Marco Ferro
Curriculum Vitae

Email: marco.ferro@irisa.fr

Birth date: 17 February 1991
Address: IRISA, INRIA Rennes – Bretagne Atlantique
            Campus Universitaire de Beaulieu
            35042 Rennes, France

Languages: ITALIAN (MOTHER TONGUE), ENGLISH (C1), FRENCH (B2)

RESEARCH

Postdoctoral Researcher — September 2022 - Present

Institut de Recherche en Informatique et Systèmes Aléatoires (IRISA) de Rennes

Active robotic estimation for optimizing the exposure to electromagnetic fields generated by 5G networks (CominLabs EM-ART project). Development of shared control techniques for medical applications based on micro-scale magnetic multi-robot systems (European project RĔGO), being Leader of Word Package 3 "Cognitive human-robot interfacing and interactions" (230 Persons Months).

Postdoctoral Researcher — Jun. 2019 - August 2022

Sapienza University of Rome

Research activity focused on the estimation and rendering of needle-tissue interaction forces, as well as the robotic optimization of thermal applicator placement for therapeutic hyperthermia. Mentoring and assistance for engineering students in Medical Robotics and UAV control.

Work contract — Sept. 2019

MEDLOGIX s.r.l.

Design and implementation of a multi-threaded C++ framework for robotic oncological hyperthermia treatments, utilizing an optical tracking system, a robotic platform, and a virtual environment.

Work contract — Jan. - Feb. 2019

Sapienza University of Rome

Realization of an integrated teleoperation simulator for the da Vinci surgical robotic platform: implementation of software for virtual teleoperation through haptic interfaces and a virtual reality headset.

Visiting Researcher — 2018

Institut de Recherche en Informatique et Systèmes Aléatoires (IRISA) de Rennes

One semester of research activity conducted in Rennes, France. Analysis and planning of a framework to solve a *Structure-from-Motion* problem using active visual perception. Collaboration in an international context.

Stage — 2015

Laboratoire d'Informatique, de Robotique et de Microelectronique de Montpellier (LIRMM)

Preparation of the Master's thesis conducted in Montpellier, France. Analysis and control of an autonomous vehicle navigation system driven by the humanoid robot HRP-4.

TEACHING

Tutor in Industrial processes automation — May 2019 - Present

University UNINETTUNO

Assisting activity to Master students of Management Engineering. Preparation and correction of exams (4 years, ∼70 hours per year). Course level: M1. Language: Italian.

Tutor in Medical Robotics — 2017 - 2022

Sapienza University of Rome

Tutoring and assistance for students in Artificial Intelligence and Robotics and Biomedical Engineering, for the development and presentation of projects for the final examination (5 years, ∼11 hours per year). Course level: M2. Language: English.

Tutor in UAV modeling and control — 2016 - 2022

Sapienza University of Rome

Tutoring and assistance for students in Artificial Intelligence and Robotics and Control Engineering, for the development and presentation of projects for the final examination (6 years, ∼11 hours per year). Course level: M2. Language: English.

Tutor in Operational Research `Jan 2020`

Université de Lorraine, Nancy, France

Tutoring and assistance activity for preparatory class students through *Travaux Dirigés* (TD). Language: English.

SUPERVISION OF STUDENTS AND EARLY-STAGE RESEARCHERS

Leon Raphalen `September 2023-present`

PhD Candidate at IRISA, Rennes

Research subject: Haptic shared control for multiple microrobot systems;

Brief presentation: The research activities will regard the development of different haptic shared control strategies to achieve challenging tasks with multiple microrobots (navigation, micromanipulation), guaranteeing optimality control requirements (e.g., safety);

Amount of supervision (so far): ∼2h/week x 14 months = ∼128h;

Paul Mefflet `April 2024-present`

CIFRE PhD Candidate at IRISA, Rennes

Research subject: Trajectory optimization for manipulation tasks using Quadratic Programming;

Brief presentation: The research activities will regard the development of control methodologies to optimize the trajectory of robotic systems to accomplish arbitrary manipulation tasks, while guaranteeing specific requirements and constraints (e.g., safety, feasibility);

