AA274A Section 6
Writeup

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Problem 1: We used the message type float32 for all three messages. The updated code is as follows:

```
#!/usr/bin/env python3
import rospy
import typing as T
from std_msgs.msg import Float32
import numpy as np
from utils import wrapToPi

# command zero velocities once we are this close to the goal
RHO_THRES = 0.05
ALPHA_THRES = 0.1
DELTA_THRES = 0.1

class PoseController:
    """ Pose stabilization controller """
    def __init__(self, k1: float, k2: float, k3: float,
                 V_max: float = 0.5, om_max: float = 1) -> None:
        self.k1 = k1
        self.k2 = k2
        self.k3 = k3
        self.V_max = V_max
        self.om_max = om_max
        self.alpha_publisher = rospy.Publisher('/controller/alpha', Float32, queue_size=10)
        self.delta_publisher = rospy.Publisher('/controller/delta', Float32, queue_size=10)
        self.rho_publisher = rospy.Publisher('/controller/rho', Float32, queue_size=10)

    def load_goal(self, x_g: float, y_g: float, th_g: float) -> None:
        """ Loads in a new goal position """
        self.x_g = x_g
        self.y_g = y_g
        self.th_g = th_g

    def compute_control(self, x: float, y: float, th: float, t: float) -> T.Tuple[float, float]:
        """
        Inputs:
            x,y,th: Current state
            t: Current time (you shouldn't need to use this)
        Outputs:
```

AA274A Section 6
Writeup

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```
    V, om: Control actions

    Hints: You'll need to use the wrapToPi function. The np.sinc function
    may also be useful, look up its documentation
    """
    ########## Code starts here ##########

    #x and y are defined as relative values with respect to x_g and y_g

    x_tilde = self.x_g - x
    y_tilde = self.y_g - y
    th_tilde = np.arctan2(y_tilde,x_tilde)

    #define the polar coordinates
    Rho = np.sqrt((x_tilde)**2 + (y_tilde)**2)

    alpha = wrapToPi(th_tilde -th)

    delta = wrapToPi(th_tilde - self.th_g)
    #Publish data
    self.alpha_publisher.publish(alpha)
    self.delta_publisher.publish(delta)
    self.rho_publisher.publish(Rho)

    #As mentioned in the Line 6 of the code, We are commanding Zero velocities, when the
Rho, alpha and delta values are less than the threshold.
    Threshold_check = ((Rho > RHO_THRES) or (alpha > ALPHA_THRES) or (delta >
DELTA_THRES))


    if (Threshold_check==1):

        #define the V and w equations in the polar coordinates

        V = self.k1 * Rho * np.cos(alpha)

        #Need to define the alpha as part of the sinc function, so that we can avoid the infinity
condition when alpha = 0
        om = self.k2 * alpha + self.k1*(np.sinc(alpha/np.pi) * np.cos(alpha))*(alpha + self.k3 *
delta)

    else:
```

AA274A Section 6
Writeup

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```
    V=0
    om=0

########## Code ends here ##########

# apply control limits
V = np.clip(V, -self.V_max, self.V_max)
om = np.clip(om, -self.om_max, self.om_max)

return V, om
```

Problem 2: What command did you use to record the requested topics to a particular file name?

rosbag record controller/alpha controller/delta controller/rho

Can use -O to specify the exact file name

Problem 3: Include the output of rosbag info in your write up.

```
rosbag info 2022-11-07-18-54-59.bag
path:        2022-11-07-18-54-59.bag
version:     2.0
duration:    15.4s
start:       Dec 31 1969 16:06:38.14 (398.14)
end:         Dec 31 1969 16:06:53.54 (413.54)
size:        34.0 KB
messages:    465
compression: none [1/1 chunks]
types:       std_msgs/Float32 [73fcbf46b49191e672908e50842a83d4]
topics:      controller/alpha   155 msgs    : std_msgs/Float32
             controller/delta   155 msgs    : std_msgs/Float32
             controller/rho     155 msgs    : std_msgs/Float32
```

