INTRODUCTION

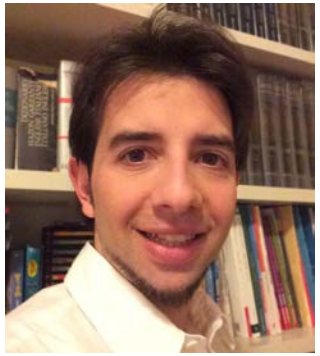
Intelligent collaborative robotics

Paolo Rocco, Andrea Zanchettin

About the instructors

Paolo Rocco is a full professor in automatic control and robotics at Politecnico di Milano.

- Chair of the BSc and MSc Programs on Automation and Control Engineering from 2013 to 2018.
- Senior Editor of the IEEE Robotics and Automation Letters and Associate Editor of the IFAC journal Mechatronics.
- Member of the Board of Directors of euRobotics; MADE, the Industry 4.0 Competence Center in Milano; I-RIM, the Italian Institute of Robotics and Intelligent Machines
- Co-founder of Smart Robots, a spin-off company of Politecnico di Milano



Andrea M. Zanchettin is an assistant professor in automatic control at Politecnico di Milano.

- Chair of the Italian Chapter of the IEEE Robotics and Automation Society (I-RAS);
- Associate Editor of the IEEE Transactions on Robotics;
- Co-founder of Smart Robots, a spin-off company of Politecnico di Milano

Aim of the course

- A broad overview on human-robot interaction and specifically on how collaborative robots can be employed safely, intelligently, and adaptively, with humans.
- An extensive discussion of modelling and control tools for robotic manipulators in interaction with the environment, and specifically with the human, with an eye to the safety standards applicable to human-robot collaboration.
- A presentation of algorithms for cognitive interaction between the robot and the human, leveraging machine learning techniques to fully implement the new paradigm of intelligent collaborative robotics.

Schedule of the course

Thursday, July 18

- 09:00-10:30: Review of robotics: introduction on robotics, direct, inverse and differential kinematics
- 11:00-12:30: Review of robotics: dynamics, motion planning
- 15:00-16:30: Collaborative robotics: introduction, motivations, classifications, applications, modes of collaboration.
- 17:00-18:30: Hand guiding: force reconstruction, admittance/impedance control, virtual fixtures

Friday, July 19

- 09:00-10:30: Speed and separation monitoring: sensors, methods for velocity scaling, danger field
- 11:00-12:30: Power and force limitations: contact modelling and classification, energy-related control algorithms
- 15:00-16:30: Intelligent collaboration: introduction, classification and prediction algorithms
- 17:00-18:30: Intelligent collaboration: application to selected problems (human walking, reaching target classification, human action prediction)

Saturday, July 20

- 09:00-10:30: Intelligent collaboration: scheduling of robot actions based on classification and prediction of human actions
- 11:00-12:30: A case study: an industrially relevant case study in intelligent collaborative robotics

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