Gennaro Raiola

Curriculum Vitae

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🖥 https://github.com/graiola

Fields of interest

Robotics, programming, human-robot interaction, motion control, force control, impedance control, inverse kinematics, DevOps.

Profession

09/2019–
Present
Post-Doc, *Jet Propulsion Laboratory (NASA-JPL)* 🌍, Pasadena, CA, United States.

At JPL I worked on demonstration of autonomous berthing, assembly and installation of scientific payloads using the robotic platform PROPS.

○ Autonomous berthing:
- created a state estimator to track the full pose and velocity of an incoming payload using Kalman filtering via a fiducial detector,
- developed a new module for casah2 to generate coordinated motions for the robotic arm in order to intercept and dock the incoming payload by means of inverse kinematics and force control,
- performed experiments in preparation for the paper *Validating an Architecture for Robotic Assembly and Servicing of Hosted Payloads on a Persistent Platform*,
- gained experience with the casah2 software architecture and the m3tk simulation software,
- integrated some of the functionalities of casah2 with the robotic operating system (ROS).

○ Autonomous assembly:
- developed code to perform assembly of instruments with PROPS using fiducial movements for localization and positioning of the instrument and force control for interaction,
- performed two demos in which the robot is able to autonomously assemble a starshade and a satellite dish,
- created new modules and autonomous behaviors for casah2.

09/2017– **Post-Doc**, *Istituto Italiano di Tecnologia (IIT)* ✆, Genoa, Italy.
06/2019 During my work at IIT, I had the opportunity to work on several aspects of the
development and maintenance of software and electronics for the quadruped robots
HyQ and HyQReal ⊙.
- Developed a real-time control framework and communication system with Ether-
CAT,
- developed the software control architecture with ROS-Control, in order to make
the robot capable of executing different types of gaits (e.g. crawl, trot, etc.)
in complex and changing terrains,
- developed the low level safety software layer to protect the robot hardware and
human operators.
- DevOps processes, including:
  - creating and maintaining fully automated CI/CD pipelines for code testing
  and deployment using GitLab-CI,
  - deploying apt servers to track the software dependencies,
  - developing Docker containers for code testing and development.
- Sensor integration and calibration for the HyQReal robot.
- Research work to create a novel whole-body locomotion framework for
quadrupedal robots using inverse dynamics and task optimization which led
to the publication of the journal paper *A simple yet effective whole-body loco-
motion framework for quadruped robots* (currently under review) ⓞ.
- Collaboration with external work groups such as Moog and Vodafone to de-
fine the requirements and functionalities of the robots for various real-world
scenarios.

03/2017– **Post-Doc**, *Robotics and Mechatronics group, University of Twente* ✆, En-
07/2017 schede, The Netherlands.
At the University of Twente, I worked on the development of a safety- and energy-
aware impedance controller for the KUKA LWR 4+ robotic arm ⊙.
- publication of the journal paper *Development of a Safety and Energy Aware
Impedance Controller for Collaborative Robots* on IEEE Robotics and Automa-
tion Letters which was selected for presentation at ICRA 2018.

01/2016- **Ph.D. student in Robotics**, *CEA-List (French Alternative Energies and
12/2016 Atomic Energy Commission - Laboratory for Integration of Systems and Tech-
nology)* ✆, Gif-sur-Yvette, France.
During the last year of my PhD, I had the opportunity to transfer my research
results to a startup at CEA-List (ISybot).
- development of a force controller to generate virtual guides through kinesthetic
teaching to be used within the software framework of the startup's collaborative
robot ⊙, ⓞ.

05/2013– 12/2013	**Research Engineer in Motion Control of Humanoid Robots**, *PAL Robotics S.L.* 🌍, Barcelona, Spain.
	At PAL Robotics, I worked on a team to design and test the ROS-Control package. The aim of ROS-Control is to implement a Hardware Abstraction Layer for different kinds of robots (e.g. humanoids, manipulators, mobile robots, etc.) ⚙.

○ implemented via ROS-Control an inverse kinematics controller with task optimization for REEM-H and REEM-C robots in collaboration with LAAS-CNRS in France ⏵.

09/2012– 02/2013	**Intern**, *ENSTA-ParisTech and UPMC-ISIR* 🌍, Paris, France.
	I developed a library in Matlab and C++ to generate motion primitives and perform skill optimization for humanoid robots (MEKA, NAO, ICub and Pepper) ⚙. This library has been successfully used with the SoftBank robot Pepper to learn and play the "ball in the cup" dexterous game ⏵.

