Eugenio Monari

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WORK EXPERIENCE

02/2024 – CURRENT

RESEARCH FELLOWSHIP UNIVERSITY OF BOLOGNA

Project name: Development of safe hand-guided robots
The reaserch fellowship reasearch is aimed at developing a fully functional mobile platform for collaborative hand-guided activities. The redundant robot Franka Emika Panda will be mounted on a custom mobile platform equipped with omni-directional wheels, resulting in a 10-dof structure. The relative position of the human operator and the collaborative robot is monitored with cameras and IMU sensors. The control that is being developed will ensure a safe and effortless guidance by the human operator, guaranteeing a collision-free motion of the robot thanks to the use of the kinematic null space.

11/2020 – 01/2024

PHD IN MECHANICS AND ADVANCED ENGINEERING SCIENCES UNIVERSITY OF BOLOGNA

The PhD project is aimed at developing a controller for the manual guidance of a collaborative robot. This involves both theoretical research on kinematics and dynamics of redundant robots and practical activities (programming, experiments, case studies, etc.) with the Franka Emika Panda robot.
Additionally, several projects in collaboration with companies are undertaken, requiring the realization of test benches and the usage of PLC programming with Beckhoff automation systems.

03/2020 – 10/2020

INTERNSHIP AT SAIMA LABORATORY UNIVERSITY OF BOLOGNA

The internship involved training on the usage of the Franka Emika Panda robot, learning how to use its libraries to write custom controllers in C++ and Python and how to integrate external sensors within the software of the robotic system.

EDUCATION AND TRAINING

2018 – 2020

MASTER'S DEGREE IN AUTOMATION ENGINEERING Univsersità di Bologna

Final grade 110/110 | **Thesis** Force control of a collaborative robot for manual guidance applications

2015 – 2018

BACHELOR'S DEGREE IN AUTOMATION ENGINEERING University of Bologna

Final grade 108/110 | **Thesis** Realtà aumentata e realtà virtuale applicate al monitoraggio strutturale

LANGUAGE SKILLS

Other language(s):

	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken production	Spoken interaction	
ENGLISH	C2	C2	C2	C2	C2
FRENCH	C1	C1	C1	C1	C1

Levels: A1 and A2: Basic user; B1 and B2: Independent user; C1 and C2: Proficient user

SKILLS

Proficiency in C, c++ and Python | Proficiency in Matlab/Simulink | Knowledge of Creo | Knowledge of Linux

PUBLICATIONS

2024
Physical Ergonomics Monitoring in Human–Robot Collaboration: A Standard-Based Approach for Hand-Guiding Applications

Journal Name: Machines

2023
On Locally Optimal Redundancy Resolution using the Basis of the Null Space

Proceedings - IEEE International Conference on Robotics and Automation

2022
A COBOT-IMU Hand-Guiding System with Online Collision Avoidance in Null Space

ROMANSY 2022: ROMANSY 24 - Robot Design, Dynamics and Control

2022
Multidirectional hemispherical dielectric elastomer proximity sensor for collision avoidance in human-robot interaction applications

Proceedings of SPIE - The International Society for Optical Engineering

2022
A New Resonance-Based Design Approach to Reduce Motor Torque Requirements in Automated Machinery

International Journal of Advanced Manufacturing Technology

2025
Marker-Based Safety Functionality for Human–Robot Collaboration Tasks by Means of Eye-Tracking Glasses.

Journal Name: Machines

PROJECTS

10/2024 – CURRENT
Horizon Europe - MEGA WAVE PTO

In this joint European project, novel wave energy conversion systema are developed. Three different architectures are considered, which are more suitable for small-scale (1kW), medium-scale (10 kW) or large-scale (100 kW) power generation. The innovation lies in the presence of magnetic gears and a modular generator. In this way, in presence of highly energetic sea states, the dynamics of the system will be decoupled, without the need to oversize the components, allowing the generation of a higher amount of energy. The work will focus on the modelling and control of the integrated system.

05/2022 – 05/2023
Support to the design of the controller of an exoskeleton - Collaboration with Robosuits SRL

- Computation of the feedforward term for gravity compensation, distinguishing between when both feet are on the ground (closed chain) and when only one foot is on the ground (open chain)
- Design of a control strategy to compensate disturbances during the transient between the closed chain case and the open chain

01/2023 – CURRENT
Support to the design of a closed-chain robot - Collaboration with OCME

During this collaboration the kinematic and dynamic equations of a five-link closed-chain robot for pick & place applications were formulated. In addition, the kinematics parameters were chosen as the result of an optimization problem aiming at maximizing the working area and minimizing the speed and torque of the motors.

11/2020 – 09/2022

SaRAH - COVR European Project

The goal of the SaRAH (Safety in Robot Arm Hand Guidance) project was to monitor the fatigue of the worker during a collaborative drilling application, so as to avoid the insurgence of long-term work-related musculoskeltal diseases. This was done using an IMU system to track the movements of the human body and force sensors placed on the end effector, which were integrated within the controller of the robot. A MATLAB app was implemented which was able to provide suggestions about how to organise the work shift to reduce the effort of the worker based on performance indices taken from available regulations.

11/2020 – 05/2022

SIC-O-MAN - Collaboration with INAIL

During the collaboration with INAIL, the Italian agency for safety at work, a collaborative robotics drilling application was examined and improved from the point of view of the safety of the worker, analysing how to adhere to existing regulations and developing innovative sensor systems.

TUTORSHIPS AND EDUCATIONAL ACTIVITIES

10/2020 – 01/2021

Tutor of the course of Project Work - Bachelor's Degree in Mechatronic Engineering

- Massimo Venturi, Friction compensation and null space control of a redundant robot, Master's Degree in Automation Engineering
- Marco Iacobucci, Dynamic parameters identification of a collaborative robot, Master's Degree in Ingegneria Meccanica
- Alessandro Bianchini, Position control for pick & place tasks of a Delta robot, Master's Degree in Ingegneria Meccanica
- Eugenio Baldolini, Design of the control law for pick & place tasks of a Delta robot, Master's Degree in Ingegneria Meccanica
- Mattia Brugnettini, Design of an innovative control algorithm for the computation of the null space command in redundant robots, Master's Degree in Automation Engineering

02/2022 – CURRENT

Tutor of the course of Mechanics of Machines for Automation - Master's Degree in Automation Engineering

- Marco Bugo,Study of singularity configurations of the Franka Emika Panda robot, Master's Degree in Automation Engineering
- Francesco Vender, Reading of data coming from printed-electrode capacitive sensors and implementation of an IoT protocol for data transmission to a Beckhoff automation system, Master's Degree in Electronic Engineering