



## **Michela Robba**

Associate professor

✉ michela@dist.unige.it

☎ +39 0103532748

☎ +39 01921945139

### ***Education and training***

**2004**

#### **PhD in Computer Science and Electronic Engineering**

Methods and models for sustainable groundwater planning and management

University of Genoa - Genoa - IT

**2000**

#### **MS in Environmental Engineering**

A decision support system for the planning and management of urban solid waste - 109/110 with publication award

University of Genoa - Genoa - IT

### ***Academic experience***

**2004 - 2012**

#### **Post-doc (5 years) researcher (3 years)**

University of Genoa - Genoa - IT

Project management lectures research

**2012 - ONGOING**

#### **Assistant Professor**

University of Genoa - Genoa - IT

Project management lectures research

### ***Work experience***

**2009 - 2012**

#### **Consultant**

PDC S.r.l. CIMA UNIGE RINA - Genoa - IT

biomass management auditor consultant research

### ***Language skills***

#### **English**

Proficient

#### **French**

Basic

## ***Teaching activity***

Actually I am Professor/Lecturer for the following courses at the Polytechnical School (University of Genoa):

- Modelling and Simulation of energy and environmental systems,
- Models and Methods for Energy Engineering

## ***Postgraduate research and teaching activity***

### **Supervision of PhD students, residents and post-doctoral fellows**

I am supervisor of two PhD students for the PhD in Computer Science and Systems Engineering

### **PhD committees membership**

Member of the board for the PhD in Computer Science and Systems Engineering

## ***Research interests***

The scientific career started in 2000 after obtaining the degree in Environmental Engineering. Since then, I continued the research line started during the master degree thesis: the integration between optimization/control issues and environmental/energy applications. The research activity has been mainly related to the development of methods and models for environmental and energy systems planning, management and control, through the methodologies of optimization, operation research, systems analysis and automation, integrated into GIS-based EDSSs (Environmental Decision Support Systems). Attention has been focused on the sustainable use of natural resources in order to satisfy demands, the different decision makers, minimize costs, minimize environmental impacts, protect ecosystems. The main applications include: models for integrated water management, renewable resources use for energy production, smart grids, waste management, electrical vehicles. In the following, the different research activities are briefly described:

***Optimal planning and control problems.*** The research activity has started with the formalization and solution of single-objective and multi-objective optimization problems, solved through mathematical programming techniques. Then, dynamic programming approaches, model predictive control approaches, multicriteria analysis, and complex optimal control models have been investigated. Attention is also focused on the optimal control of distributed systems (including approaches based on multi agent systems) and on the definition of hierarchical architecture for complex systems.

***Optimal control of smart grids, microgrids and electrical vehicles.*** The research has been focused on the planning and operational management of electrical grids with renewable resources and storage systems at different

spatial and temporal scales. Specifically, an innovative architecture has been developed that allows integrating electrical constraints and containing the runtime for real time optimal control. Moreover, as regard the local scale three main research themes have been investigated in strict connection with the research infrastructures owned by University of Genova thanks to National Projects (i.e., the Smart Polygeneration Microgrid funded by the Ministry of Research (2.4 M€), and the Sustainable Energy Building funded by the Ministry of Environment (3 M€)): the definition of models for grid-connected polygeneration microgrids; the control of systems based on photovoltaics and storage through Model Predictive Control (MPC) techniques and PLC (Programmable Logic Controllers) devices; the operational management of islanded microgrids under tertiary, secondary and primary control. For all application areas different models have been adopted with different approximations for thermal and electrical distribution networks, and for production and storage systems.

***Models for water resources use.*** The main efforts of the research activity have been focused on the formalization of decisions and on the integration and formalization of hydrological, hydraulic, chemical, ecological models through state equations. This means the formalization of optimization problems that can be solved through different techniques in connection with the complexity of the decision problem. Two kinds of decision problems are sought from the different problems: Planning problems (a long term strategy aiming at system configuration); Control problems (a short/medium term strategy to improve the existing systems through the application of all available knowledge for the use and conservation of water and soil resources).

