

# SI211: Numerical Analysis Project

Prof. Boris Houska

Deadline for the report: Dec 2, 2019

## 1 Project Requirements

In this project we ask you to work on an equality constrained optimization problem of your own choice. One basic requirement, however, is that you write your optimization problem in the form

$$\min_{x \in \mathbb{R}^n} F(x) \quad \text{s.t.} \quad G(x) = 0. \quad (1)$$

Implement at least one exact Newton (=SQP) method and one Newton-type methods for solving your optimization problems. Compare the two methods by showing visualizing the iterates of the optimization methods. Notice that in order to “pass”, the vector  $x$  should be at least 2 dimensional and there should be at least one non-trivial equality constraint.

## 2 Project Report

Write a short report (preferably in Latex) containing the following sections:

1. *Title and Authors* (find a good title + name of the author)
2. *Introduction* (describe the problem that you want to solve and cite relevant literature)
3. *Problem Formulation* (introduce a suitable mathematical notation to define the problem that you are trying to solve)
4. *Solution Method* (explain how you have implemented the Newton and Newton-type method (please also submit your code along with the report) and compare their convergence rates.
5. *Numerical Results* (plot/visualize and explain your numerical results)
6. *Conclusion* (summarize the highlights of your results)

Please do keep in mind that the particular topic of your project is less important as long as it has something to do with numerical optimization. We take into account creative ideas, good writing style (write in full, short sentences, avoid complicated grammar if possible, write in logical paragraphs, find good section/subsection titles), technical correctness, effective notation, impressive and meaningful visualizations that are explaining that highlight the key points and novelty of your results, etc.. Please do consult with the TAs, as they might give you examples for research papers/reports that are relevant for you and can help you to learn about scientific writing. Also, you might search in google/baidu or other search engines for “scientific writing”. Search for a scientific writing tutorial, e.g., from MIT or Stanford online courses (this is not strictly required for this course, but you will need this do to research!).