Technische Universität Chemnitz
Prof. Dr. R. Herzog, T. Etling, S. Richter, Dr. D. Shklyarov, A. Stötzner

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Optimization for Non-Mathematicians

Sheet 1

Exercise 1: Interactive `Matlab` – tutorial

Download the file `tutorial.m` from the class homepage and start `Matlab`. Type `echodemo tutorial` in the Command Window and work through the interactive tutorial.

Exercise 2: Introduction to `Matlab` – functions and plots

Use the template `my2Dplot.m` to plot the following functions and check if there exist minima, maxima or saddle points.

(a) Plot the quadratic function (`quadFct.m`)

$$f(x) = \frac{1}{2}x^\top Bx + g^\top x + c$$

with

$$B = \begin{pmatrix} 2 & 0 \\ 0 & 1 \end{pmatrix}, \quad g = \begin{pmatrix} -4 \\ -2 \end{pmatrix}, \quad c = 6.$$

for $x = (x_1, x_2) \in [-8, 12] \times [-8, 12]$. Try also other matrices:

$$B_2 = \begin{pmatrix} -2 & 0 \\ 0 & -1 \end{pmatrix}, \quad B_3 = \begin{pmatrix} 2 & 0 \\ 0 & -1 \end{pmatrix},$$

and calculate there eigenvalues with:
$\gg$ `eig(B)`

(b) Plot the Rosenbrock function (`rosenbrockFct.m`)

$$f(x_1, x_2) = (1 - x_1)^2 + 100(x_2 - x_1^2)^2$$

for $(x_1, x_2) \in [-3, 3] \times [-3, 3]$.

(c) Implement and plot the periodic function (`periodicFct.m`)

$$f(x_1, x_2) = \sin(x_1)\cos(x_2)$$

for $(x_1, x_2) \in [-2\pi, 2\pi] \times [-2\pi, 2\pi]$.