Lecture 14
Trends, Model Validation and Input Experiment Design

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Contents: (variants of the following from main lecture notes. No. one in syllabus list.)

1. How to treat trends in the data. Lecture notes Ch. 9.

   - Organizing the input and output data Chapters 9.1 and 9.2.
   - handle trends as in Chapter 9.4.
     Note: Trends y^0 and u^0 should satisfy the dynamic model, for example if h^d is the deterministic system gain. We should have $y^0 = h^d u^0$ and we could use trended data matrices $Y := Y - y^0$ and $U := U - u^0$ as identification data.
   - An approximation often used is centering the data where y^0 and u^0 the sample mean of the output and input i.o.
   - We suggest to 1) First use the raw data matrices Y and U for identification. If the model does not pass the validation test- 2) Second. Use centered data.

2. Model validation. Lecture notes Ch. 10

   - One often use solution is to divide the input and output data matrices U and Y into identification data set U_{id}, Y_{id} and validation data set U_{val}, Y_{val}.
   - As an example, use say 2/3 of the N samples for identification and the last 1/3 part of the samples for validation. The point is that You should use some data U_{val}, Y_{val} for validation that is not used in order to identify the model
   - Using dsr.m: $[A, B, D, E, C, F, x0] = dsr(Y_{id}, U_{id}, L, g, J)$ to identify the model.
   - Simulate the model over all data U and Y and calculate the prediction error criterion V_N as a measure of the quality of the model

3. Input experiment design. Lecture notes Ch. 11.

   - An effective input experiment is the pseudo binary input signal. Use e.g. the prbs1.m function. $U = prbs1(N, Tmin, Tmax)$. Se figures in Chapter 11 for examples.
   - Other input experiments in the idinput.m function.