Robotic Swarm Control Lab, University of Houston   <Orin H Council>

Weekly reports are to be emailed to atbecker@uh.edu by 5:00pm on Tuesdays. The purpose of a weekly report is to: (1) give you text and images for your papers, thesis, and dissertation, (2) document progress, (3) identify if you are stuck or need resources.

Weekly report

1. **My *Goals* from last week**
   - **Deliverable 1:** Complete Simulink Model - **Complete**
   - **Deliverable 2:** Test interface with current control loop and Simulink. Verify Simulink can send valid current commands to control loop. - **In Progress**
2. **My *Accomplishments* this week**
   a. Project 1: Magnetic Coil Control for Mico robots
      - **Deliverable 1:** Refine Simulink model of the control system. See Equation (1) and (2) for the state-space equations for the ball bearing. Two equations are used (x-axis and y-axis). I did this in order to be able to use a direct measurement (position) as a feedback state. Equation (3) is the magnetic field gradient used to compute the forced induced on the sphere. I would like to implement true tracking methods rather than waypoint tracking.
      - Figure 1 and Figure 2 show the commanded track (Figure 1) and the actual track (Figure 2). 60 seconds to tracking the shape.
      - **Deliverable 3:** Test interface with current control loop and Simulink. Verify Simulink can send valid current commands to control loop. (In Progress).

$$\begin{bmatrix} \dot{x} \\ \dot{v}_x \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ 0 & \dfrac{(-6\pi\mu\, r\, v_x)}{m_s} \end{bmatrix} \begin{bmatrix} x \\ v_x \end{bmatrix} + \begin{bmatrix} 0 \\ \dfrac{(F_{mx} - u_k F_N)}{m_s} \end{bmatrix} u(t)$$

Equation (1)

$$\begin{bmatrix} \dot{y} \\ \dot{v}_y \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ 0 & \dfrac{(-6\pi\mu\, r\, v_y)}{m_s} \end{bmatrix} \begin{bmatrix} y \\ v_y \end{bmatrix} + \begin{bmatrix} 0 \\ \dfrac{(F_{mx} - u_k F_N)}{m_s} \end{bmatrix} u(t)$$

Equation (2)
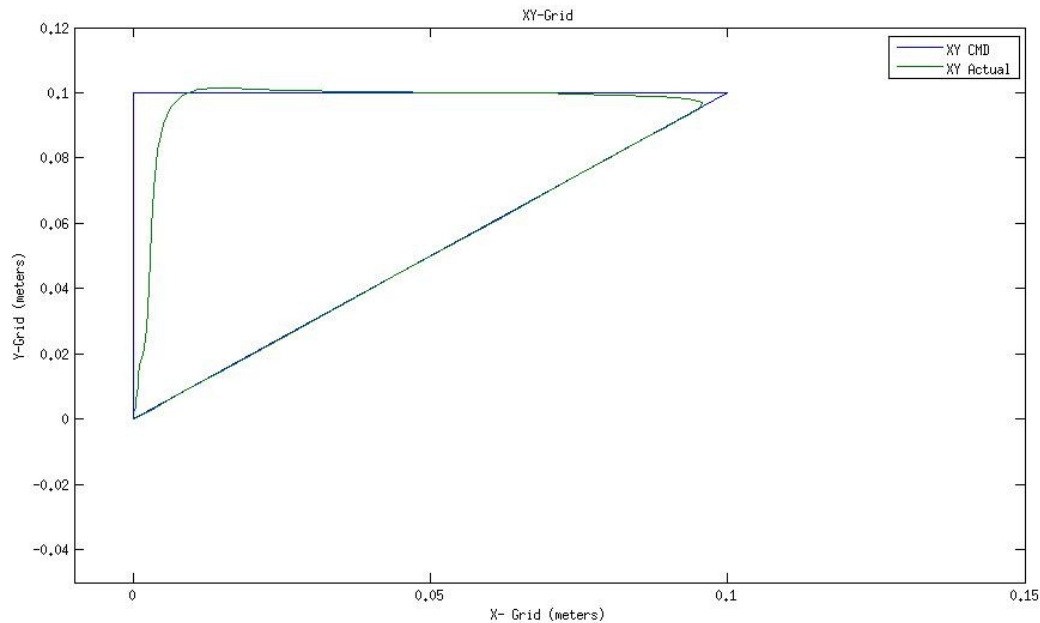
Figure 1

3. **My *Goals* for next week**
   - Objective 1. Build a coil with the electrical and physically properties required for a working coil control system.
   - Objective 2:Start construction on a frame to hold the six coils and operating area for micro-robots.
   - Objective 3: Refine Simulink model of the control loop. Compare MPC, PID, and FULL state feedback to determine which control methods performs the best.
   - Objective 4: Setup imagine capture program in MATLAB/Simulink.
   - Objective 5: Improve Tracking of sphere in model to desired location (x,y).
     a. Meeting with Dr. Becker on Friday 19 JUN15 at 1300. Request confirmation via Google Calendar. Review proposed state-space equations for object and Simulink modeling.

4. What I need Dr. Becker to do:
   a. Continue to provide daily oversight of Ademir in coil and frame construction.
   b. Discuss during next meeting additional model constraints and controls.
   c. Discuss and agree on project time line from now until the end of the summer session.