



COURSE DESCRIPTION ROBOT INTERACTION CONTROL

SSD: AUTOMATICA (ING-INF/04)

DEGREE PROGRAMME: INGEGNERIA DELL'AUTOMAZIONE E ROBOTICA (P38)
ACADEMIC YEAR 2022/2023

COURSE DESCRIPTION

TEACHER: SICILIANO BRUNO
PHONE: 081-7683179
EMAIL: bruno.siciliano@unina.it

GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE: U2329 - ADVANCED ROBOTICS
MODULE: U2330 - ROBOT INTERACTION CONTROL
CHANNEL: FG A-Z
YEAR OF THE DEGREE PROGRAMME: II
PERIOD IN WHICH THE COURSE IS DELIVERED: SEMESTER II
CFU: 6

REQUIRED PRELIMINARY COURSES

Foundations of Robotics
Nonlinear Dynamics and Control

PREREQUISITES

Knowledge on the foundations of robotics

LEARNING GOALS

The course aims to provide students with the skills for controlling the interaction between robots and poorly structured environments, through force control, visual control, manipulation and cooperation

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding

The course path aims to provide students with methodological tools for controlling robots in interacting with poorly structured environments. to modeling, planning and control of robots. Force

control and visual control techniques for rigid manipulators and control for manipulators with elastic joints are introduced, as well as techniques for controlling manipulation and cooperation of robotic systems. The students must demonstrate that they have learned the solutions to the interaction control problem based on the techniques studied in the course.

Applying knowledge and understanding

The student must demonstrate that (s)he is able to apply the methodologies acquired to model and control robotic systems interacting with the environment

COURSE CONTENT/SYLLABUS

Interaction of manipulator with the environment

Compliance control

Impedance control

Force control

Parallel force/motion control

Constrained motion

Natural and artificial constraints

Hybrid force/motion control

Vision for control

Image processing

Pose estimate

Stereo vision and camera calibration

Task-space visual control

Image-space visual control

Hybrid visual control

Modeling of manipulators with elastic joints

Control of manipulators with elastic joints

Robotic manipulation

Contact models

Models of friction

Definition of grasps

Internal and external forces

Kinematic and dynamic models of a system consisting of cooperating robots and manipulated object

Control and planning of a manipulation task

READINGS/BIBLIOGRAPHY

B. Siciliano, L. Sciavicco, L. Villani, G. Oriolo, Robotics –Modeling, Planning and Control, Springer, London, 2009, ISBN 978-1-84628-641-4

B. Siciliano, O. Khatib (Eds.), Springer Handbook of Robotics, 2nd Edition, Springer, Berlin, 2016 ISBN 978-3-319-32552-1

B. Siciliano, O. Khatib, T. Kröger, Multimedia Extension to Springer Handbook of Robotics, 2016
Lecture notes available at <https://prisma.dieti.unina.it/index.php/education/education-courses/723-robot-interaction-control>

TEACHING METHODS OF THE COURSE (OR MODULE)

The teacher will use: a) lectures for about 70% of the total hours, b) classroom exercises for about 20% of the total hours, c) seminars for about 10% of the total hours

EXAMINATION/EVALUATION CRITERIA

a) Exam type

- Written
- Oral
- Project discussion
- Other : The interview consists in ascertaining the acquisition of the concepts and contents introduced during the lessons.

In case of a written exam, questions refer to

- Multiple choice answers
- Open answers
- Numerical exercises

b) Evaluation pattern

The final grade will be weighted on the credits of each module of the course Advanced Robotics and therefore composed as follows:

Module: Robot Interaction Control, 6 CFU, 50%

Module: Field and Service Robotics, 6 CFU, 50%