

ECE-420: Discrete-Time Control Systems

Project Part B State: Implementing a Controller

Due: By 5 PM on Monday November 3 (e-mail me a memo and your modified Simulink model)

In this part of the project you will simulate a closed loop discrete-time state variable system in both Matlab and Simulink. You will need to download the project files from the class website for this. This project was written for Matlab R2012b with a 64 bit operating system. You should start project early so you can get the system all working. In this project you need to change what is inside the **state feedback** function block.

Mathematical Background: Consider a simple discrete-time state variable model

$$x(n+1) = Gx(n) + Hu(n)$$

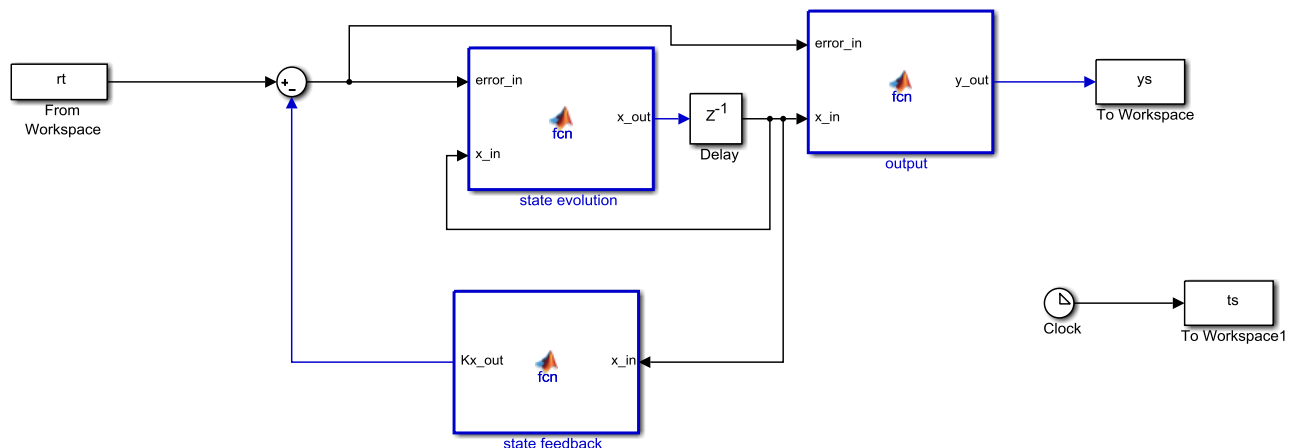
$$y(n) = Cx(n) + Du(n)$$

with state variable feedback $u(n) = -Kx(n)$.

We ultimately want to use adaptive control again, so we need to implement Ackermann's formula for determining the state variable feedback gain matrix (vector) K so that we can update this feedback gain as the system changes. Most of the code has been written for you, but you need to complete it. You should look up the commands **poly**, **fliplr**, **zeros**, and **mpower**.

I have initialized matrices within **state feedback block** with hard-coded sizes, but you should complete the given code (the "fix me!!!" parts) so that it could be generalized easily for an arbitrary size. **Do not** hard code things like the controllability matrix! You also need to use **pinv** with a smallest singular value of 0.0001 to get the inverse of the controllability matrix.

The file **closedloop_state_driver.m** simulates a discrete-time state variable system in Matlab, and invokes a Simulink model **closedloop_state_model.mdl**.



You should end up with a graph that looks like Figure 1 if everything is working correctly

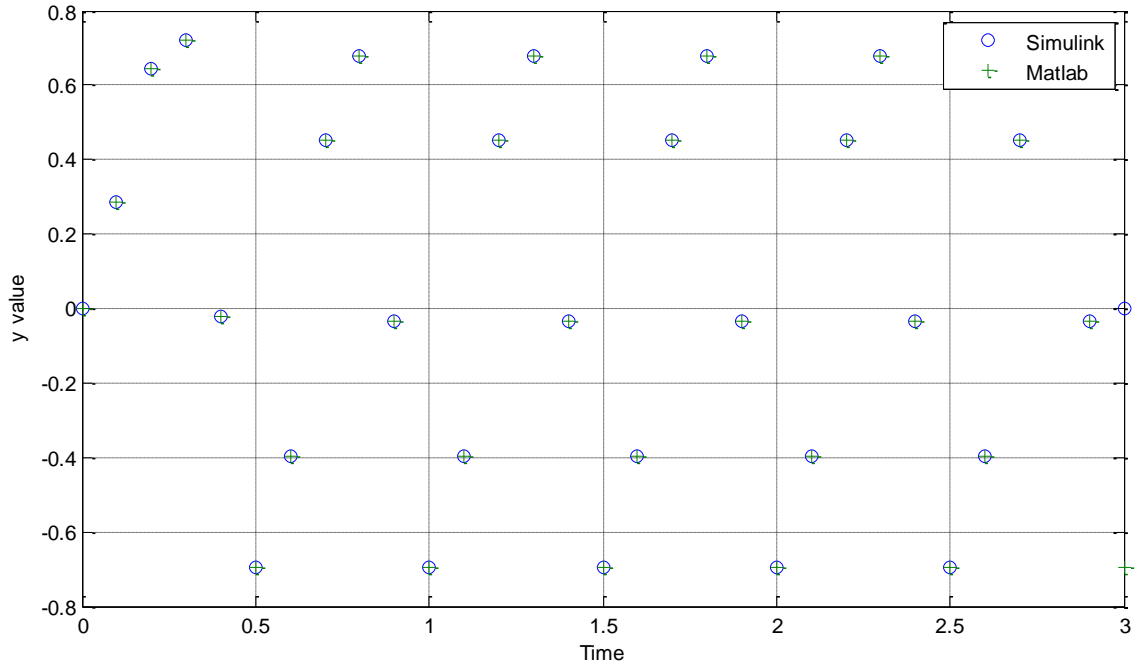


Figure 1. Results of the Matlab and Simulink simulations.