

**Scuola di Dottorato del Politecnico di Bari**

**Ph.D. School**

**Optimization and Control of Complex Systems**

**CFU: 3 (24 ore)**

**SSD: ING-INF/04**

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| **Goal** | This course aims at providing PhD students with modeling and methodological tools for formulating and solving optimization and control problems in the field of complex systems engineering.  During the course several optimization and control problems will be formalized, particularly referred to relevant issues within management and industrial engineering. Problem definition and resolution will be also implemented in simulation and engineering software.  At end of this course students will be able to deal with optimization and control of complex systems and to implement resolution techniques through simulation and engineering tools (Matlab).  The final goal is to provide PhD students with the necessary background for starting research in the field of optimization and control of complex system such as large-scale systems.  Each lesson consists in lectures, numerical examples, simulation and analysis of case studies. |
| **Program** | Non-linear optimization. Examples: resource distribution, task planning and scheduling problems.  Introduction to game theory. Connection of games theory with optimization and control.  Introduction to parallel and distributed computation. Parallelization and decomposition in optimization problems. Iterative methods for nonlinear problems.  Decision and control systems architecture: Centralized, Decentralized, Hierarchical and Distributed approach.  Decentralized optimization and control. Primal and dual decomposition. Motivating examples. Resource allocation in single and multi-period.  Hierarchical optimization and control. Multi-level programming. Motivating examples. Optimal planning for complex organizational structures in smart cities.  Distributed optimization and control. Motivating examples. Energy scheduling for large-scale systems in smart grids. |
| **References** | Başar T. & Olsder G. J., *Dynamic Noncooperative Game Theory*, SIAM Series in Classics in Applied Mathematics. Philadelphia, PA:SIAM, 1999  Bertsekas, D. P., & Tsitsiklis, J. N. (1989). *Parallel and distributed computation: numerical methods* (Vol. 23). Englewood Cliffs, NJ: Prentice Hall  Boyd S. & Vandenberghe L., *Convex Optimization*, Cambridge University Press, UK, 2004.  Slides and supporting material from the lecturer. |