Master of Science in Mechanical Engineering

# Mechatronics and Robotics

FA4





Administration Administration Floores Accounting (Finence Marketing Problicity Promotion (Rosearch Ausiness Ausiness Development (Finencia (Manufacturing (Planning





## Contacts



#### Prof. Francesco Braghin

francesco.braghin@polimi.it

#### **Track description**

Creating mechatronic systems requires skills from a broad range of disciplines. Consider modern passenger cars and intelligent robots for households and industry. These complex and highly interactive systems pose fundamental questions about their modelling, optimization and control. The Mechatronics and Robotics track offers students the integrated and multidisciplinary engineering expertise needed to design, develop and manage innovative and intelligent high-tech products and systems that meet today's challenges in the most diverse fields of application, ranging from energy to mobility, from health to the environment. The track also offers course packages focused on three specific subtopics, i.e. robots, mechatronics and vehicles.

### Skills

Students will learn how to:

- model, optimize and control multiphysics/multidomain innovative systems
- exploit the potentialities of smart materials/metamaterials for innovative (smart) systems
- design, develop and manage complex mechatronic systems
- design, develop and manage (co)robotic systems (from traditional anthropomorphic robots to humanoid and bioinspired robots)
- develop high-performance control logic (for vehicles, drones, machines, ...)



### FA4: Core Courses

#### **Course Title**

Data Analysis and Experimental Characterization for Mechatronic and Robotic Systems

Actuating Devices for Mechanical Systems

Advanced Dynamics of Mechanical Systems

Advanced Machine Design

Advanced Manufacturing Processes B

Smart Materials

YEAR	SEM	ECTS	ECTS GROUP
1	2	10	10
1	1	5	5
1	2	10	10
1	1	10	10
1	1	5	5
1	2	5	5

## FA4: Track Specific Courses

#### **Course Title**

Methods and Technologies for Feedback Control Systems

Mechatronic Systems A

Nonlinear Dynamics and Chaos

**Topology Optimisation** 

Nonlinear Optimization

Numerical Analysis For Partial Differential Equations B

Model Order Reduction Techniques

#### **Elective courses**

(Machine Learning and Model Identification for Mechanical Systems, Nonlinear Control, Robust Control, Algorithmic Game Theory, Robotics, Collaborative Robotics, Micro and Nano Robotics, Design of Robotic Systems, Soft Robotics, Swarm Robotics, Mechanics Micro Electro Mechanical Systems - Sensors, Connected and Autonomous Vehicles, Hybrid And Electric Vehicles, Smart Farming, U Vehicles, Wind Turbine and Wind Farm Modelling and Control B, Metamaterials and Metastructures, Smart Structures and Devices,

#### Lab course

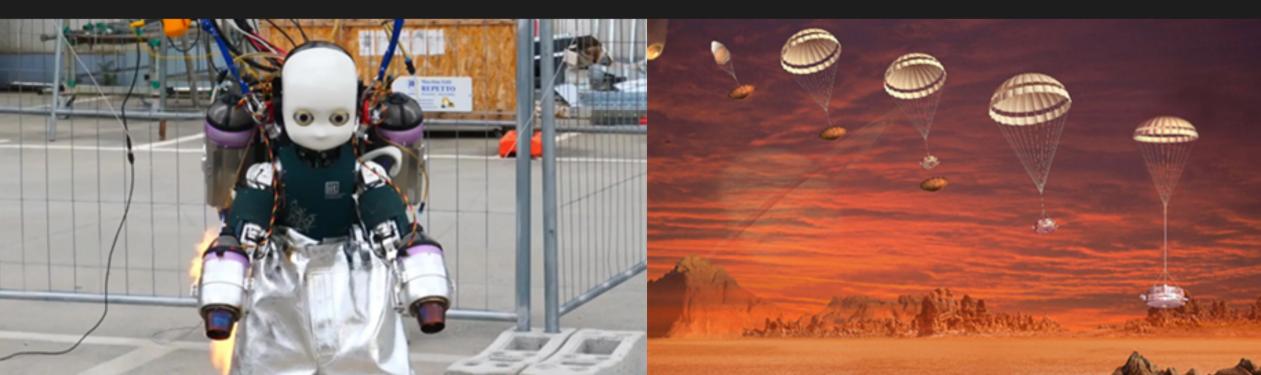
(Noise, Vibration and Harshness Testing, Bioinspired Robotics, Innovative Applications of Industrial Robotics, Mechatronics, Mech Engineering Applications of Deep Learning, Metamaterials and Metastructures, Haptics and Multisensory Interaction in Extended R Modelling In Engineering, Robotic Manufacturing)

	YEAR	SEM	ECTS	ECTS GROUP	
	1	1	10	10	
	2	1	10	10	
	1	2	5		
	1	1	5		
	1	2	5	5	
	1	2	5		
	1	1	5		
r, Bio-inspired s and Design of Unmanned s,)	2	1-2	5	20	
nanical Reality, Human	2	1	5	5	

### FA4: Master's Thesis

### Flying humanoid robot (with IIT)

Optimal landing on other planets (with NASA)



Optimal trajectory for autonomous driving



### **FA4: Master's Thesis**

Upper limb exoskeleton Acoustic cloaking through metamaterials



### Collaborative robot for healthcare



