Robotics: Mobile Robots

1   Mobile robotics

Part I
- How would you describe a mobile robot?
- Give some examples of fields of application of a mobile robot, AGV or rover.
- What is the difference between an industrial AGV and a rover?
- How can we summarize the problem of mobile robotics and what are the main constraints?
- What are the main types of motion for mobile robots?
- What are the main wheel types?
- Give some examples of wheels' configurations for mobile robots.
- How is the kinematics of a fixed/steered wheel modeled?
- What is the center of instantaneous rotation for a mobile robot?
- What are the main constraints for a differential drive/bicycle/4-wheel/etc. mobile robot? Which of these are redundant?
- How is the configuration space of a robot defined?
- What is a holonomic constraint (in broad terms) and what relation does it have with a mobile robot?
- How is the accessibility of the configuration space of a non-holonomic system?
- How do omniwheels and mecanum wheels work?
- What is the main constraint we use to determine the model for a wheeled system?
- Control strategies for heading in case of a bicycle, a differential steering and an omnidirectional robot.

Part II
- What type of sensors does a mobile robot employ, in the most general classification?
- What does a proprioceptive sensor measure? And an exteroceptive?
- What are distance sensors and how are they used for mobile robots? What are the main advantages?
- What is a laser scanner and how does mapping with a LiDAR work?
- In which case would you choose a vision system sensing approach vs. laser scanning?
- What is environment mapping and what are the main characteristics?
- What is the definition of the problem of navigation?
- How do we classify the sources used for position determination?
- What is odometry, in broad terms? How is it related to sensing and what is its main drawback?
- What is SLAM?
- What are the main approaches in path planning in mobile robotics?
- How can the possible paths be described in an efficient way?
- What is a grid-based search approach? And an edge visibility graph?
- What is the main principle behind potential fields path-planning and what are the main issues?
- How does terrain geometry affect mobile robots?

2 ROS

- What is ROS, and what are its applications?
- How are messages moved around the ROS framework?