

# 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 EtherCAT,
  - 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 locomotion framework for quadruped robots* (currently under review) 🌐.
  - Collaboration with external work groups such as Moog and Vodafone to define the requirements and functionalities of the robots for various real-world scenarios.
- 03/2017– **Post-Doc**, *Robotics and Mechatronics group, University of Twente* 🌐, Enschede, The Netherlands.
- 07/2017 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 Automation Letters which was selected for presentation at ICRA 2018.
- 01/2016– **Ph.D. student in Robotics**, *CEA-List (French Alternative Energies and Atomic Energy Commission - Laboratory for Integration of Systems and Technology)* 🌐, Gif-sur-Yvette, France.
- 12/2016 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 🌐.

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## 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**, *University of Naples "Federico II"*, Naples, Italy.

2006–2009 **Bachelor's Degree (B.Sc) in Computer Engineering**, *University of Naples "Federico II"*, Naples, Italy.

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## 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.

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## 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*.

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## Languages

italian native proficiency  
english professional working proficiency  
french limited working proficiency