Laboratory Work – 2.0

ANALYZING SIMPLE MODELS FROM REAL LABORATORY PROCESS DATA

1. Goal of the lab:

This lab shows how to develop and analyze simple models from a real laboratory process data. We start with a small description of the process, learn how to import the data to the toolbox and preprocess/condition it and then proceed systematically to estimate non-parametric models.

System Description

This case study concerns data collected from a laboratory scale "hairdryer". (Feedback's Process Trainer PT326; See also page 525 in Ljung, 1999). The process works as follows:

Air is fanned through a tube and heated at the inlet. The air temperature is measured by a thermocouple at the outlet. The input is the voltage over the heating device, which is just a mesh of resistor wires. The output is the outlet air temperature represented by the measured thermocouple voltage.

Setting up Data for Analysis

1. Firstly, ***load*** the input-output data (*dryer2)* to the MATLAB® Workspace.
2. Set up the data as an ***iddata*** object. Name it "*dry". Ts = 0.08 s*
3. For better book-keeping, give proper names to the input and output channels and Time units:
   Input Name = *'Heater Voltage'*
   Output Name = *'Thermocouple Voltage'*
   Time Unit = *'seconds'*
   Input Unit = '*V*'
   Output Unit = '*V*'

4. Choose the first 300 data points for model estimation (Call it '*ze'*)
5. Plot the interval from sample 200 to 300 of data object '*ze'*.
6. It can be observed that the data is not zero mean. Therefore, remove the constant levels and make the data zero mean (Hint: use ***detrend*** command in MATLAB). Plot the same interval (as the previous plot) for comparison.
7. Estimate the impulse response of the system by correlation analysis (***impulseest****)*
8. Plot the impulse response coefficients (***impulseplot***)
9. Show the 3 standard deviations of confidence region for the plotted impulse response (***showConfidence***)
10. What does the shaded region mark?
11. What is a time delay (dead-time) before the output responds to the input (significant output outside the confidence interval)?