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:** Setup a control loop for current coils. This consisted of a current controller, a micro-controller and a coil (or some kind of restive load). - **Complete**
   - **Deliverable 2:** Begin creating a Simulink model of the control system. Specifically, determine what physical parameters allow the assumption of a relatively uniform magnetic field strength to be true. - **Complete**
   - **Deliverable 3:** 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:** Begin creating a 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. I would like to use FULL state feedback and determine the velocity feedback state by computing the velocity from previous position change information. I could also use an estimator for that state variable. I will also compare to MPC and PID. Request your opinion on these ideas.
      - I generated Figure 1 and Figure 2. These figures show the impulse response (**position of ball in x-axis only)** for the minimum current (1.33 A – Figure 1) and maximum current (17 A – Figure 2). As you can see from these graphs, the system behavior is similar enough that I can argue the feedback gains are valid for the entire range of operation. According to the model, it takes about **1.33A** to make a **10 gram** ball bearing move on a metal surface with a friction coefficient of about **0.47**.
      - **Deliverable 3:** Test interface with current control loop and Simulink. Verify Simulink can send valid current commands to control loop. (In Progress).

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

Equation (1)

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

Equation (2)

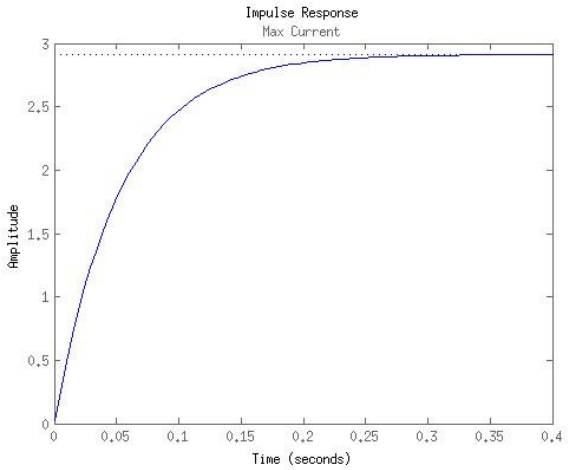

Figure 1

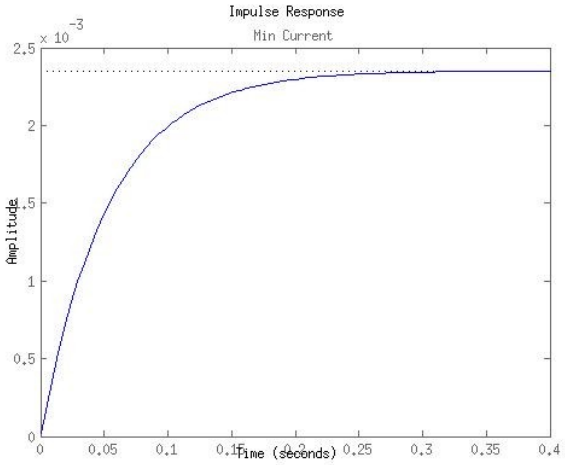

Figure 2

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: Continue system modeling and building in Simulink of the control loop. Compare MPC, PID, and state feedback to determine which control methods performs the best.
     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.