Problem Set 2

19fmiROBEG - AI Robotics

1 Problems

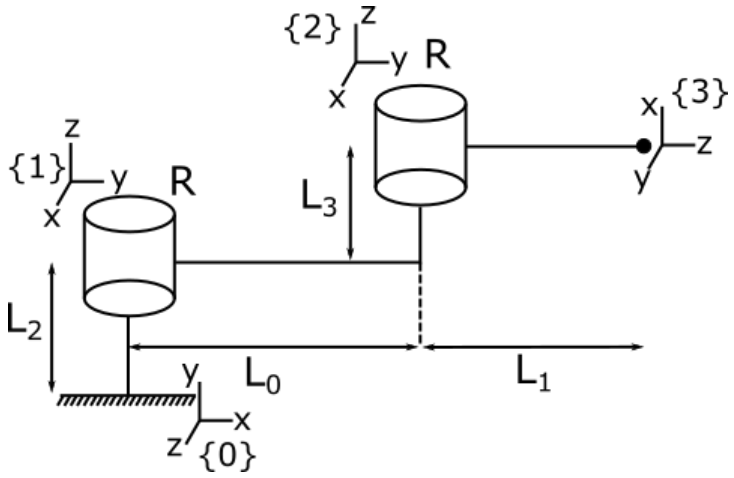
Problem 1. (1 point) Describe the topological description of the configuration space of the following:

(a) A four wheeled robot driving on a plane

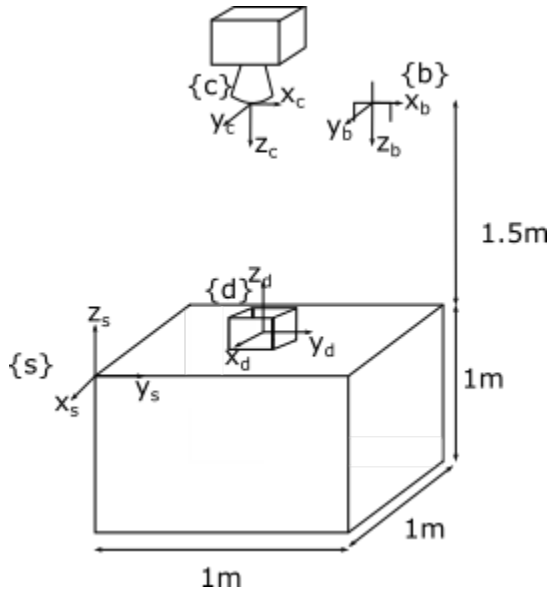
(b) An RRP arm attached to a wheeled cart confined to motion in one dimension along a track

(c) A flying drone with an RRPRR arm attached to it

Problem 2. (2 point) The 2R robot configuration is shown below. At each joint the reference frame has been asigned such that the z axis is aligned such that motion of the joint is about that axis. Find the end-effector transfromation matrix $\{3\}$ in the base frame $\{0\}$ T_{03} in terms of the joint angles θ and joint displacements L_0, L_1, L_2, L_3



Problem 3. (2 points) Consider the scenario shown below. There is a cube with dimensions $(0.1m \times 0.1m \times 0.1m)$ placed on the center of a table and a retractable claw attached above and a camera located at the center of the table top at a height of $1.5m$ from the table top. Four coordinate frames have been defined: The fixed frame $\{s\}$, the frame of the robots end-effector $\{b\}$, the frame of the camera $\{c\}$ and the frame of the box which is located at the center of the cube$\{d\}$.



(a) Find the transformation matrices T_{ad}, T_{ac}, T_{dc}

(b) Find the transformation matrix T_{bd} given that the current position of the end-effector is $0.25m$ to the right of the camera.