Mandatory exercise 3

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Native matlab implementation of a level control of an equalization tank.

The code for the process control without time delay is in the file *mandatory3\_part1.m.*

In this file all the parameters are defined, and some are available for the user to change via a prompt.

The sensor has a noise parameter, and this is filtered using the following filter formula

Where is the filtered measured value, is the current measured value and is the filter constant.

The error is calculated from the difference between and the setpoint. The error is then used in the PID control formula as show below

Where and are Controller gain, integral time and derivative time respectively.

These parameters are calculated with the Skogestad method without time delay

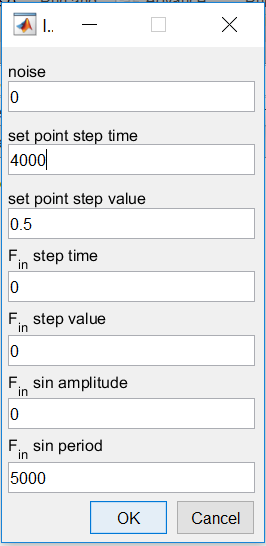
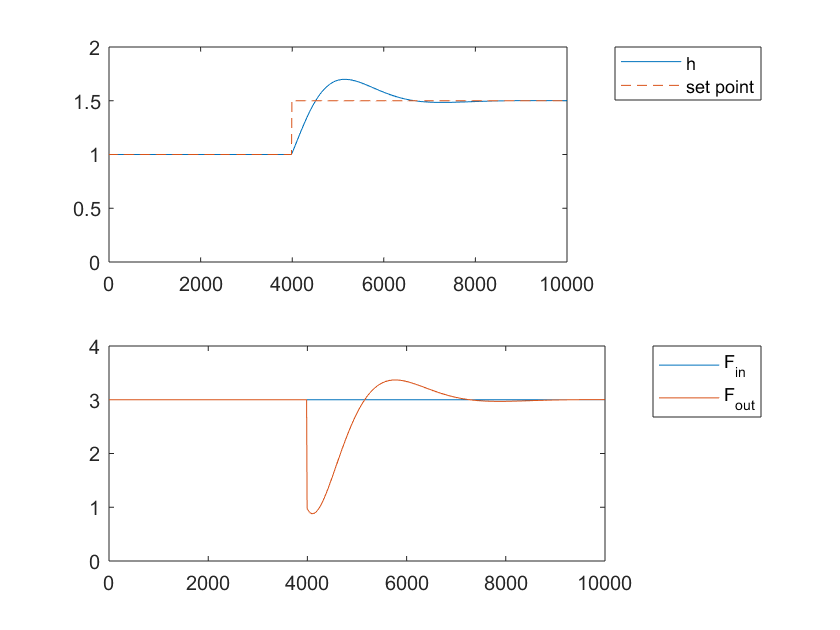
Where is the time constant of the process and is the cross area of the water tank.

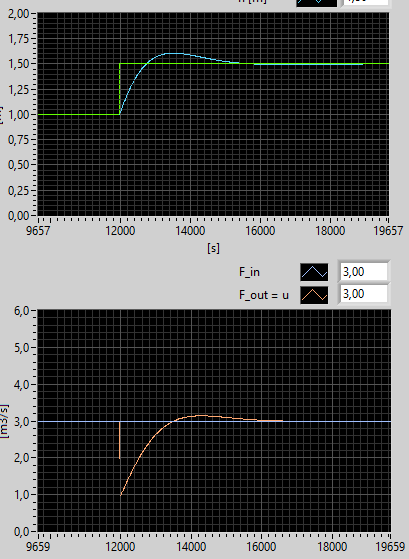
As the process is reversed the control signal is negative.

Finally, the results are plotted.

