ARI 2015 – Homework 3

Assignment 1 – Identification of the first-order system

a) Based on your birthday, generate a step response of your unique system. The generating file can be found in Moodle.

   Syntax in Matlab:

   [y] = hw_3a_std(dd, mm, yy);

   Inputs:

   dd – day of your birthday, for instance, 03
   mm – month of your birthday, for instance, 11
   yy – last two digits of the year of your birth, for example 89

   Outputs:

   y – the step response of the system

b) Identify the first-order system, response of which you generated. The output is noisy. The transfer function is of the form:

$$F_1(s) = \frac{k}{Ts + 1}.$$

c) Identify the constants: gain k, time constant T. Include a short description how you obtained those parameters.

d) Compare the original step response and the step response of the system obtained by identification. Include the plot showing how well you identified the system.

Assignment 2 – Identification of the second-order system

a) Using the function hw_3b_std, which can be also downloaded from Moodle, generate a step response of a second-order system. The syntax is identical to the function discussed above.

b) Identify the second-order system from the response. The structure of the transfer function is

$$F_2(s) = k\frac{\omega_n^2}{s^2 + 2\zeta\omega_n s + \omega_n^2}.$$

c) Show the steady-state value, overshoot and settling time.

d) Calculate the damping factor ζ, natural frequency ω_n and gain k, which you got by identification. Do not forget to include the approach for identification.

e) Compare the responses of the original system and your identified system.