

Mobile robots

Credits: 4 Semester 2 Compulsory: No

Format	Lectures 20 h	Tutorials 12	Private study 68 h
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Lecturers: (W.Khalil;G.Garcia) (ECN)

Objectives: This course presents fundamentals of wheeled mobile robots modeling, control and localization and an introduction to Unmanned Aerial Vehicles (UAV's).

Contents: The following subjects will be addressed:

Wheeled Robot:

- Non holonomic constraint equations,
- Classification of robots, using the degrees of mobility and steering,
- Posture kinematic model,
- Configuration kinematic model,
- Motorisation of wheels.
- Dynamic models including the contact model,
- Trajectory generation,
- Controllability and stabilisation, static and dynamic feedback linearization, nonlinear control based on Lyapunov.
- Relative localisation: odometry, inertial systems.
- Absolute localisation: GPS, sensor fusion,
- 3D range measurements, and goniometry.
- Analysis of the observability of robot location.

Practical Work: The students will program mobile robots to follow some prescribed trajectories and to implement control laws taking into account the Cartesian localization.

Abilities: After completing this course, the students will be able to:

- Generate the motion trajectories considering the robot constraints,
- Simulate the robot motion,
- Implement suitable control strategy,
- Choose an appropriate localization system for a mobile robot,
- Design and implement localization systems using various state observers
- Acquire basic concepts on the UAV's.

Assessment: 30% continuous assessment, 70% from end of semester examination.

Recommended texts:

- C.Canudas, B. Siciliano, G.Bastin (editors), *Theory of Robot Control*, Springer-Verlag, 1996. (chapters 7,8, and 9)
- Ch. Ahikencheikh, A. Seireg, *Optimized-Motion Planning; Theory and Implementation*. John Wiley 1994
- R.W. Prouty, *Helicopter Performance, Stability, and Control*, Krieger Pub Co, June 1995.