

MICRO-452

Basics of mobile robotics

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Cursus	Sem.	Type
Microtechnics	MA1, MA3	Opt.
Robotics, Control and Intelligent Systems		Opt.
Robotics	MA1, MA3	Obl.

Language of teaching	English
Credits	4
Session	Winter
Semester	Fall
Exam	Written
Workload	120h
Weeks	14
Hours	4 weekly
Courses	2 weekly
Exercises	2 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 a real mobile robot.

Content

- History of mobile robotics
- Applications, products and market
- Sensors
- Perception, feature extraction
- Modeling
- 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, localisation, navigation, locomotion.

Learning Prerequisites**Required courses**

Introduction to automatic control
Introduction to signal processing

Recommended courses

Microinformatique (SMT)

Important concepts to start the course

Embedded system programming
 Basics of automatic control
 Basics of signal processing

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 appropriate 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.

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
 Elements of Robotics M. ben-Ari and F. Mondada, Springer, 2017.
 additional literature provided on Moodle

Ressources en bibliothèque

- [Handbook of Robotics / Sicilian](#)
- [Probabilistic Robotics / Thrun](#)
- [Elements of Robotics / Ben-Ari](#)
- [Autonomous Robots / Bekey](#)
- [Introduction to Autonomous Mobile Robots / Siegwart](#)

Notes/Handbook

Lecture slides are continuously 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

- <https://moodle.epfl.ch/course/view.php?id=14824>