AA274A Section 6
Writeup

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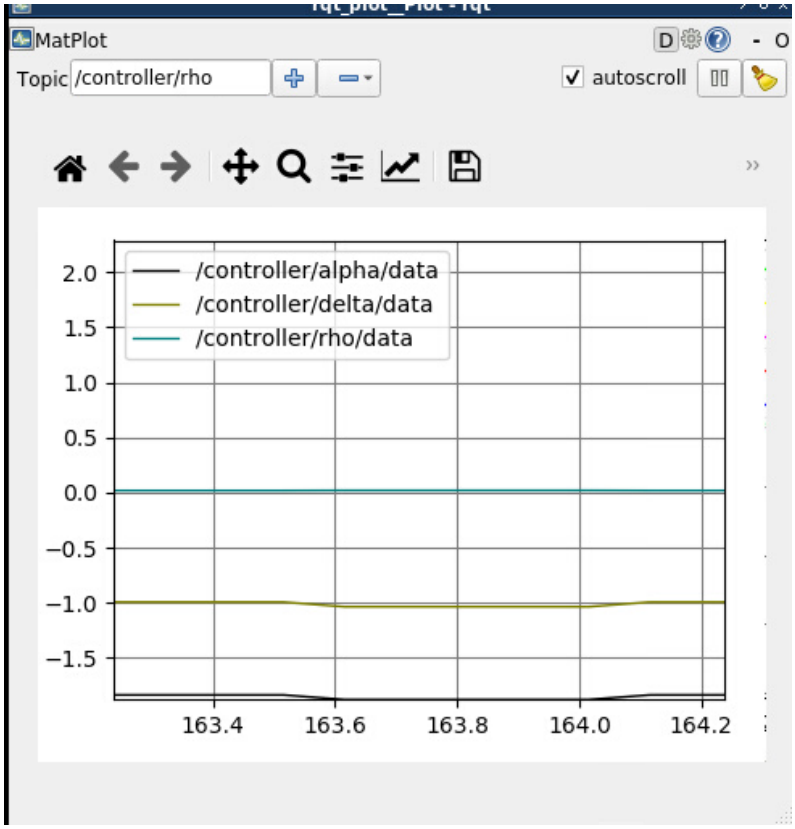
Problem 4: What happens when you run the command rosbag play? Why do we need to start roscore before running rosbag play?

Rosbag play puts the messages we previously recorded in the ROS system with the appropriate timing. Roscore is needed to have the framework to put the messages in.

rosbag play -l FileName

Problem 5: Take a screenshot of the resulting plot in rqt_plot and include it in your submission.

Before changing the x axis limits:



AA274A Section 6
Writeup

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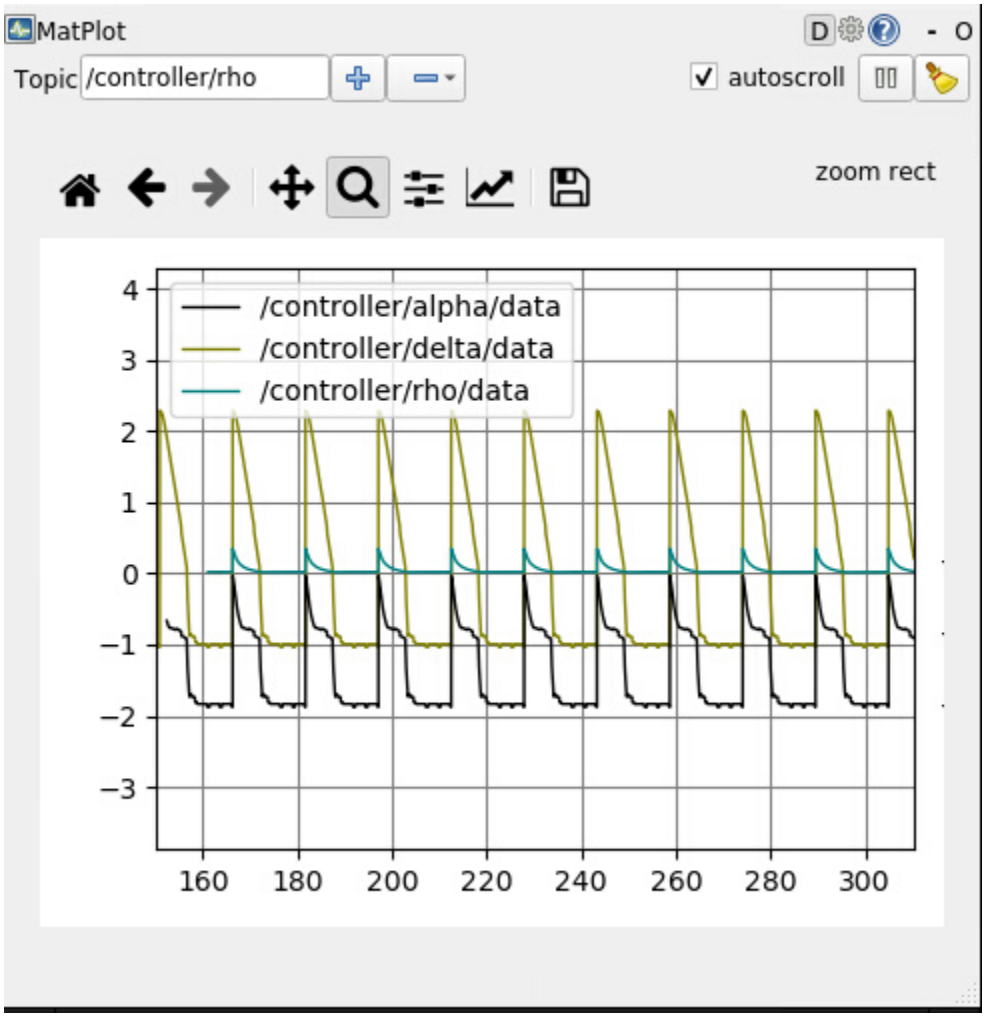
After changing the x axis limits:



AA274A Section 6
Writeup

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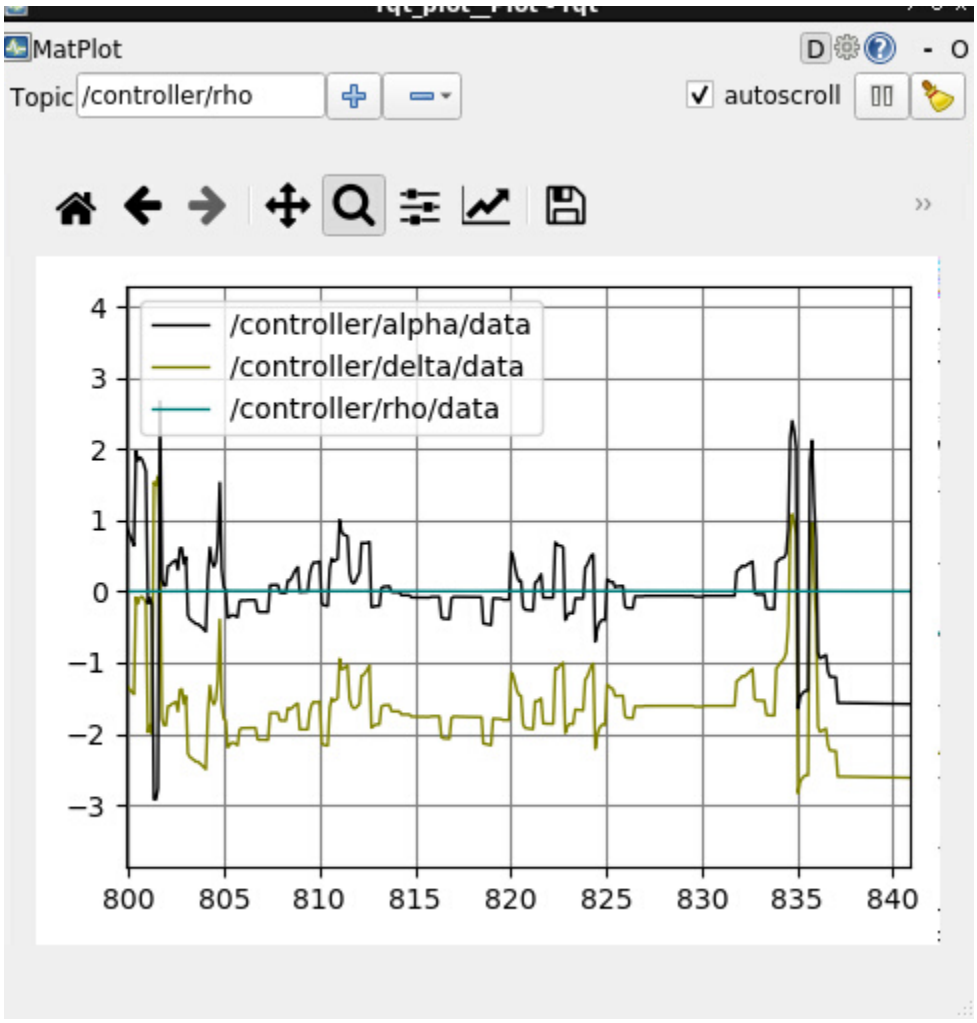
Problem 6: If you have time, record and play back rho, alpha, and delta for several controller gains. What differences do you see as you change each of the gains? Include the plots in your write up.



We increased the gains and then we saw more extreme swings in alpha, delta, and rho.