

Digital Control and System Identification

Coursework: System Identification

*To be submitted on Blackboard before:
23:59pm, 3rd Sunday November 2019*

This coursework constitutes 10% of your total mark for the module.

Submission details

Submit a single pdf document on TurnitinUK via Blackboard. Maximum extension 4 pages (including figures and references).

Penalties

- **Zero mark for late submission.**
- If you have issues with the submission, email me with coursework attached **before deadline**. Make sure that you attach the coursework!

Academic Malpractice clarification

The coursework is an individual assessment, hence courseworks with evident similarities in any question will be subject to the Schools academic malpractice rules.

Instructions

Get the file with a name ending as the value stated in the Column "FILE SYSID" on Blackboard. State clearly in your submission the file that you have used.

Make sure that you have saved the file in the Current Folder. Load the file using `load('file1xx')`. Then a system identification data object will be created in the workspace, name `DataId`. Input and output signals are accessible using `DataId.u` and `DataId.y`. Sampling time is $T_s = 1$ second and the length of each signal is 7366 samples.

The loaded variable, `DataId`, can be used the system identification toolbox, but state the commands that you have used. You also can load this file in the graphical interface by choosing Data Object in the "time domain data" import menu.

Coursework

Identify different models using parametric identification with ARX and EO structures for the system that maps input `DataId.u` into output `DataId.y`. The system is assumed to be LTI, the maximum number of poles is 4 and a delay shorter than 10 seconds.

Write a report answering the following questions:

Question 1 ARX model: Use the order selection tool in the toolbox with orders [1:4 1:3 1:10] to find the best fit ARX model.

[10 marks]

Question 2 Using autocorrelation analysis of the residuals, explain why that best ARX model is not suitable of the data.

[20 marks]

Question 3 Use OE models to produce a table with five transfer functions that fit the experimental data, with suitable levels in the autocorrelation and cross correlation.

[20 marks]

Question 4 Based on the above table, select the most appropriate OE model of the system considering best fit, autocorrelation, cross correlation, and number of parameters.

[15 marks]

Question 5 Using non-parametric frequency domain method, discuss whether or not the best fit ARX model should be discarded.

[15 marks]

Question 6 Using the file provided during the lecture and using $\sigma = 0.05$, run the m-script until you find a system where the identification is poor. Save this system and use it to answer the following tasks:

1. Plot the Bode plot that you have found.
2. Discuss whether the OE identification provides better or not results.
3. Produce an input where the identification work for the system that you have found.

[5, 5, 10 marks]

Provide good quality figures to support your statements.