Announcement for the course

Nonlinear Optimization Methods

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


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 course is offered as a reading course with weekly discussion sessions via MS Teams. The exercises have to be solved independently, and the results are discussed in a weekly MS Teams session.

Schedule and exams

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<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Lecture</td>
<td>Mondays, 12:00, starting 02.11.2020</td>
</tr>
<tr>
<td>Location</td>
<td>online, via ILIAS and MS Teams</td>
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<tr>
<td>Exercise</td>
<td>will be decided in first lecture</td>
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<tr>
<td>Location</td>
<td>online, via ILIAS and MS Teams</td>
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<tr>
<td>Exam</td>
<td>oral, on demand</td>
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<tr>
<td>Volume</td>
<td>Course 2 SWS, Exercises 2 SWS, 6 LP</td>
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<tr>
<td>Lecture notes</td>
<td>will be provided via ILIAS (in English)</td>
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<tr>
<td>Contact</td>
<td>JProf. Matti Schneider, M.Sc. Felix Ernesti</td>
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Literature


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
- ADMM