EPFL

MICRO-454 **Mobile robots**

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Cursus	Sem.	Type
Microtechnics	MA1, MA3	Obl.
Microtechnics	MA1, MA3	Opt.

Language of teaching	English
Credits	4
Session	Winter
Semester	Fall
Exam	Written
Workload	120h
Weeks	14
Hours	**4 weekly**
Courses	4 weekly
Number of positions	

Summary

The course teaches the basics of autonomous mobile robots. Both hardware (energy, locomotion, sensors) and software (signal processing, control, localization, trajectory planning, high-level control) will be tackled. The students will apply the knowledge to program and control quad rotors.

Content

- History of mobile robotics
- Applications, products and market
- Introduction to quadrotors dynamics and control
- Sensors
- Perception, feature extraction
- Coping with uncertainties
- Markov localization: Bayesian filter, Monte Carlo localization, extended Kalman filter
- Navigation: path planning, obstacle avoidance
- Control architectures and robotic frameworks
- Current challenges in mobile robotics
- Locomotion principles and control
- Embedded electronics

Keywords

mobile robots, sensing, perception, navigation, locomotion, drones.

Learning Outcomes

By the end of the course, the student must be able to:
- Choose the right methods to design and control a mobile robot for a particular task.
- Integrate approriate methods for sensing, cognition and actuation
- Justify design choices for a robotic system
- Implement perception, localisation/navigation and control methods on a mobile robot

Transversal skills

- Plan and carry out activities in a way which makes optimal use of available time and other resources.
- Identify the different roles that are involved in well-functioning teams and assume different roles, including leadership roles.
- Use both general and domain specific IT resources and tools

Teaching methods

Ex cathedra, exercises, work on mobile robots

Expected student activities

- weekly lectures
- studying provided additional materials
- lab exercises with practical components

Assessment methods

Written exam

Supervision

Assistants   Yes
Forum   Yes

Resources

Bibliography

Introduction to Autonomous Mobile Robots R. Siegwart, and I. Nourbakhsh, MIT Press, 2004
Autonomous Robots: From Biological Inspiration to Implementation and Control G.A. Bekey, MIT Press, 2005
Probabilistic Robotics S. Thrun, W. Burgard and D. Fox, MIT Press, 2005
Handbook of Robotics (chapter 35) B. Sicilian, and O. Khatib (Eds.), Springer, 2008
additional literature provided on Moodle

Ressources en bibliothèque

- Autonomous Robots / Bekey
- Introduction to Autonomous Mobile Robots / Siegwart
- Probabilistic Robotics / Thrun
- Handbook of Robotics / Sicilian

Notes/Handbook

Lecture slides are continously provided on Moodle during the course.
Introduction to Autonomous Mobile Robots R. Siegwart, and I. Nourbakhsh, MIT Press, 2004
Probabilistic Robotics S. Thrun, W. Burgard and D. Fox, MIT Press, 2005

Moodle Link

- http://moodle.epfl.ch/course/view.php?id=261