Module Description, available in: EN

Engineering of Industrial Robots

General Information

Number of ECTS Credits

3

Module code

TSM_IndRobot

Valid for academic year

2025-26

Last modification

2024-10-03

Coordinator of the module

Anna Valente (SUPSI, anna.valente@supsi.ch)

Explanations regarding the language definitions for each location:

- Instruction is given in the language defined below for each location/each time the module is held.
- Documentation is available in the languages defined below. Where documents are in several languages, the percentage distribution is shown (100% = all the documentation).
- The examination is available 100% in the languages shown for each location/each time it is held.

	Lausanne			Lugano	Zurich		
Instruction				**X** E 100%			
Documentation				**X** E 100%			
Examination				**X** E 100%			

Module Category

TSM Technical scientific module

Lessons

2 lecture periods and 1 tutorial period per week

Entry level competences

Prerequisites, previous knowledge

- Linear algebra
- Basics of mechanics (statics and kinematics)
- Mechanical design (recommended)
- Basic programming skills
- Basics of robotics (recommended)

Brief course description of module objectives and content

The course targets technical and application challenges related to the design of advanced robotic solutions for industrial and service applications. It addresses the design, engineering and optimization of serial and parallel kinematics robotic arms, as well as of mobile platforms.

The course will cover theoretical content and practical activities of mechanical design, programming and simulation, as well as laboratory experiences with real hardware

Industrial use cases and service use cases will be addressed during the application/laboratory activities, specifically dealing with cutting-edge solutions and challenging markets demanding advanced robotic platform.

The laboratory ctivities will involve the use of industrial robots, cobots, and both commercial and experimental mobile platforms (wheeled and legged), to demonstrate course topics and to support the students in developing their projects and testing some of the designed hardware solutions.

Aims, content, methods

Learning objectives and acquired competencies

The learning objectives are:

- Ability to select a robotic platform starting from specific use cases requirements as well as productivity and safety KPIs
- Design, engineer, analyze statically and dynamically a robotic solution
- Design accessories (tools, fixturing, sensors), including vision-based perception systems

Contents of module with emphasis on teaching content

Robotics basics review

- Position and orientation
- Kinematics
- Dynamics
- Trajectory and motion planning

Engineering of arm-type robots

- Problem statement: reference industrial task
- Serial and parallel robot architectures
- Workcell configuration: kinematic model, reach, tools, sensors
- Structural design, computation of inertias
- Design and dimensioning of actuators and transmission mechanisms
- Tool, fixturing, services design
- Motion simulation and optimization
- Design of vision-based sensing solutions

Engineering of mobile robots

- Problem statement: reference industrial task
- Kinematic models for wheeled robots
- Kinematic models for legged robots
- Robot configuration: kinematic model, tools, sensors
- Locomotion system design
- Path planning and motion simulation
- Design of vision-based navigation system

Teaching and learning methods

- Interactive lectures
- Tutorials in presence with lab equipment
- Self-study with exercises and assignments

Literature

P. Corke, “Robotics, Vision and Control”. Springer Cham, 2nd edition (2017).

B. Siciliano, O. Khatib, “Springer Handbook of Robotics”. Springer Berlin, Heidelberg (2008).

Assessment

Additional performance assessment during the semester

The module contains additional performance assessment(s) during the semester. The achieved mark of the additional performance assessment(s) applies to both the regular and the resit exam.

Description of additional performance assessment during the semester

Two assignments given during the course count 30% of the final mark.

Basic principle for exams

As a rule, all the standard final exams for modules and also all resit exams are to be in written form

Standard final exam for a module and written resit exam

Kind of exam

written

Duration of exam

120 minutes

Permissible aids

No aids permitted

Exception: In case of an electronic Moodle exam, adjustments to the permissible aids may occur. Lecturers will announce the final permissible aids prior to the exam session.

Special case: Resit exam as oral exam

Kind of exam

oral

Duration of exam

30 minutes

Permissible aids

No aids permitted