Francesco Tassi

Robotics and Control Engineer
Istituto Italiano di Tecnologia, Genova
PhD Student - Politecnico di Milano

Born in Catanzaro, Italy, 15/05/1993
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Experience

2.2020 - 2.2023 **PhD Student**
Istituto Italiano di Tecnologia - IIT, Genoa, Italy
HRI^2 - Human-Robot Interfaces and Physical Interaction (iit.it/hrii)

- **Hierarchical Optimal Control** strategies in Human-Robot Collaboration for **multi-tasking** through **redundant robots**.
- **Adaptive compliance** control algorithms for **Human-Robot Interaction**
- Dynamic **teleoperation** of redundant robots through hierarchical control.
- Optimal QP-based motion **planning** and **whole-body impedance** control.

9.2018 - 1.2020 **Research Fellow**
CNR - National Research Council, Milan, Italy
STIIMA - Intelligent Industrial Technologies for Advanced Manufacturing

- *Adaptive* Model Predictive Control (**MPC**) for real-time control of redundant robots.
- *Time-Varying* **MPC** for nonlinear systems, with varying system dynamics throughout the control horizon.

9.2017 - 3.2018 **Jet Propulsion Laboratory - NASA**
California Institute of Thechnology, Pasadena
M.Sc in Robotics and Mechatronics Engineering - Graduation Thesis:
Lagrangian and Eulerian Multi-Scale Control of a Distributed Multibody Robotic System
Supervisor: Prof. Francesco Braghin
JPL Mentor: Dr. Marco B. Quadrelli

Description: Modeling and control of a multibody robotic system, for the realization of an orbiting space-based observatory with large aperture and reconfigurable structure.
Topics: Model Predictive Control (**MPC**), potential fields, path planning, Kalman filtering and optimal estimation, Sequential Convex Programming (**SCP**), Optimal Transport, Deterministic vs Stochastic control.

Latest Publications

F. Tassi, E. De Momi, and A. Ajoudani **"An Adaptive Compliance Hierarchical Quadratic Programming Controller for Ergonomic Human-Robot Collaboration"**, Robotics and Computer-Integrated Manufacturing, Volume 78, 2022, 102381, ISSN 0736-5845, https://doi.org/10.1016/j.rcim.2022.102381.

F. Tassi, F. Iodice, E. De Momi, and A. Ajoudani, **"Sociable and Ergonomic Human-Robot Collaboration through Action Recognition and Augmented Hierarchical Quadratic Programming,"**, 2022 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2022.

F. Tassi, S. Gholami, S. Giudice and A. Ajoudani, **"Impact Planning and Preconfiguration based on Hierarchical Quadratic Programming,"** 2022 International Conference on Robotics and Automation (ICRA), 2022, pp. 1433-1439, doi: 10.1109/ICRA46639.2022.9811681

F. Tassi, E. De Momi and A. Ajoudani, **"Augmented Hierarchical Quadratic Programming for Adaptive Compliance Robot Control,"** 2021 IEEE International Conference on Robotics and Automation (ICRA), 2021, pp. 3568-3574, doi: 10.1109/ICRA48506.2021.9561506.

F. Tassi, S. Gholami, E. De Momi and A. Ajoudani, **"A Reconfigurable Interface for Ergonomic and Dynamic Tele-Locomanipulation,"** 2021 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2021, pp. 4260-4267, doi: 10.1109/IROS51168.2021.9636775.

M. B. Quadrelli, R. Hodges, V. Vilnrotter, S. Bandyopadhyay, **F. Tassi**, S. Bevilacqua, **"Distributed Swarm Antenna Arrays for Deep Space Applications"**, IEEE Aerospace Conference, Big Sky, MT, Mar. 2019.

J. Zhao, G. J. Lahr, **F. Tassi**, A. Santopaolo, E. De Momi, and A. Ajoudani, "**Impact-Friendly Object Catching at Non-Zero Velocity based on Hybrid Optimization and Learning**," 2023 International Conference on Robotics and Automation (ICRA), 2023. [SUBMITTED] arXiv preprint arXiv:2209.12563.

