CSE 4392-5369

Vision-based Robot Sensing, Localization and Control

Dr. Gian Luca Mariottini, CSE Dep., University of Texas at Arlington

Assignment #4 - Nov.19th, 2013
Deadline: Nov. 26th, 2013 - 11.59pm

Exercise 1

A holonomic mobile robot with position (x, y) and orientation θ moves in the 2-D Cartesian space according to the following continuous-time kinematic model

$$\dot{x} = v_x$$
$$\dot{y} = v_y$$
$$\dot{\theta} = \omega$$

where (v_x, v_y) represent the translational velocities (in m/s) and ω is the (positive counterclockwise) angular velocity.

1. Derive and write down the fully-extended mathematical derivations for the control law $\mathbf{u} = [v_x,\ v_y,\ \omega]^T$, that will make this robot track a generic trajectory $\mathbf{x}^{des} = [x^{des},\ y^{des},\ \theta^{des}]^T$, such that the error $\mathbf{e} = \mathbf{x} - \mathbf{x}^{des}$ goes exponentially to zero. Scan the pages with the calculations and attach them to the submission.
2. Write a MATLAB code that implements the above control and will plot the planned (i.e., desired) trajectory, as well as the actual trajectory of the controlled robot. Use as $\mathbf{x}^{des}$ a Cartesian trajectory planned in the parameter s, such that $\mathbf{x}_i^{des} = [0,\ 3,\ 0]^T$ and $\mathbf{x}_f^{des} = [0,\ 3,\ \pi/2]^T$, $k_i = k_f = 4$, and $step = 0.0025$. Furthermore, fix the initial robot pose is $\mathbf{x}(t_0) = [0.25,\ 2.75,\ 0]^T$.
   (*Suggestion: Note that you can assume $b = 0$ in this case, and use gains $k_1 = k_2 = 0.5$*)