Amount of supervision (so far): ∼2h/week x 11 months = ∼88h;

Sara Rossi `2023`

M.Sc. Student of Artificial Intelligence and Robotics at Sapienza University of Rome

Research subject: Haptic feedback for robot-assisted needle insertion medical procedures;

Brief presentation: The research activity investigated the role and effectiveness of different types of haptic feedback in presenting relevant feedback information during needle insertion in soft tissues through a remotely operated robot. The importance lies in the identification of adequate feedback strategies to cope with clinician's lack of perception capabilities during robot-assisted procedures;

Master Thesis: "Deconstructing haptic feedback information in robot-assisted needle insertion in soft tissues". The thesis is not available, but a publication on an international journal has been realized and is available here;

Amount of supervision: ∼6h/week x 6 months = ∼144h;

Valerio Gioffrè `2022`

M.Sc. student of Control Engineering at Sapienza University of Rome

Research subject: Interaction control during robot-assisted hyperthermia medical treatments;

Brief presentation: The research focused on the design and development of interaction control strategies (e.g., impedance and admittance control) during the accomplishment of robot-assisted hyperthermia treatments, framed within the activities of ROBHOT project, belonging to the Digital Innovation Hubs in Healthcare Robotics (DIH-HERO) European framework;

Master Thesis: "Patient-robot physical interaction control for robot-delivered hyperthermia treatments". The thesis is not available, but a publication on an international journal is currently under review;

Amount of supervision: ∼6h/week x 6 months = ∼144h;

Alessandro Mirante `2022`

M.Sc. student of Control Engineering at Sapienza University of Rome

Research subject: Identification and simulation of dynamic model of the da Vinci Research Kit (dVRK) surgical robot;

Brief presentation: The research addressed the design of a physics-based dynamic simulator of the dVRK robot, integrating the robot kinematic and dynamic properties in a virtual environment. The availability of a reliable robot simulator is crucial for developing new research ideas and to reduce costs of training sessions for clinicians;

Master Thesis: "A dynamic simulator for the da Vinci Robotic Surgery System". The thesis is not available, but a publication on an international journal has been realized and is available here;

Amount of supervision: ∼6h/week x 6 months = ∼144h;

Damiano Brunori, Federico Magistri, Lorenzo Saiella `2019`

M.Sc. students of Artificial Intelligence and Robotics at Sapienza University of Rome

Research subject: Virtual Reality-enabled simulator of the da Vinci Research Kit surgical robot;

Brief presentation: The research involved the integration of a robotic simulator of the dVRK robot, with haptic interfaces and virtual reality headset, to replicate and extend the functionalities of the Master console. The complete system represents an efficient, safe and low-cost tool, useful to design and validate new surgical instruments and control strategies;

Final project for Medical Robotics course: "A Portable da Vinci Simulator in Virtual Reality". A publication on an international conference has been realized and is available here;

Amount of supervision: ∼6h/week x 3 months = ∼72h.

EDUCATION

Ph. D. in Automatica, Bioingegneria e Ricerca Operativa 2015-2018
Sapienza University of Rome

Research activity in vision-based robot navigation, object pose estimation and Structure-from-Motion problems. Educational activity in taking lectures for groups of Master students and managing students' exam projects.

Thesis: Vision-based methods for state estimation and control of robotic systems with application to mobile and surgical robots. (pdf)

M.Sc. in Artificial Intelligence and Robotics 2012-2015
Sapienza University of Rome

Master in English. Focus on Robotics, A.I., Machine Learning, Computer Graphics and Vision. Analysis and control of industrial, mobile, aerial and surgical robots. Robot programming and simulation. Reinforcement learning. Microcontroller system design.

Final grading: 110/110 cum laude

Thesis: Vision-based navigation for vehicles autonomously driven by humanoid robots.

B.Sc. in Computer Engineering 2009-2012
University of Naples Federico II

Basics of Maths and Physics. Electronics, Programming, System Theory and Automation. Operating Systems and Computer networks.

