Computer Science 685 Midterm

Paul McKerley (G00616949)

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1. If I understand the question correctly, it is to define the forward kinematics of the point at the end of $L2$. Since this is the position of the gripper, I will refer to it as G. I interpret the diagram to mean that $L1$ is a fixed bar, which slides up and down $y1$, causing $d1$ to vary. Also, θ_2 can change, causing $L2$, which is also fixed, to swing around.

   So the position of G in the second coordinate frame is simply how far it is translated from the end of $L1$, which is

   $$G_2 = \begin{bmatrix} L2 \\ 0 \end{bmatrix}$$

   Now in the first coordinate frame, G is rotated by θ_2 and translated by $L1$ on the x axis and $d1$ on the y axis. So

   $$G_1 = \begin{bmatrix} L1 \\ d1 \end{bmatrix} + R(\theta_2) \cdot \begin{bmatrix} L2 \\ 0 \end{bmatrix} = \begin{bmatrix} L1 \\ d1 \end{bmatrix} + \begin{bmatrix} L2cos(\theta_2) \\ L2sin(\theta_2) \end{bmatrix} = \begin{bmatrix} L1 + L2cos(\theta_2) \\ d1 + L2sin(\theta_2) \end{bmatrix}$$

   As mentioned above, the kinematic parameters are $L1$, $L2$, and implicitly the angles of $d1$ with respect to $x1$, and $L1$ with respect to to $d1$. The joint variables are $d1$ and θ_2.

2.

3.

4.