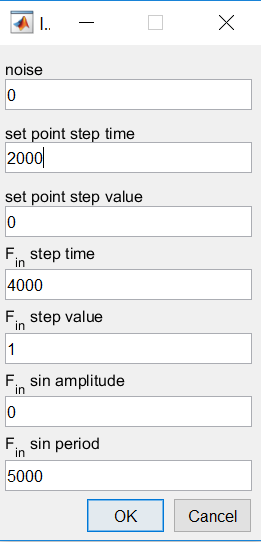
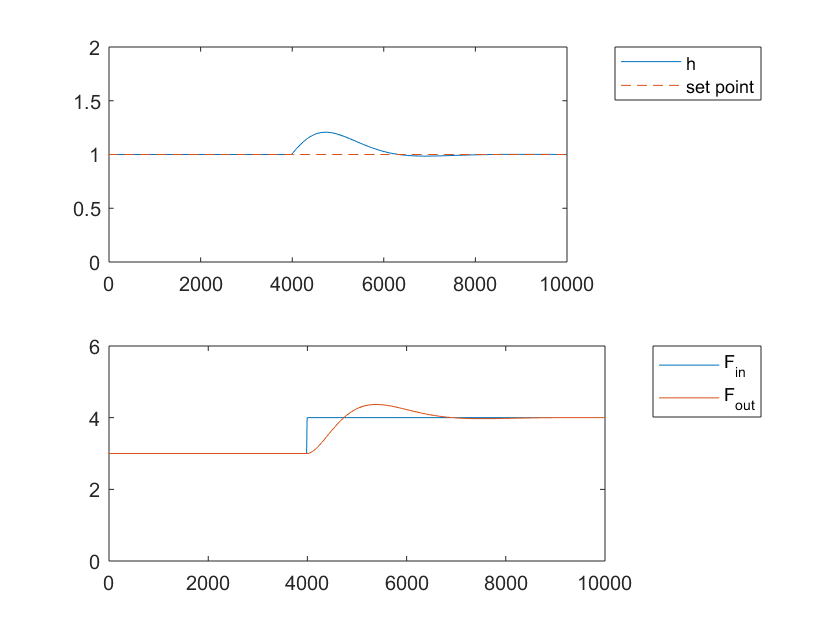
Below follows some results and comparisons to the labview simulation for the same process parameters.

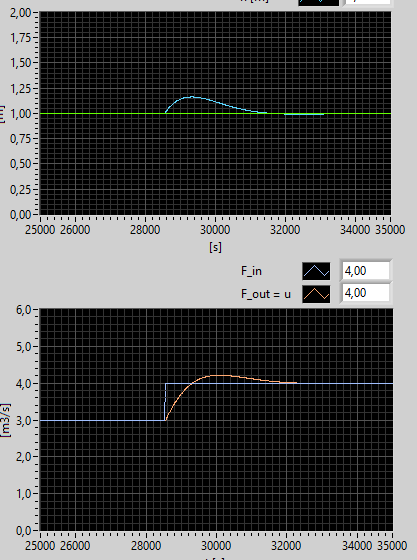
1. **set point step response**



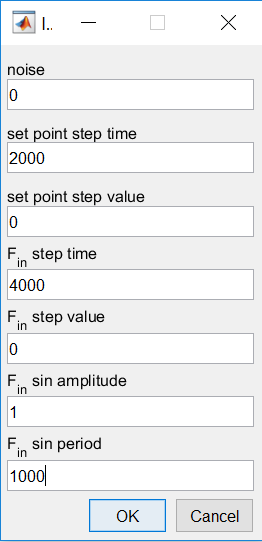
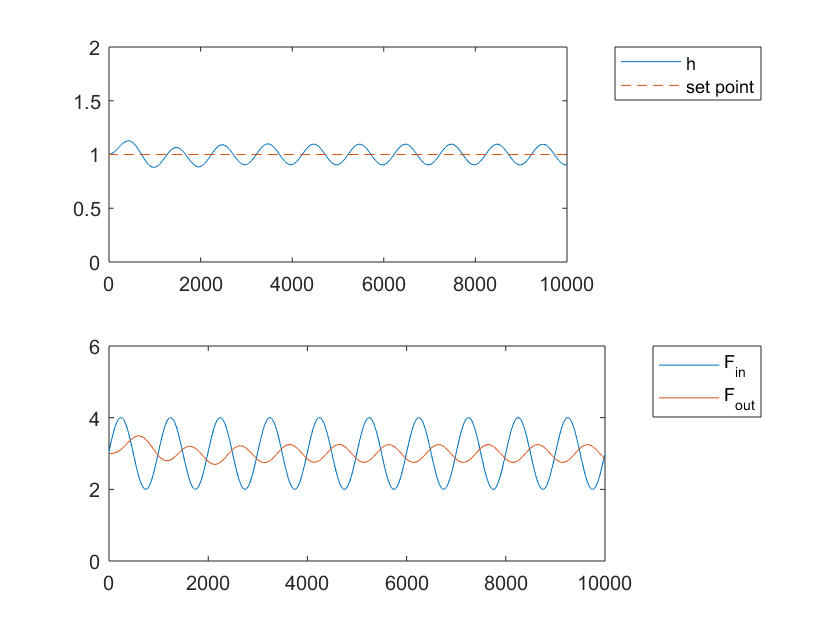


