# Avviso di corso di eccellenza

## *Interior Point Methods for Linear, Quadratic and Nonlinear programming*

Prof. Jacek Gondzio, University of Edinburgh, UK

Aula Buzano, Dipartimento di Matematica
20-28 ottobre

Il corso avrà una durata di 20 ore. La prima lezione è fissata per

**lunedì 20 ottobre alle ore 10:30**.

In calce al programma si riporta il calendario del corso. Per ulteriori informazioni contattare l'organizzatore del corso, Dott.ssa Sandra Pieraccini (pieraccini@calvino.polito.it).

**Description**
Interior point methods (IPMs) for linear, quadratic and nonlinear programming have been around for 20 years and have completely changed the field of optimization. In this course the lecturer will focus on their theory, implementation and applications.

**Jacek Gondzio** is Professor of Optimization at the School of Mathematics, University of Edinburgh, Scotland, UK. His research interests are the theory and implementations of large scale optimization methods, sparse matrix methods and parallel computing techniques in optimization. He has given significant contributions to the development of interior point methods for linear, quadratic and nonlinear programming (LP, QP, NLP), simplex-type methods and cutting plane methods for convex optimization. He developed two software packages for LP, QP, NLP: HOPDM (*Higher-Order Primal-Dual Method*), and OOPS (*Object-Oriented Parallel Solver*), well suited for very large optimization problems (up to millions of constraints and decision variables) displaying any special structure.

# Programme

L1: Convexity and its role in optimization
L2: Duality, Lagrangian duality, Wolfe's duality
L3: Geometric view of duality, Dual LP, Dual QP.
L4: IPM for LP: motivation
L5: IPM for LP: theory of the path-following method
L6: IPMs: form theory to practice
L7: IPM for QP
L8: Benefits of separable QP
L9: IPM for (convex) NLP
L10: More on Newton Method and logarithmic barriers. Self-concordant barriers
L11: Linear algebra issues: weighted least squares, normal equations, augmented system
L12: Positive definite, indefinite, quasidefinite systems primal-dual regularization, Cholesky factorization
L13: Exploiting sparsity in LU and LDLt factorizations. Reordering (minimum degree ordering, nested dissection)
L14: Very large scale problems, tree-sparsity patterns
L15: Markowitz portfolio optimization
L16: Financial planning problems
L17: Nonlinear programming: linesearch methods
L18: Nonlinear programming: trust region methods
L19: Data mining: Support Vector Machines
L20: Support vector machines with nonlinear kernel

# Timetable

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|---|---|---|
| Monday 20 | 10:30-12:30 | 14:30-16:30 |
| Tuesday 21 | 10:30-12:30 | 14:30-16:30 |
| Wednesday 22 | break | break |
| Thursday 23 | 10:30-12:30 | 14:30-15:30 |
| Friday 24 | 10:30-12:30 | 14:30-15:30 |
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| Monday 27 | 10:30-12:30 | 14:30-16:30 |
| Tuesday 28 | 10:30-12:30 | |