
1. (5 points)

The goal of this exercise is to write a MATLAB function named “problem1.m” for analysis of dynamic systems $G(s)=1/(s^2+3s+2)$. The script should perform the following tasks.

- a) Create the transfer function model $H(s)$, generate a pseudorandom binary signal input with a sample rate of 10 Hz and for a duration of 200 seconds. Simulate the response of the system to this input signal. Create a MATLAB figure and plot the input and output signals in two subplots. (**Hint** - call function `tf` to create the transfer function, `idinput` to generate signal input and `lsim` to simulate time response of dynamic system)

(1 point)

- b) Calculate the autocorrelation of the computed output signal in part “a” to lag 200. Create a MATLAB figure and plot the autocorrelation signal. (**Hint** - call function `xcorr` to calculate autocorrelation)

(1 point)

- c) Estimate the impulse response using correlation analysis for 10 seconds. Create a MATLAB figure and plot the estimated impulse response. In the same figure, plot the impulse response of the system (using the transfer function directly) for 10 seconds as well. Compare the plots. (**Hint** - call function `cra` and `impz` for estimating impulse response)

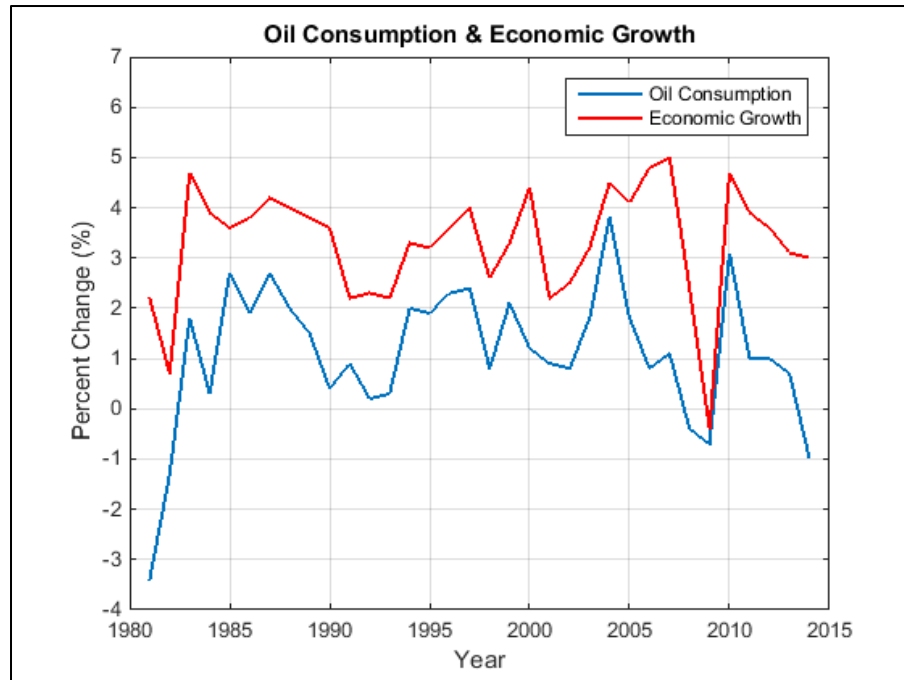
(2 point)

- d) Estimate frequency response of the system using spectral analysis. Moreover, estimate the transfer function with ETFE method. Generate a MATLAB figure and show the bode plots of both estimations in the same plot. (**Hint** - use `etfe`, `spa` for estimating frequency response)

(1 points)

2. (5 points)

Figure 2 illustrates the percentage change in oil consumption and economic growth in US from 1981 to 2014. Load the data file “data2.mat”. The first, second, and third column of data correspond to year, oil consumption, and economic growth, respectively.



Write a script called “problem2.m”. The script should perform the following tasks:

- Analyze the relationship between oil consumption and economic growth quantitatively. Do you consider these parameters correlated or not? Discuss the method that you used in your analysis. Provide the required computations in your MATLAB script.

(2.5 points)

- Estimate a polynomial model for predicting economic growth from the change in oil consumption using MATLAB polynomial estimation functions, “polyfit” and “polyval”. What polynomial order do you choose for the given data? Why? (Hint: You may divide the given data to training and validation sets)

(2 points)

- c) Plot the estimated function in part “b” on the scatter plot of data. Predict the economic growth in year 2015 assuming that the oil consumption percentage change was -0.5%.
(0.5 points)

What to return?

You are supposed to submit your assignment to the related link for assignment 4 in MyCourses. Your submission should include one zip file “Assign04_student number.zip” consisting of a pdf file “Assign04_student number.pdf”, and two MATLAB scripts “problem1.m” and “problem2.m”.

The hard deadline for submission of this assignment is 10.11.2019 at 23:59.