

ETECH 496: Exam 1

Submission Deadline: 11 PM, Tuesday, April 14.

To submit your exam on Dropbox, follow these rules strictly:

- For problem 1, print your outputs in a word file named as 'NAME_P1'.
- For problem 2, name your MATLAB script as 'NAME_P2.m'.
- Put both files in a folder named 'NAME_Exam1', zip (compress) the folder, and submit on Dropbox.

There will be a penalty for not following the submission rules above.

Problem 1 [2 points]:

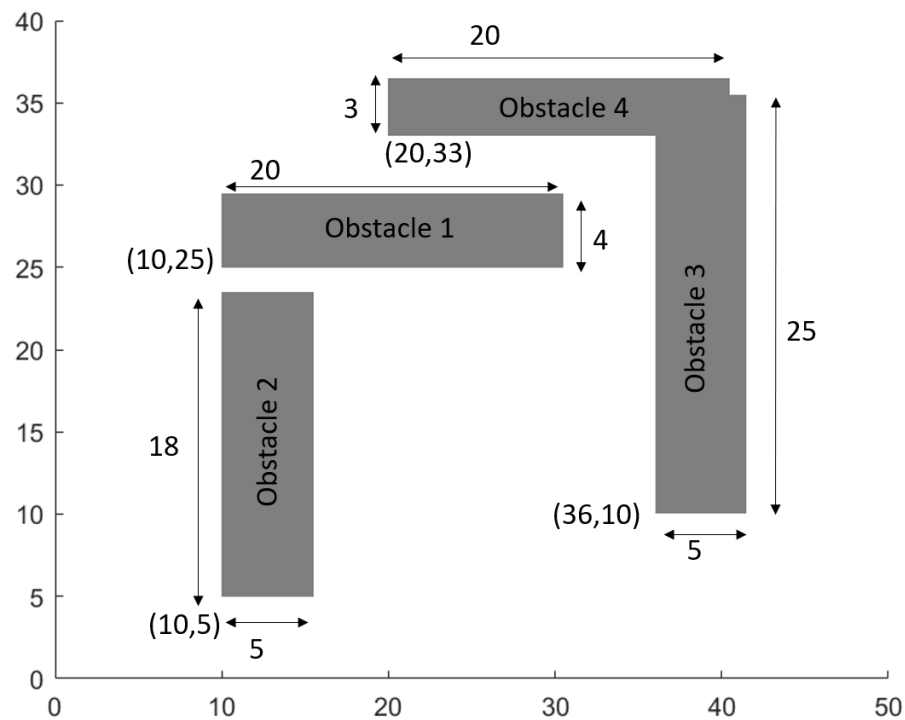
At an instant, a UAV's roll, pitch, and yaw angles in global frame are 10, 15, and 70 degrees, respectively. Total thrust F by motors is 20 N.

- a) What is rotation matrix from body to global frame?
- b) What are components of F in global X, Y, and Z directions?

Copy your MATLAB outputs for the above two in a word file and submit that.

Name the word file 'NAME_P1'. For example, I have attached Verma_P1. Follow the format in Verma_P1.

Problem 2 [13 points]: name your MATLAB script as 'NAME_P2.m'.



An obstacle field (50 m x 40 m) consists of four obstacles as shown in the figure. For each obstacle, coordinates of bottom-left corner and dimensions are given. For example, obstacle 1 is 20 m x 4 m and coordinates of bottom-left corner are (10 m, 25 m).

Use $dx=dy=0.5$ m.

Start location is (20 m, 5 m).
Bot heading at start location is $\pi/2$.

The bot can take only three steps (also shown in the figure):

- 1) Straight in direction of bot heading with step-size dx .
- 2) 90 degrees left turn with radius dx .
- 3) 90 degrees left turn with radius $2 * dx$.

The bot can't take right turns.

Use path-length for the cost.

Write MATLAB code to plot the following figures:

- Figure 1: obstacle field and trajectory from start location to (10 m, 35 m).
- Figure 2: CTG map
- Figure 3: VVF map

