

Advanced Control Laboratory (085705)

ROS #1: Getting to know the Robot Operating System - ROS

This Lab focus is to familiarize you with ROS, and learning the basics in order to communicate with a real robot via ROS. All code written as part of this report should be submitted along with your answers to the Moodle site of the course, in PDF format.

Section 1 lists the tutorials you are required to cover, while the other sections contain questions regarding ROS.

1. (50%) Cover the following tutorials, it is highly recommended to try out the examples as you read the text rather than just skim over it.

No need to submit anything from this section, but make sure you go over it all because you'll be using it throughout the course.

- (a) <https://www.mathworks.com/help/robotics/examples/get-started-with-ros.html>
- (b) <https://www.mathworks.com/help/robotics/examples/connect-to-a-ros-network.html>
- (c) <https://www.mathworks.com/help/robotics/examples/exchange-data-with-ros-publishers-and-subscribers.html>
- (d) <https://www.mathworks.com/help/robotics/examples/work-with-basic-ros-messages.html>
- (e) <https://www.mathworks.com/help/robotics/examples/work-with-roscat-logfiles.html>
- (f) <https://www.mathworks.com/help/robotics/examples/get-started-with-gazebo-and-a-simulated-robot.html>

2. (20%) Communicating with the Pioneer

- (a) (5%) What are all the default topics that the Pioneer robot has ?
- (b) (7.5%) We want to be able to send velocity commands to the Pioneer, Create a Publisher/Subscriber (choose the right one) to the “/RosAria/cmd_vel” topic.
- (c) (7.5%) We want to be able to receive odometry readings from the Pioneer, Create a Publisher/Subscriber (choose the right one) to the “/RosAria/pose” topic.

3. (15%) Pioneer ROS Velocity message

- (a) (7.5%) Present the structure of the Pioneer ROS velocity message.
- (b) (7.5%) If the robot is moving forward with velocity of $1 \frac{km}{h}$ while also turning to the right with a rate of $2 \frac{deg}{s}$, how would the equivalent velocity message look like?

4. (15%) Pioneer ROS Odometry message

- (a) (7.5%) Present the structure of the Pioneer ROS Odometry message.
- (b) (7.5%) If the robot is located in location of $\begin{bmatrix} 10 \\ 15 \\ 0.5 \end{bmatrix}$ and a yaw angle of 30° in reference to the primary position, how would the equivalent Odometry message look like?