MICRO-453

Robotics practicals

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Cursus	Sem.	Type
Microtechnics	MA2	Obl.

Language of teaching	English
Credits	2
Withdrawal	Unauthorized
Session	Summer
Semester	Spring
Exam	During the semester
Workload	60h
Weeks	14
Hours	**2 weekly**
TP	2 weekly
Number of positions	

Il n'est pas autorisé de se retirer de cette matière après le délai d'inscription.

Summary

The goal of this lab series is to learn how to apply control methods for a variety of robots, ranging from industrial robots to autonomous mobile robots, to robotic devices, all the way to interactive robots.

Content

The TP cover the follwwoing topics:
Optic Flow-based Mobile Robot Control: The goal of this laboratory is to apply locomotion concepts used by insects in the control of mobile robots. More specifically, students use the concept of optic flow, used by many species of insects, to program an embedded controller on a wheeled robot to avoid obstacles or follow corridors.
Artificial Muscles: This laboratory first provides a general overview of artificial muscle technologies used in robotics with particular emphasis placed on dielectric elastomer actuators (DEAs), a type of soft, elastomer-based actuator. Then, students fabricate DEAs by hand and test the mechanical and electrical properties of their devices, comparing their results with theoretical predictions.
Outdoor Flying Robots: This laboratory offers a practical exercise on the design of a combined altitude and speed controller for a miniature autonomous airplane. The students will first design a controller with a MATLAB/Simulink simulation model and then consider the issues of porting it to the real platform.
Mobile robot position estimation and navigation: The goal of this practical is to implement position estimation and navigation on the marXbot mobile robot.Position will be estimated by matching histograms of distances between the robot sensor and a reference map.
Teaching Robots to Accomplish a Manipulation Task: In this robotic practical, the student will be teaching a robot to build a tower by stacking several objects on top of each other. Each group is provided with five objects with different shapes and sizes. In order to accomplish this task, the robot must be capable of 1) identifying the objects; 2) estimate the location and pose of the objects; 3) generate appropriate motion to pick up each object and stack these on top of other objects.
Industrial SCARA Robot Adept: The Adept Cobra s350 is a high performance robot specifically designed for tasks such as assenbly, manipulation or packaging where there is need of fast and precise actions. The goal of the practical is to learn using this system by a set of simple tasks.
Haptics: This lab is closely linked to research projects in haptics and medical robotics carried out at the Laboratoire de Systèmes Robotiques. It will give you a brief overview of the state of the art of haptic devices, problems which have to be addressed to generate useful sensations, the type of sensations that can be produced, as well as how they can be programmed.
The robot ABB IRB 120: The goal of this practical is to get familiar with industrial robots with a serial structure. The students will get a first introduction to the robot, then will have to implement an application using this device.
Delta Direct Drive: This practical introduces the students to manipulation robots having a parallel structure**.** In particular the modelisation and the control are compared with the corresponding techniques present in more classical systems.
Assembly, programming and characterization of a modular fish robot: This practical is aimed at realizing a swimming fish robot using the same modules used for the Salamandra robotica II and AmphiBot III robots. Students will

first implement some simple programs on the on-board microcontroller, then assemble the modules together and implement a trajectory generator for swimming. Finally, the performance of the robot and its dependency on the trajectory parameters will be characterized.

Keywords

industrial robotics, haptics, autonomous robots, manipulation, navigation

Learning Prerequisites

Important concepts to start the course

Robotics
Programming
Automatic control

Learning Outcomes

By the end of the course, the student must be able to:

- Assess / Evaluate the performances or a robotic system
- Synthesize a control system
- Discuss the performances of a system
- Elaborate the model of a system

Transversal skills

- Plan and carry out activities in a way which makes optimal use of available time and other resources.
- Use a work methodology appropriate to the task.
- Collect data.
- Write a scientific or technical report.

Teaching methods

Students attend a set of practicals by groups of two, supervised by an assistent.

Expected student activities

Preparation of the practicals before attending it, writing of the rreport after the practical.

Assessment methods

Written report and oral feedback during the practical

Supervision

Office hours	No
Assistants	Yes
Forum	No

Resources

Moodle Link

- http://moodle.epfl.ch/course/view.php?id=524