Alessandro Puglisi

ROBOTICIST · CONTROL ENGINEER
Milan, Italy

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Skills

Programming	C++, Python, MATLAB, C, LaTeX
Software	ROS 1/2 (Robot Operating System), Gazebo, Simulink, Linux
Libraries and Toolboxes	matplotlib, OpenCV, robotics-toolbox, ros2_control, Nav2, slam_toolbox
Engineering	Robotics, Control Theory, Modeling, Mechanics
Languages	Italian (Mother tongue - C2), English (C1)

Experience

Space Robotics Lab (SRL)
Sendai, Japan
RESEARCH STUDENT — *Apr. 2024 - Aug. 2024*

- Conducted 500+ hours of research in Tohoku University's largest robotics lab, which comprises 80+ members across 5+ teams, under the supervision of Yoshida Kazuya Sensei.
- Researched methods for robustly and efficiently transforming a prototype multi-modal limbed climbing robot, equipped with a transformable Gripper-Wheel module.
- Integrated the new module in high/low-level control software, with a **ROS2** architecture written in **C++** and **Python**, enabling efficient actuation of new joints in both modes.
- Improved **Gazebo** simulation reliability and **ros2_control** controller performance by fine-tuning dynamical parameters and **PID** gains, obtaining a realistic simulation for algorithm testing, using Python to analyze performances.
- Tested the updated software and transition algorithm on the physical system, achieving system stability and eliminating steady-state error in motor control.

Projects

Modeling, Control, and Dexterity Analysis of a Multi-Modal Limbed Robot
M.S. THESIS, "SPACE ROBOTICS LAB SEQUEL" — *Sept. 2024 - Mar.2025*

- Identified the kinematics/dynamics model of a transformable gripper-wheel limbed robot, using MATLAB **robotics-toolbox**.
- Researched performance indices to characterize the maneuverability of limbed systems, defining a novel theory on configuration dexterity.
- Developed software for analyzing the novel "base manipulability ellipsoid" and visualizing robot kinematics.
- Proved the reliability of the new performance criteria, with a **nature-inspired** example, based on insect kinematics.
- Designed a new joint controller in MATLAB and Simulink, Implemented and simulated both in wheeled and legged locomotion mode, with ROS 2 (C++) and Gazebo.

Simulation of MBARI's Underwater ROV Doc Ricketts
PERSONAL PROJECT — *Jan. 2025 - Present*

- Created and tuned a physically consistent model of ROV Doc Ricketts with a manipulator, from the Sketchfab model
- Integrated light source, sonar, thruster actuator, and buoyancy engine in **Gazebo** simulator.
- Modeled an underwater world for simulation.
- Developing **Python** GUI for ROV low-level commands, bridging **ROS2** and Gazebo.
- ... More features are under development!

Mobile Robot Odometry, Mapping and Way-points Navigation
PERCEPTION, LOCALIZATION, AND MAPPING FOR MOBILE ROBOTS — *Apr. 2023 - July 2023*

- Implemented **Odometry** estimation for an autonomous shuttle, with ROS and C++.
- Mapped an indoor environment from ROS bag Laser Scan and 3D Lidar data, using **slam_toolbox**.
- Denoised the map, and performed autonomous navigation from csv waypoints, using AMCL (Adaptive Monte Carlo Localization) for localization and **Navigation** stack for path generation and tracking.

Simulation and Trajectory Tracking Control of a Car-like Robot

CONTROL OF MOBILE ROBOTS   *Dec. 2023 - Jan.2024*

- Simulated a car-like robot with kinematic and dynamic bicycle model, using **ROS** and **odeint C++** library.
- Designed and Implemented a **PI trajectory tracking** controller with **feedback linearization**, with C++, relying on Bode theory for controller tuning.
- Analyzed controller performance for different kinematic/dynamic models, using **Python** to read and plot ros bags.
- Maintained tracking error below 3% in x and y coordinates, over a trajectory with a 2-meter amplitude.

Education

University of Montpellier   *Montpellier, France*

PHD CANDIDATE, RSM (LIRMM)   *Oct. 2025 - 2028*

- **Thesis title**: Mapping and monitoring of the surface state and biological colonization of submerged parts of offshore wind turbines by acoustic imaging
- **Objectives**: Developing methods for autonomous inspection (structural health and biodiversity) of offshore wind farms. Acoustic and optical sensors are used to collect data, and processed with machine learaning algorithms for scene understanding. The inferred information will be relevant for semantic 3D reconstruction, robot navigation, and spatiotemporal analysis of offshore structures.
- **Keywords**: Image processing, Modeling, Imaging Sonar, Marine Robotics

Politecnico di Milano   *Milano, Italy*

M.S. IN AUTOMATION AND CONTROL ENGINEERING   *Sept. 2022 - Apr. 2025*

- **Final Grade**: 110L/110 (**GPA**: 29.35/30)
- **MSc Thesis**: Motion Control and Manipulability Analysis of LIMBERO-GRIEEL: a Multimodal Limbed Robot for Unstructured Environments
- **Relevant Courses**: Perception Localization and Mapping, Control of Industrial and Mobile Robots, Networked Control, Data Driven Control, Model Identification and Data Analysis, Dynamics of Mechanical Systems.
- Simulated and controlled robotic systems in Python and C++ using ROS and Gazebo, employing classical and advanced multi-variable controllers.

Tohoku University   *Sendai, Japan*

EXCHANGE STUDENT AT SPACE ROBOTICS LAB   *Apr. 2024 - Aug. 2024*

- **Courses** : System Control Engineering, Laboratory Experiments.
- Conducted experiments in different fields of Engineering, like fluid dynamics, thermodynamics, electronic filtering, and Control Theory.

Politecnico di Milano   *Milano, Italy*

B.S. IN AUTOMATION AND CONTROL ENGINEERING   *Sept. 2019 - Sept. 2022*

- **Final Grade**: 110/110
- **Relevant Courses**: Fundamentals of Robotics, Informatics, Linear Algebra and Geometry, Probability, Calculus 1 and 2, Electronics, Measurement and Instrumentation, Modeling of Mechanical Systems.
- Mastered control theory, its mathematical foundations, and the software required for implementation.