Final grading: 104/110

PROFESSIONAL SERVICE

- Co-organizer (with V. Iacovacci, S. Misra, and P. Robuffo Giordano) of the Workshop on Empowering Humans with miniaturized control: Shared Autonomy for Small-Scale Robots (SASSR), at IEEE International Conference on Robotics and Automation (ICRA), Atlanta, USA, 2025.

- Associate Editor for the 2025 IEEE International Conference on Robotics and Automation (ICRA 2025).

- Associate Editor for the 2024 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2024).

- Co-organizer for the Special Issue *Visual and Haptic Cues for Physical Human-Robot Interaction and Co-Manipulation* at the IEEE International Conference on Robot and Human Interactive Communication, held in August 2023 in Busan, Korea.

- Member of the International Program Committee for the 5th IEEE International Conference on Robotic Computing (IRC 2021), Virtual Conference, 2021.

- Member of the International Program Committee for the 4th IEEE International Conference on Robotic Computing (IRC 2020), held in Taichung, Taiwan, 2020.

AWARDS

- *Qualification de droit commun*, from French National Council of Universities (*Conseil National des Universites*), allowing to be eligible for an application as *Maître de Conferences* in French Universities, 2020.

- "Avvio alla Ricerca 2020" Starting Research funding from Sapienza University of Rome for the Project: "*Interaction force estimation methods in teleoperated robot-assisted clinical procedures through a Digital Twin paradigm*", 2020.

PUBLICATIONS

International Journals

1. M. Ferro, F. N. Piñan Basualdo, P. R. Giordano, S. Misra, and C. Pacchierotti, "*Haptic Shared Control of Pairs of Electromagnetic Untethered Microrobots*", in IEEE Transactions on Automation Science and Engineering, 2024, doi: 10.1109/TASE.2024.3477308.

2. L. Kuang, M. Malvezzi, M. Ferro, D. Prattichizzo, P. R. Giordano, F. Chinello, and C. Pacchierotti, "*A 4-DoF Wearable Hand Device for Haptic Rendering of Surfaces and Edges*", in Mechatronics, 2023. doi: 10.1016/j.mechatronics.2024.103173.

3. L. Kuang, M. Ferro, M. Malvezzi, D. Prattichizzo, P. R. Giordano, F. Chinello, and C. Pacchierotti, "*A Wearable Haptic Device for the Hand with Interchangeable End-Effectors*", in IEEE Transactions on Haptics, pp. 1-11, June 2023, doi: 10.1109/TOH.2023.3284980.

4. M. Ferro, C. Pacchierotti, S. Rossi and M. Vendittelli, "*Deconstructing Haptic Feedback Information in Robot-Assisted Needle Insertion in Soft Tissues*," in IEEE Transactions on Haptics, 2023, pp. 1-7, April 2023, doi: 10.1109/TOH.2023.3271224.

5. M. Ferro, A. Mirante, F. Ficuciello and M. Vendittelli, "*A CoppeliaSim Dynamic Simulator for the Da Vinci Research Kit*". IEEE Robotics and Automation Letters, vol. 8, no. 1, pp. 129-136, Jan. 2023, doi: 10.1109/LRA.2022.3222994.

6. M. Ferro, C. Gaz, M. Anzidei and M. Vendittelli, "*Online Needle-Tissue Interaction Model Identification for Force Feedback Enhancement in Robot-Assisted Interventional Procedures*". IEEE Transactions on Medical Robotics and Bionics (T-MRB), vol. 3, no. 4, pp. 936-947, Nov. 2021, doi: 10.1109/TMRB.2021.3118304.

7. M. Ferro, A. Paolillo, A. Cherubini and M. Vendittelli, "*Vision-based navigation of omnidirectional mobile robots*". In IEEE Robotics and Automation Letters, vol. 4, no. 3, pp. 2691-2698, July 2019, doi: 10.1109/LRA.2019.2913077.

