulate and solve multi-material structural topology and shape optimization problems within a phase field approach. The first-order optimality system is determined and then numerically solved by an H^1 -gradient projection method.

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