# Irene Frizza

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**Robotics Research Scientist** (JSPS Fellow) with hands-on experience in locomotion, robot control, and contact-rich interaction, combining model-based and learning-based methods. Strong background in simulation-driven development (Isaac Gym, MuJoCo), system integration, and experimental robotics, with experience using reinforcement learning as a tool for locomotion and stability analysis.

## Selected Robotics Research Projects

**Compliant Leg Joints for Humanoid Locomotion** — Designed and implemented compliant leg joints with parallel and series elasticity for **humanoid locomotion**. Applied **reinforcement learning–based** locomotion controllers and simulation pipelines to evaluate stability, impact absorption, and robustness under contact-rich conditions. Used physics-based simulation to analyze interactions between compliance and control, informing design and control decisions. **GitHub** **Video**

**RGB-D Terrain Perception for Robotic Locomotion** — Developed a **real-time RGB-D perception pipeline** for terrain exploration and adaptive foot placement during locomotion. Focused on robust perception-to-action integration for operation in unstructured and cluttered environments. **Video**

**Adaptive Robotic Feet for Dynamic Locomotion** — Led the **end-to-end design** and experimental validation of adaptive robotic feet enabling improved landing stability during dynamic locomotion. Integrated **compliant structures, pneumatic actuation, and embedded sensing**, and evaluated performance through iterative experiments. Validated the system in dynamic walking scenarios using RGB-D terrain perception to adapt foot-ground interaction in real time. **Video**

**Tunable-Stiffness Actuation for Robotics** — Developed and characterized a **tunable-stiffness actuator**, covering design, modeling, and experimental validation. Analyzed stiffness modulation, response time, and repeatability to support control-oriented design decisions. **Video**

## Technical Skills

**Programming**: Python C/C++ MATLAB Real-time Embedded codebases
**Robotics & Simulation**: Isaac Gym MuJoCo ROS Gazebo URDF Rigid-body dynamics Kinematics
**Control & Learning**: Reinforcement Learning Model-based control Impedance control Trajectory optimization
**Actuation & Physical Interaction**: Variable-stiffness mechanisms Pneumatic actuation System identification Sensor fusion
**Hardware & Prototyping**: Pneumatic systems Embedded sensing Arduino 3D printing Machining

## Experience

**The University of Tokyo — Tokyo, Japan** 2024 – Present
Postdoctoral Researcher (JSPS Fellow) — Developed simulation and control frameworks for soft robotic joints in Isaac Gym, variable-impedance joint models, and reinforcement-learning (PPO) pipelines for uneven-terrain locomotion. Built automated pipelines for reproducible RL testing across terrains and push-recovery.

**AIST (JRL) — Tsukuba, Japan** 2024
Engineer — Moonshot Robotics Project. Developed embedded control software (PID) and pneumatic actuation modules (valves, compliant air chambers); integrated MoCap-based feedback.

**AIST (JRL) — Tsukuba, Japan** 2021 – 2023
Research Assistant — Designed and manufactured compliant pneumatic feet (CAD, machining, silicon casting, 3D printing) with embedded sensing; developed model-based control for variable stiffness, integrated the system onto the HRP-4CR humanoid robot, and conducted locomotion experiments with impact-force measurements, and terrain-adaptation tests.

**LIRMM (CNRS) — Montpellier, France** 2020
Researcher — Built MuJoCo-based simulation tools to evaluate variable-stiffness mechanisms; conducted model-based design studies on stability, impact damping, and multi-contact behavior for humanoid locomotion.

**Tokyo Univ. of Agriculture & Technology — Tokyo, Japan** 2019
Research Intern — Conducted gait analysis using motion-capture and force-plate systems; evaluated ground-reaction-force trends and human locomotion characteristics for compliant-foot controller development.

## Education

Ph.D. in Robotics — University of Montpellier, France 2023
M.Sc. in Robotics & Automation Engineering — University of Pisa, Italy 2019
B.Sc. in Electronic Engineering — University of Pisa, Italy 2016

## Selected Achievements

Awarded the **JSPS Postdoctoral Fellowship** national research grant in 2024.
Awarded the **Kanako Miura Award** at IEEE-RAS Humanoids in 2022.

**First author publications** in peer-reviewed robotics journals, including *Journal of Intelligent & Robotic Systems* (2025), *Advanced Robotics Research* (2025), *Machines* (2025), and *International Journal of Humanoid Robotics* (2022), with additional publications in **IEEE Robotics and Automation Letters (RA-L)** and conference papers at **IEEE Humanoids** and **RSJ**.

**Invited speaker** at ICRA 2024 (Workshop on Anthropomorphic and Zoomorphic End-Effectors); contributed to workshops at **IROS**, **ICRA**, and **Humanoids**.

References available upon request.