31385 Autonomous Robot Systems Control

(rev 1.1)

1 Objective

The objective of this exercise is to make a direction controller and a line follower to the square program

When you have finished this exercise you will be able to:

- Drive straight lines with the square program
- Follow a line with the square program

2 Direction control.

Implement a angular controller in the square program, where

$$\Delta V = K * (\theta_{ref} - \theta_{odo}) .$$

Use your physical intuition to chose a suitable value for K.
Make the experiment first in the simulator at the speeds 20, 40 and 60 units (speed command). Plot the positions (x,y) and x,y and θ versus time in MATLAB on the home page.

Repeat the experiments with the real robot.

3 Line following controller

In this part a line following controller for the square program should be implemented.

3.1 Line sensor calibration

Make a function that converts uncalibrated linesensor values to calibrated using the linear transformation described in the calibration exercise.

3.2 Finding the line with minimum intensity algorithm

Implement a function that finds the position of the lowest calibrated linesensor value

3.3 Following the line 1

Using the functions from 3.1 and 3.2 implement a proportional controller to follow the line

$$\Delta V = K * (\Delta ls)$$

Use your physical intuition to chose a suitable value for K.
Make the experiment first in the simulator. Plot the positions (x,y) and x,y and θ versus time in MATLAB on the home page.

Repeat the experiments with the real robot.

3.4 Finding the line with centre of gravity algorithm

Center of mass: $x_c = \frac{\sum x_i I_i}{\sum I_i}$, where I is the normalized sensor intensity and x is the position. If the line is black, I is replaced with (1-I).

Make a function that implements the centre of mass algorithm.

3.5 Following the line 2

Test line following with centre of mass algorithm.