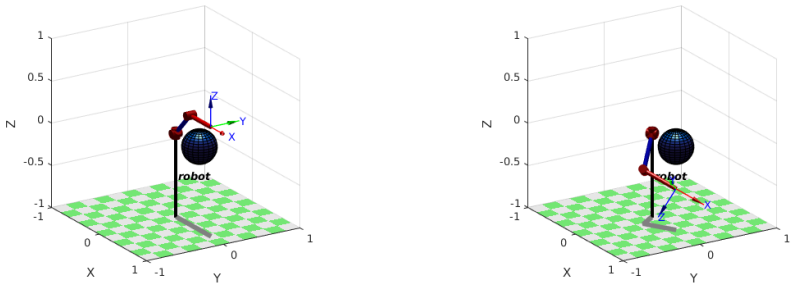
CS4610/CS5335: Homework 2

Out: 2/19/16, Due: 3/1/16

Please turn in this homework to Rob Platt via email on the due date. HW PA Q1 and Q2 should be submitted in the form of a set of two files named Q1.m and Q2.m. All this should be zipped up into a single file and emailed to me.

Have a look at the accompanying zip file. Stub files for Q1.m and Q2.m are provided to you. You should implement each of these. Once implemented, you should be able to run "hw2(X)" in order to run code for question "X". hw2.m is given to you and should not need to be modified. The only thing you need to do is to insert code into the stub functions in Q1.m and Q2.m.



(a) (b)

Figure 1: Illustration of Q1. (a) initial arm configuration. (b) end effector in desired position.

PA Q1: In this question, you're going to use an RRT to find a collision free path from a given start configuration to a goal configuration where the end effector is at a desired position. Your function will take as input a robot (encoded as a SerialLink class), a starting arm configuration (encoded as a 1x4 vector of joint angles), and a desired position (encoded as a 3x1 vector). The output should be a series of milestones that achieve a collision free path. This function should work for arbitrary desired positions.

You should use the RTB functions to calculate the forward kinematics of the arm as needed. No two milestones should be more than 0.5 distance apart measured as the L2 joint space norm between two adjacent arm configurations. You should use a standart (single tree) RRT approach. You may either locate the root of the tree at the starting configuration or at the goal. Figure 1 shows the starting configuration and a goal configuration.

PA Q2: Write a function that does trajecotry smoothing (as covered in the RRT slides) on an arbitrary trajectory. The input should be an $n \times 4$ sequence of milestones. The output should be an $m \times 4$, $m \leq n$, smoothed sequence of milestones.