***Models for renewable resources use for energy production.*** The research activity has been firstly focused on the definition of a GIS-based EDSS able to define planning and management strategies for the optimal use of forest biomass, agricultural scraps, and industrial and urban untreated wood residues for energy production. The optimization module is divided in three sub-modules able to face three different kinds of decision problems: the strategic planning level, the tactical planning level, and the operational level. Strategic level decisions refer to plant sizing and layout definition. Tactical level decisions refer to planning over a medium-short term horizon, generally considered within a discrete-time setting, within the assumption that the plant capacity and the sizing of all facilities are known. The operational level is based on the modelling of the supply-chain process as an ordered sequence of the operations to be performed for biomass collection and treatment. More recently, activity has been focused on the planning and control of a mix of renewable resources, with specific attention to the intermittent characteristics of resource availability, and planning and control both for decentralized and microgrid systems. Moreover, an effort has been made to identify the possible challenges for methods and models to estimate renewable resources potential, in collaboration with a network of international experts.

***Models for material recovery and energy production from solid waste.*** There are two main possibilities in order to recover the produced solid waste: material recovery and energy recovery. Material recovery can be performed

through separate collection, recycling of different materials, or through plants that separate specific materials or that transform the refuse into something that can be used. Energy production can be performed, through several kinds of plants, on different kinds of materials present in the refuse: organic material, untreated and treated waste, Refuse Derived Fuel, etc. The main objective is to define suitable strategies that can allow proper material recovery and energy production programs. Two kinds of decision models have been investigated: single-objective decision models for cost-benefit analysis, and multi-objective and multi-Decision Makers decision models.

## ***Editorial activity***

- Editorial Board Member for the international journal *Journal of Control Science and Engineering*
- Reviewer for the following international journals: Resources, Conservation and Recycling, INS-Information Sciences, Waste Management, Irrigation and Drainage, Water Resources Management, Journal of Environmental Management, Engineering Optimization, Decision Support Systems, IEEE Systems Journal, IEEE Transactions on Smart Grid, IEEE Transactions on Sustainable Energy, Energies, IEEE Transactions on Computers, International Journal of Life Cycle Assessment, International Journal of Operational research, Environmental Modelling and Software, Environmental Engineering and Management Journal, Energy, Energy Conversion and Management (2014), Journal of Sustainable Energy, Grids and Networks, Electrical Power and Energy Systems Research (2015), IEEE Transactions on Systems, Man, Cybernetics: Systems, Autosoft, IEEE Transactions on Automation Science and Engineering.
- Session Organizer and Chairman for the session “Renewable resources use for energy production) for conference IEMSS 2008 (Summit in Environmental Modelling and Software), Barcelona, July 2008.
- Member (and reviewer) of the International Program Committee of ICORES 2016 (“International Conference on Operations Research and Enterprise Systems”).
- Member (and reviewer) of the International Program Committee of ICORES 2017 (“International Conference on Operations Research and Enterprise Systems”).
- Chairman for session “Intelligent Control Systems and Optimization” at congress ICINCO 2009 (International Conference on Informatics in Control, Automation and Robotics), Milan.
- Session Organizer and Chairman for the conference IEMSS 2004 (Summit in Environmental Modelling and Software), Osnabrueck, 2004.
- Chairman for the conference IFAC WC 2011, Milano, 2011.
- Chairman for the conference IEEE EMS (European Modelling Symposium) 2013, for sessions “Parallel and Distributed Architectures and Systems”, “Internet Modelling, Semantic Web and Ontologies”,

and “Mobile/Ad hoc wireless networks, mobicast, sensor placement, target tracking”.

- Chairman for the conference IEEE MSC/CCA (IEEE Multi-Conference on Systems and Control/Conference on Control Applications) 2014 Antibes for the session “Grid Control”.
- Chairmain for the session “Optimization” at the congress IEEE ISSE (International Symposium on Systems Engineering), 2015.
- Reviewer for the PhD thesis “Optimal Design of Water Distribution Systems Using Agent Swarm Optimization” (Candidato: Idel Montalvo Arango; Supervisors: Prof. Joaquin Izquierdo Sebastian, Prof. Rafael Perez Garcia), University of Valencia, Spain, (2011).
- Member (and reviewer) of the International Program Committee of IFAC World Congress 2017.
- Reviewer and Member of the Commission for the PhD in Information Technology (Polytechnic school, Milano), 2016/2017.
- Evaluator for European Commission: COST action (<http://www.cost.eu/>) (2016/2017); ESFRI from 2014 ([https://ec.europa.eu/research/infrastructures/index\\_en.cfm?pg=esfri](https://ec.europa.eu/research/infrastructures/index_en.cfm?pg=esfri))
- Evaluator of project proposals: FWO-SBO (<http://www.fwo.be/en>)

### ***Assigments abroad***

Visiting student at MIT (Massachusetts Institute of Technology), University of Azores, University of Antwerp and University of Hawaii,