8. G. A. Fontanelli, M. Selvaggio, M. Ferro, F. Ficuciello, M. Vendittelli and B. Siciliano, "*Portable dVRK: an augmented V-REP simulator of the da Vinci Research Kit*". In Acta Hungarica Polytechnica, ISSN 1785-8860. - 16:8, pp. 79-98, 2019, doi: 10.12700/APH.16.8.2019.8.6.

International Conferences

1. (*Under review*) L. Raphalen, M. Ferro, S. Misra, P. R. Giordano and C. Pacchierotti, "*Haptic Shared Control of a Pair of Microrobots for Telemanipulation using Constrained Optimization*", submitted in IEEE International Conference on Robotics and Automation 2025 (ICRA 2025).

2. M. Ferro, P. Pavoni, and M. Vendittelli, "*Robot-assisted superficial hyperthermia treatments: the ROBHOT system*", in IEEE International Conference on Automation Science and Engineering, 2024, doi: 10.1109/CASE59546.2024.10711644.

3. A. Cristofaro, M. Ferro, F. Galasso, M. Mizzoni, A. Pacciarelli and M. Vendittelli, "*Combining 3D Planning and Control Barrier Functions for Safe Motion of Quadrotor UAVs Among Obstacles*". 2023 9th International Conference on Control, Decision and Information Technologies (CoDIT), Rome, Italy, 2023, pp. 2445-2450, doi: 10.1109/CoDIT58514.2023.10284394.

4. A. Cristofaro, M. Ferro and M. Vendittelli, "*Safe trajectory tracking using closed-form controllers based on control barrier functions*". 2022 IEEE 61st Conference on Decision and Control (CDC), Cancun, Mexico, 2022, pp. 3329-3334, doi: 10.1109/CDC51059.2022.9992322.

5. M. Ferro, S. Ciampa, F. R. Cappelli, E. Pagliaroli, A. Soriani, M. Vendittelli, "Marker-based registration for antenna positioning in superficial hyperthermia". 13th International Congress of Hyperthermic Oncology, 2021.

6. L. Saiella, A. Cristofaro, M. Ferro and M. Vendittelli, "*Fault-tolerant formation control of a team of quadrotors with a suspended load*", 2021 International Conference on unmanned aircraft systems, Athens, Greece, 2021, pp. 1-9, doi: 10.1109/ICUAS51884.2021.9476749.

7. M. Ferro, D. Brunori, F. Magistri, L. Saiella, M. Selvaggio, G. A. Fontanelli, "*A portable da Vinci simulator in virtual reality*". In 2019 Third IEEE International Conference on Robotic Computing (IEEE IRC), Naples, Italy, 2019, pp. 447-448, doi: 10.1109/IRC.2019.00093.

8. G. A. Fontanelli, M. Selvaggio, M. Ferro, F. Ficuciello, M. Vendittelli and B. Siciliano. "*A V-REP Simulator for the da Vinci Research Kit Robotic Platform*". In 7th IEEE RAS/EMBS International Conference on Biomedical Robotics and Biomechatronics, Enschede, The Netherlands, 2018, pp. 1056-1061, doi: 10.1109/BIOROB.2018.8487187.

9. M. Ferro, A. Paolillo, A. Cherubini, M. Vendittelli. "*Omnidirectional humanoid navigation in cluttered environments based on optical flow information*". In 16th IEEE-RAS International Conference on Humanoid Robots, Cancún, Mexico, 2016, pp. 75-80, doi: 10.1109/HUMANOIDS.2016.7803257.

International Workshops

1. M. Ferro, C. R. Gaz, M. Vendittelli, "*A framework for sensorless identification of needle-tissue interaction forces in robot-assisted biopsies*", ICRA 2020 Workshop on Shared Autonomy: Learning and Control (SALC), Virtual conference, 2020.

2. M. Ferro, G. A. Fontanelli, F. Ficuciello, B. Siciliano, M. Vendittelli, "*Vision-based suturing needle tracking with Extended Kalman Filter*", in 7th Joint Workshop on New Technologies for Computer/Robot Assisted Surgery (CRAS 2017), Montpellier, France, Septembre 2017.