F. Tassi, and A. Ajoudani, **"A Hierarchical Quadratic Programming Framework for Hybrid Impedance/Admittance and Force Control,"**, 2022 IEEE Transition on Robotics [SUBMITTED]. Online preview: tinyurl.com/2prtnsjh

Education

2.2020 - 2.2023 **PhD, Politecnico di Milano**
Carried out at: Istituto Italiano di Tecnologia - IIT, Genova, Italy
Supervisors: E. De Momi, A. Ajoudani.

9.2016 - 4.2018 **Politecnico di Milano**
M.Sc in Mechanical Engineering
Specialization: Robotics and Mechatronics Engineering
Mark: 105/110 (Cumulative GPA: 3.8)

Major projects:

- **Modelling and Control of a Magnetic Levitation System (MagLev)**
  Linear and nonlinear optimal control and estimation (LQR, gain scheduling, Kalman filtering, feedback linearization etc.)

- **Design and Control of a 4DOF Pick and Place Robot Manipulator**
  Robot design and 3D printing, kinematic and dynamic analysis, control and obstacle avoidance.
- **Modeling and control of a nonlinear system**
  (cascaded control, deterministic and stochastic observers, anti-windup, digital controller realization).
- **Electrical Motors for Industry and Transport Applications**

9.2012 - 7.2016 **Politecnico di Milano**
B.Sc in Mechanical Engineering

2007 - 2012 **Liceo Scientifico - Luigi Siciliani**
Catanzaro - Italy
High School Diploma

Teaching Experience

Robotics Basics and Research Environment,
Scientific High School - 15th June 2022, Genoa, Italy

Schools

Summer School on Autonomous Mobile Robotics in the framework of Industry 4.0, Lecce, Italy. June 13-18, 2022.

DeepLearn 2021 Summer School
4^{th} International School on Deep Learning. Gran Canaria, Spain, July 26-30, 2021.

39^{th} **Annual School in Bioengineering**
"AI-enabled health care: from decision support to autonomous robots".
Bressanone, September 7 – 10, 2020.

Cognitive Robotics for Human-Robot Interaction
Prof A. Sciutti, F. Rea, A. Vignolo.
University of Genoa, June 22 – 26, 2020.

Languages and Certificates

Italian (native), English (advanced, CEFR level: C1):
- Cambridge English: Certificate in Advanced English (CAE) - C1 Level - June 2012
- Cambridge English: First Certificate in English (FCE) - 2011
- Cambridge English: Preliminary English Test (PET) - 2008
- Cambridge English: Key English Test (KET) - 2007

French (scholastic)

Scientific Communication in English
Prof. T. Sluckin, University of Southampton, 15-30 March 2021

Technical-Scientific Writing Course
Prof. E. Matricciani,
National Research Council (CNR), Milan, 5-7 November 2019

Computer Skills

Programming Languages/Middleware (proficient):
C++, Python, Matlab/Simulink, ROS (ROS Control, Rviz, Gazebo, MoveIt!)

Hardware:
Franka Emika Panda 7DOF Manipulator, Robotnik Steel mobile base, Kuka LWR4+, PISA/IIT SoftHand, SCHUNK PRL-Plus manipulator, SCHUNK EGP parallel gripper, TurtleBot2, Robotiq grippers, NVIDIA Jetson Tx2.

Optimization Solvers:
Alglib, osqp, qpOASES, quadprog, gurobi.

Mechanical Design:
CATIA, Autodesk Inventor, Solid Works, Abaqus, Solid Edge.

Operating Systems:
GNU/Linux, Windows.

Word processing applications:
LaTeX, LibreOffice, Microsoft Office, Mathematica.

Other Software:
Slic3r, Arduino, Kdenlive, Adobe Premiere, Adobe Photoshop.

Personal Skills

- Willing to learn and challenge myself
- Open to new experiences and relations
- I enjoy working in a stimulating environment

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