

# Lectures on Non-linear optimization

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*Size* 7.5 ECTS credits.

*Meetings* One meeting each week during the weeks 40–49.  
Each meeting consists of a *Lecture* and a *Discussion*.

- Literature*
- [BSS] Bazaraa, Sherali, Shetty  
*Non-linear programming*, Wiley, 2006
  - [KF] Koller, Friedman  
*Probablistic graphical methods*, MIT Press, 2009
  - [H] Hastie  
*Elements of Statistical Learning*, Springer, 2008
  - [LRV] Lundgren, Rönnqvist, Värnbrand  
*Optimization*, Studentlitteratur, 2010
  - [NW] Nocedal, Wright  
*Numerical optimization*, Springer, 2006
  - [N] Nilsson  
*Finita elementmetoden, en kort introduktion till teorin*, Högskolan i Halmstad, 2011
  - [E] Eriksson et al  
*Computational Differential Equations*, Studentlitteratur, 1996

*Examination* Laboration and Course project.

*Goal* To give Ph.D. students an opportunity to learn about Non-linear optimaization.

# Suggestion for a schedule

<i>Week</i>	<i>Occasion</i>	<i>Lecturer</i>	<i>Contents</i>
40	Lecture 1	EJ	<b>Basics.</b> [LRV, BSS, NW] Intro, working procedure, mathematical definitions, an example.
41	Lecture 2	EJ	<b>Convexity.</b> [BSS, LRV] Convex sets, convex functions, linear problems, Simplex method.
42	Lecture 3	EJ	<b>Optimization methods.</b> [LRV] Network optimization, non-linear optimization, constrained and unconstrained.
43	Lecture 4	EJ	<b>Numerical methods.</b> [NW] Line segment methods, trust region methods, conjugate region methods, finite difference methods.
44	Lecture 5	BN	<b>Finite Element method (FEM).</b> [N, E]
45	Laboration	MC	<b>Solving optimatization problems by FEM.</b> [N, E]
46	Lecture 6	EJ	<b>Probabilistic foundations.</b> [KF] Stochastic networks and likelihood inference.
47	Lecture 7	EJ	<b>Inference as optimization.</b> [KF] Combinatorial optimazation and search. Continuous optimization.
48	Lecture 8	EJ	<b>Discriminant analysis.</b> [H] Neural networks, support vector machines, random forests. Linear vs non-linear.
49	Seminar	EJ, MC	<b>Project seminar.</b>