



UNIVERSITÀ POLITECNICA DELLE MARCHE

Supervisor: Prof. Matteo Claudio
Palpacelli

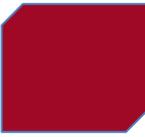
Dept. of Industrial Engineering and
Mathematical Sciences (DIISM)

Project idea: Human-Centered
Adaptive Humanoid Robotics



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DIISM Department, Machine Mechanics Group
Activities



Research Interests

My research focuses on Collaborative Robotics and Human-Centered Intelligent Systems, with particular emphasis on:

- Learning from Demonstration (LfD) and skill transfer from humans to robots;
- Human-Robot Interaction (HRI) in assistive and industrial contexts;
- Humanoid and service robotics for rehabilitation and assisted living;
- AI-enabled collaborative and assistive robotic systems operating in real-world environments.

My research integrates robotics, AI, and sensing technologies to develop safe, adaptive, and context-aware human-robot interaction systems.

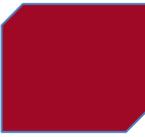
The following slides highlight selected research projects to which I have actively contributed and which align with these research interests.





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Selected Research Experience

FOCAAL – Fog Computing in Ambient Assisted Living

Development of adaptive human-robot interaction strategies for upper-limb rehabilitation using UR5e collaborative robots.

Implementation of Learning from Demonstration approaches on PAL Robotics TIAGO, integrating depth-based human motion reconstruction for skill transfer.

Integration of robotic systems within distributed fog computing architectures for real-time personalized assistance.



EXCELLENCE IN RESEARCH



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Selected Research Experience

VITALITY – Innovation Ecosystem (PNRR)

UNIVPM coordinates Spoke 5 within a regional innovation ecosystem focused on intelligent systems, automation, and technology-driven sustainability of living and working environments.

The initiative promotes interdisciplinary research and technology transfer through a Hub & Spoke collaborative model involving universities, research centers, and industry partners.

EDIH4MARCHE – European Digital Innovation Hub

UNIVPM participates in EDIH4MARCHE supporting SMEs in their digital transformation.

Activities include digital maturity assessment, “Test Before Invest” services, and deployment of advanced digital and robotic technologies in industrial environments, alongside training and technology transfer initiatives.



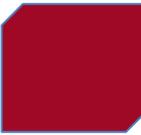
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Description



HR EXCELLENCE IN RESEARCH



Prof. Matteo Claudio Palpacelli (ORCID: [0000-0001-6931-6618](https://orcid.org/0000-0001-6931-6618))

Academic & Scientific Leadership

- Associate Professor in Machine Mechanics at UNIVPM, DIISM Department.
- General Chair ASME/IEEE MESA 2024; member of the conference international board.
- Head of the MIR Laboratory
- Member of the Industry 4.0 Commission - National PhD Program DRIM
- Affiliated member, I-RIM

Supervision & Research Track Record

- 2 PhD candidates supervised (plus previous doctoral mentorship)
- Extensive supervision of MSc and BSc theses
- 94 publications, H-index 19, more than 1000 citations
- Quality Assurance Coordinator - Mechanical Engineering Programs





Relevant publications:

- Carbonari L., Callegari M., Palmieri G., Palpacelli M.-C. “A new class of reconfigurable parallel kinematic machines” (2014), *Mechanism and Machine Theory*, 79, pp. 173 - 183. DOI: 10.1016/j.mechmachtheory.2014.04.011 (cited 130 times);
- Palpacelli M.-C., Carbonari L., Palmieri G., Callegari M. “Analysis and Design of a Reconfigurable 3-DoF Parallel Manipulator for Multimodal Tasks” (2015), *IEEE/ASME Transactions on Mechatronics*, 20 (4), art. no. 6960887, pp. 1975 – 1985. DOI: 10.1109/TMECH.2014.2365616 (cited 74 times);
- Scoccia C., Palmieri G., Palpacelli M.C., Callegari M. “A collision avoidance strategy for redundant manipulators in dynamically variable environments: On-line perturbations of off-line generated trajectories” (2021), *Machines*, 9 (2), art. no. 30, pp. 1 – 16. DOI: 10.3390/machines9020030 (cited 34 times);
- Chiriatti G., Palmieri G., Scoccia C., Palpacelli M.C., Callegari M. “Adaptive obstacle avoidance for a class of collaborative robots” (2021), *Machines*, 9 (6), art. no. 113. DOI: 10.3390/machines9060113 (cited 33 times).



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Staff, equipment and laboratories



HR EXCELLENCE IN RESEARCH

- Research Team
 - 6 faculty members (1 Full Professor, 4 Associate Professors, 1 Researcher)
 - 4 PhD candidates, 2 Postdocs, 2 research engineers (i-Labs)
- Research areas:
 - Robotics, Human Robot Collaboration (HRC), Rehabilitation and Service Robotics, Motion analysis, Machine design
- Infrastructure (labs):
 - **MIR** – Mechatronics and Industrial Robotics
 - Access to **I-LABS Industry** and **Artes 4.0** facilities
- Courses offered in **9 engineering degree programs**
- Contact: m.palpacelli@univpm.it

More info at:
<https://mdm.univpm.it/mdm/>



Massimo Callegari, FP



Giacomo Palmieri, AP



Matteo Palpacelli, AP



Luca Carbonari, AP



Daniele Costa, AP

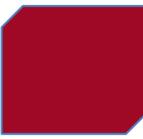


Cecilia Scoccia, R



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MIR – Mechatronics and Industrial Robotics Laboratory

The MIR Laboratory supports integrated teaching, research, and technology transfer activities in mechatronics and industrial robotics.

Research focuses on the design, prototyping, and validation of collaborative and intelligent robotic systems, parallel kinematic machines, and Industry 4.0 technologies.

Infrastructure:

- Collaborative and industrial robotic platforms (UR5e, Fanuc CRX, Unitree G1)
- OptiTrack motion capture system
- Advanced sensing and data acquisition systems
- Integrated simulation, modeling, and industrial robot programming environments



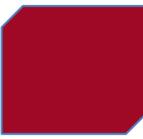


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i-Labs Industry – Innovation Hub

i-Labs Industry is a non-profit innovation consortium bridging academia and industry in advanced digital and robotic technologies.

Facilities are accessible to UNIVPM researchers for experimentation, prototyping, and industrial validation.

Services include Test Before Invest activities, applied research support, and professional training.

Robotic Infrastructure:

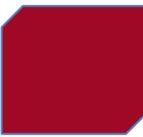
UR5e, UR10e, ABB YuMi, ABB IRB 2600,
KUKA KMR iiwa, FANUC CRX, mobile AGVs





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Project idea



Human-Centered Adaptive Humanoid Robotics

Development of humanoid robotic systems capable of safe, adaptive, and context-aware interaction across industrial, domestic, and assistive environments.

Ongoing research within the laboratory focuses on the definition and validation of safety and interaction metrics for humanoid systems operating in heterogeneous environments.

A complementary MSCA research direction would investigate learning-based and adaptive control strategies (e.g., Learning from Demonstration and perception-driven adaptation) enabling humanoid systems to adapt and optimize their behavior with respect to formally defined safety and interaction constraints.

Experimental validation will be conducted on a Unitree G1 humanoid platform within both academic (MIR Lab) and industrial (i-Labs Industry) environments.