Education

2014-2016	*Ph.D. student in Robotics* @ Université Paris-Saclay, Palaiseau, France. 🌍.
2009-2012	*Master's Degree (M.Sc) with honor in Automation and Control Engineering* given by the University of Naples "Federico II", Naples, Italy.
2006-2009	*Bachelor's Degree (B.Sc) in Computer Engineering* given by the University of Naples "Federico II", Naples, Italy.

Technical skills

○ Proficient in the following programming languages: C, C++ and Matlab

○ Competent with Python and Bash scripting.

○ Competent with Qt, Eigen and ROS

○ Excellent knowledge of GIT.

○ Excellent knowledge of CMake and Makefile for managing the build process of software and Doxygen for code documentation.

○ Competent with Docker and Virtual Machines deployment for testing and development.

○ Deep knowledge of Linux-based operating systems (Ubuntu, Kali, Debian).

○ Experienced with real time operating systems (RTAI Linux, Xenomai Linux, RT-PREEMPT), Kernel configuration and EtherCAT.

Publications

Journals

2020	**G. Raiola**, E. Mingo Hoffman, M. Focchi, N. Tsagarakis, C. Semini. "A simple yet effective whole-body locomotion framework for quadruped robots". *Under review at Frontiers in Robotics.*

2019   R. Orsolino, M. Focchi, S. Caron, **G. Raiola**, V. Barasuol, C. Semini.
        "Feasible Region: an Actuation-Aware Extension of the Support Region". 📄
        IEEE Transactions on Robotics.

2019   F. Stulp, **G. Raiola**.
        "DmpBbo: A versatile Python/C++ library for Function Approximation, Dynamical Movement Primitives, and Black-Box Optimization". 📄
        The Journal of Open Source Software.

2018   Susana Sánchez Restrepo, **Gennaro Raiola**, Joris Guerry, Evelyn D'Elia, Xavier Lamy and Daniel Sidobre.
        "Towards an Intuitive and Iterative 6D Virtual Guides Programming Framework for Human-Robot Comanipulation". 📄
        Robotica.

2017   **Gennaro Raiola**, Carlos Cardenas Alberto, Tadele Shiferaw Tadele, Theo De Vries, Stefano Stramigioli.
        "Development of a Safety and Energy Aware Impedance Controller for Collaborative Robots". 📄
        In *IEEE Robotics and Automation Letters.*
        The contents of this paper were also selected by ICRA'18 Program Committee for presentation at the Conference.

2017   S. Chitta, E. Marder-Eppstein, W. Meeussen, V. Pradeep, A. Rodriguez Tsouroukdissian, J. Bohren, D. Coleman, B. Magyar, **G. Raiola**, M. Ludtke and E. Perdomo Fernandez.
        "ros_control: A generic and simple control framework for ROS". 📄
        The Journal of Open Source Software.

2017   **Gennaro Raiola**, Susana Sanchez Restrepo, Pauline Chevalier, et al.
        "Co-manipulation with a Library of Virtual Guiding Fixtures". 📄
        Autonomous Robots, Special Issue on Learning for Human-Robot Collaboration.

Conferences

2017   Pauline Chevalier, **Gennaro Raiola**, Brice Isableu, Jean-Claude Martin, Christophe Bazile and Adriana Tapus.
        "Do Sensory Preferences of Children with Autism Impact an Imitation Task with a Robot?".
        Conference on Human-Robot Interaction (HRI).

2017   Susana Sanchez Restrepo, **Gennaro Raiola**, Pauline Chevalier, Xavier Lamy, and Daniel Sidobre.
        "Iterative Virtual Guides Programming for Human-Robot Comanipulation". 📄
        IEEE International Conference on Advanced Intelligent Mechatronics (AIM).

2015   **Gennaro Raiola**, Xavier Lamy, and Freek Stulp.
"Co-manipulation with Multiple Probabilistic Virtual Guides". 📄
International Conference on Intelligent Robots and Systems (IROS).

2015   **Gennaro Raiola**, Pedro Rodriguez-Ayerbe, Xavier Lamy, Sami Tliba, and
Freek Stulp.
"Parallel Guiding Virtual Fixtures: Control and Stability". 📄
IEEE Multi-Conference on Systems and Control (MSC).

2014   Freek Stulp, Laura Herlant, Antoine Hoarau, and **Gennaro Raiola**.
"Simultaneous On-line Discovery and Improvement of Robotic Skill". 📄
International Conference on Intelligent Robots and Systems (IROS).

2013   Freek Stulp, **Gennaro Raiola**, Antoine Hoarau, Serena Ivaldi, and Olivier
Sigaud.
"Learning Compact Parameterized Skills with a Single Regression". 📄
IEEE-RAS International Conference on Humanoid Robots.

Languages

italian	native proficiency
english	professional working proficiency
french	limited working proficiency