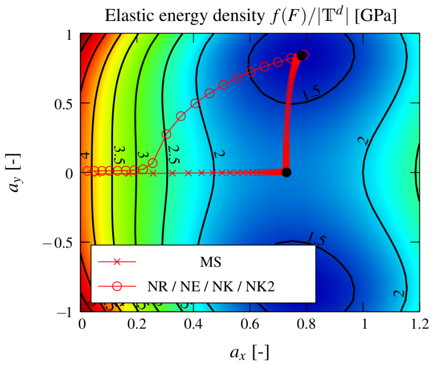
Announcement for the course
Nonlinear Optimization Methods



Comparing different optimization methods for minimizing the elastic energy of a laminate material[a]

[a] from: Kabel, M., Böhlke, T., Schneider, M.: Efficient fixed point and Newton-Krylov solvers for FFT-based homogenization of elasticity at large deformations. Comp. Mech., 54(6), 1497-1514 (2014).

Course Contents

Optimization problems are a central topic for almost any working engineer. Examples include dimensioning of components, minimizing the elastic energy within finite element methods of modern AI (artificial intelligence) methods. This course introduces the participants to the basics of nonlinear optimization of differentiable functions. Furthermore, an overview of different classes of optimization algorithms presented, discussing which method to apply to a specific problem. In the associated exercise sessions, solution methods discussed in the lectures will be implemented, also discussing how to use freely available optimization packages in Python.
The lecture as well as the tuturial will take place on campus. Please bring **your own notebook** to the tutorial.

Schedule and exams

Lecture	Mondays, 11:30 - 13:00, starting 24.10.2022, 10.50 HS 101
Tutorial	Fridays, 11:30 - 13:00, starting 28.10.2022, 10.50 HS 101
Exam	oral, on demand
Volume	Course 2 SWS, Exercises 2 SWS, 6 LP
Lecture notes	will be provided via ILIAS (in English)
Contact	JProf. Matti Schneider, M.Sc. Felix Ernesti, M.Sc. Jonas Lendvai

Literature

[1] Nocedal, J. und Wright, S. J.: Numerical optimization. Springer, 1999.

[2] Boyd, S. und Vandenberghe, L.: Convex optimization. Cambridge University Press, 2004.

Target audience

This course addresses bachelor and master students with an interest in nonlinear optimization.

Prerequisites:

- Basic training in advanced mathematics

Syllabus

- Necessary and sufficient optimizality conditions for unconstrained optimization
- Gradient methods
- Fast and conjugate gradient methods
- Newton and Quasi-Newton methods
- Optimality conditions for constrained optimization
- Projection methods for simple constraints
- Lagrange duality, penalty methods and the method of multipliers
- Interior point methods
- Active set strategies
- Alternating Direction Method of Multipliers (ADMM)