2.12: Introduction to Robotics
Lab 11:
Trajecotry Planning and Robot Manipulation in Matlab*

Spring 2020

Instructions:

1. **You will be working on this lab alone on your individual computer, but if you face any issues, contact a TA. Feel free to work alongside a fellow classmate, but turn in your own work.**
2. **In the end, we will ask you to compile a brief report that includes your response to the questions in the handout, and the the visualized results with comments.**

1 Introduction

In this lab, you will experiment with robot trajectory planning and control techniques. Specifically, you will:

1. Use MATLAB Robotic Toolbox to plan and execute the trajectory of a 7-DOF manipulator in the task space and joint space.
2. Use MATLAB Robotic Toolbox and Nonlinear Model Predictive Controller Toolbox to plan and execute a collision-free trajectory with the same robot.
3. Use the same tools to conduct a pick and place operation
4. Due May 1,2020

We will explore MATLAB and its amazing toolboxes in this lab. The examples that are demonstrated in this lab are meant to be a guidance towards your future robotics practice. Make sure to check out other cool toolboxes if you want to utilize the other concepts that you have learned from 2.12.

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1. Version 1 - 2020: Jerry Ng, Rachel Hoffman-Bice, Steven Yeung and Kamal Youcef-Toumi

2 Setting up

2.1 Getting Add-Ons

If you haven't already done so, please install the **Robotics System Toolbox** in MALTAB. In addition, you will need the **Model Predictive Control Toolbox**. Please do that as well. You can manage your MATLAB add-ons by going through the following. Note that the examples have been tested in MATLAB R2019 and R2020, so if doesn't work on your machine, please check if you have the correct version of MATLAB.

```
HOME -- ENVIRONMENT -- Add-Ons -- Get Add-Ons
```

2.2 Lab code

The github repository can be found here

```
https://github.com/mit212/Lab11_2020.git
```

Please clone or download the zip file into a known location. Otherwise you can also download it from Stellar.

MALTAB has developed this amazing tool called live editor. It allows you to run cell by cell in the script just like Jupyter Notebook in Python. There are three main scripts you are going to run. They are the three .mlx files located in the Script folder. You may operate your workflow with the following. It is very intuitive.

```
LIVE EDITOR -- SECTION -- RUN SECTION / RUN SECTION AND ADVANCE
```

If you have installed the Toolboxes correctly the scripts should run without error. However, if you experience issue such as cannot find the helper file, we have put back-ups in the helper folder.

3 Deliverable

As the live editor script is in an interactive format, please follow the instructions in the scripts and answer the embedded questions. Please compile all your answers in the same document and submit through Stellar. Please feel free to reach out to us in Piazza if you have any question in terms of the lab material or the topics that are covered.