COMPUTER LAB 3 – SYSTEM IDENTIFICATION TASK PREPARATION

Learning Objectives

- To prepare you with the skills to complete the system identification assessment

This computer lab involves 2 tasks centred on:
1) Loading csv files,
2) Data comparison and system estimation

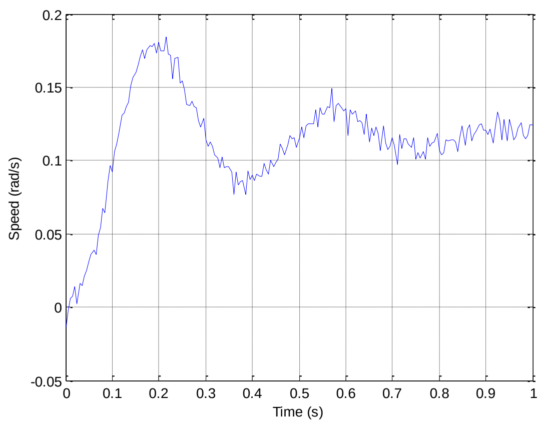
Task 1: In this task, you will load an example of servo motor position data that was captured from a servo motor.

Open the csv file openloop_1.csv in excel to inspect the structure of the file, and use this information to load the csv data into MATLAB and plot the two represented signals (one signal is the response, the other is a time vector). You may need to type "help csvread" in MATLAB to work out how to skip the initial unnecessary information present in the csv file.

In the latest versions of MATLAB you can also just double click on the file to import it.

Task 2: When working with a real physical system, you may start with an approximate model of the system, but unfortunately you typically do not know the exact parameters of the model. Hence, the first step in many practical situations is to capture a measurement of the system response to a step input, and then tune the parameters in your transfer model until its simulated step response best matches the collected data (typically in a RMS error sense).

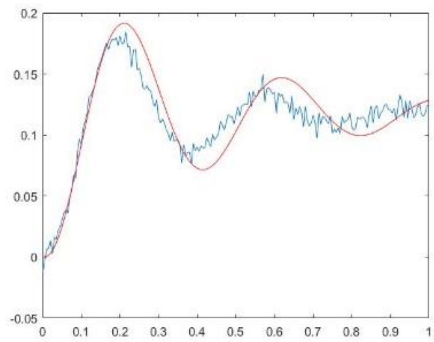
The figure below shows the experimentally measured speed of the SEA output load for 1 V step input to the system. Note that, as is usual for experimental data, there is some noise in the measurement of the speed of the output load, and that the real system has slightly different spring, damping and inertia constants to the system modelled in Tutorial 4. The



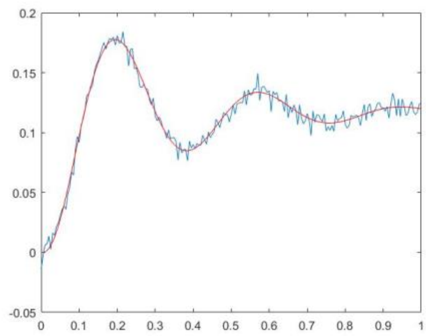
data in this graph is also available for download from Blackboard in the file SEA_speed.mat.

(a) The transfer function of this system is given by $\frac{\theta_L(s)}{E_a(s)} = \frac{4674.15}{s^4+168.36s^3+988.38s^2+39673s}$

- Modify the transfer function provided to compute the transfer function from input voltage to output speed rather than position (recall that $\omega_L(s) = s\theta(s)$).
- Use MATLAB to compute time response of the output load speed in response to a 1 V step input.
- Plot against the recorded speed response in SEA_speed.mat. Use "load SEA_speed.mat" to load the data into MATLAB (see help load).



(b) Write a MATLAB script in a .m file that sets up each of the system components as variables, and compares the step response of the system to the data in SEA_speed.mat. Use trial and error to find better estimates of the system component values.



Hint: Compute a single figure of merit for the quality of the model against the system data. Sum of Squared Error (SSE) is commonly used for this purpose (SSE is related to the RMS that you examined in earlier computer labs, in the sense that RMS=√(SSE/data length)).