Main parts of the course

- Optimization terminology and convex optimization.
- Linear optimization and optimization of flows in networks.
- Quadratic optimization and least squares problems.
- Unconstrained and constrained nonlinear optimization.

On the next slides follows some of the main concepts from the course.

Optimization terminology and convex optimization

- Definition of optimization problem
  - Feasible point, Objective function
- Global optimum, Local optimum
- Feasible direction, Descent direction
- Convex set, Convex/Concave function
- Convex optimization problem
- Convex problem: local optimum $\Rightarrow$ global optimum

Linear optimization and Optimization of flows in networks

- Problem formulation linear programming
- Graphical solution
- Simplex method
  - Standard form, basic tuple, BS, BFS
  - Algorithm
  - Phase 1 problem
- Network and transport problem
- Fundamental subspaces of a matrix
- Duality for LP, Complementarity

Quadratic optimization (Quadratic programming, QP)

- Unconstrained QP
- Optimality condition
- Positive (semi)definite matrix
- LDLT factorization
- QP with equality constraints
  - Nullspace method
  - Lagrange method
- Least squares problems
- Pseudoinverse

Nonlinear optimization

- Unconstrained nonlinear optimization.
  - First and second order (necessary) optimality conditions
  - Newtons method (Line search, Approximate Hessian)
  - Gauss Newton
- Nonlinear optimization with constraints.
  - Optimality conditions for problems (KKT conditions)
    - with equality constraints
    - with inequality constraints
  - Regular point
  - Lagrange relaxation
    - Global optimality conditions (GOC)
    - Relaxed problem (PR_y)
    - Dual problem (D)
    - Weak duality
    - Strong duality, Convex regular problem

Homeworks and exam

The **final exam** takes place Wednesday 2018-01-10, 14-19.

You must register for the exam during 20 nov - 18 dec 2017. Use "My Pages".

- No aids except formula sheet (which is handed out)
- Total credit = exam score + homework score.
- The maximum exam score = 50. Maximum bonus from the homework sets = 4.
- You are guaranteed to pass if you get 25 credits.
- The tasks are written in English, but you may write your answers in either English or Swedish.

End of the course, what's next?

Courses given at the division

- SF2863 Systems Engineering (Per2)
- SF2812 Applied Linear Optimization (Per3)
- SF2822 Applied Nonlinear Optimization (Per4)
- SF2812 Mathematical Systems Theory (Per2)
- SF2842 Geometric Control Theory (Per3)
- SF2852 Optimal Control Theory (Per1)

Good luck on the exam!

Questions?