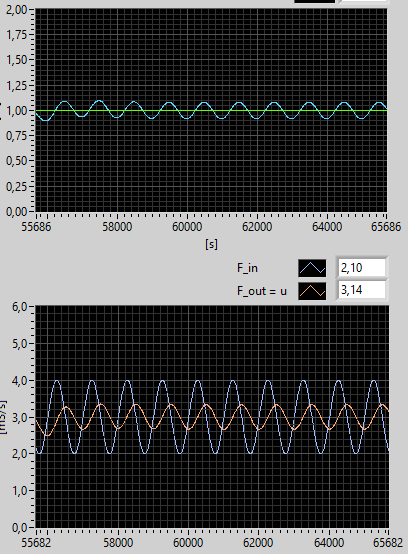
1. **step response**



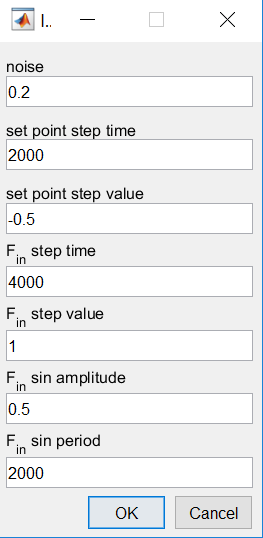
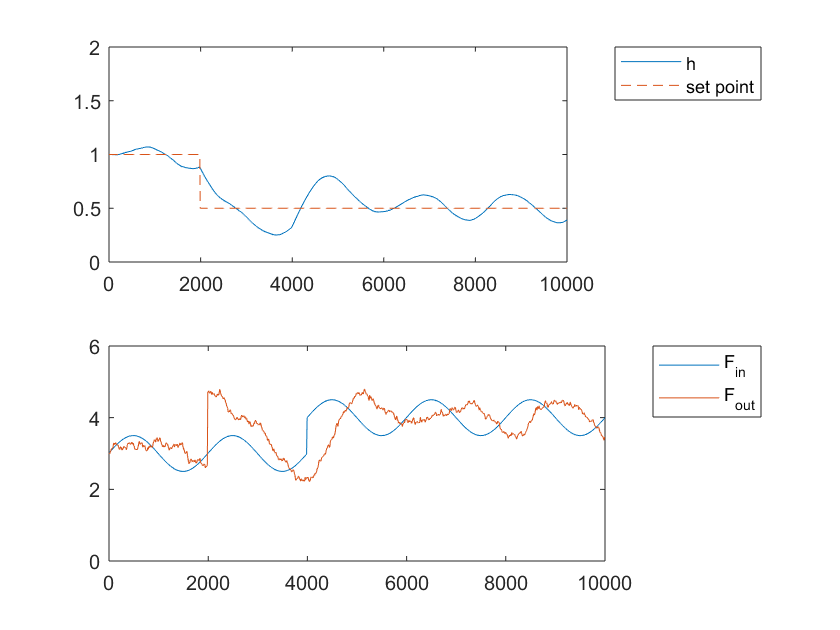


1. **Variable response**





1. **Setpoint step, step, noise and variable .**

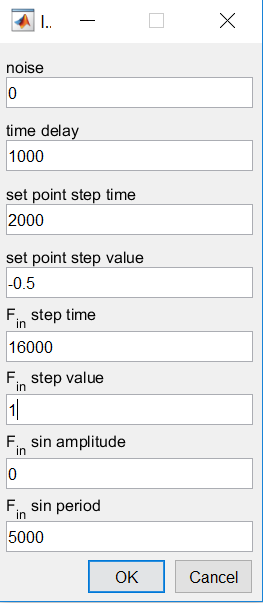
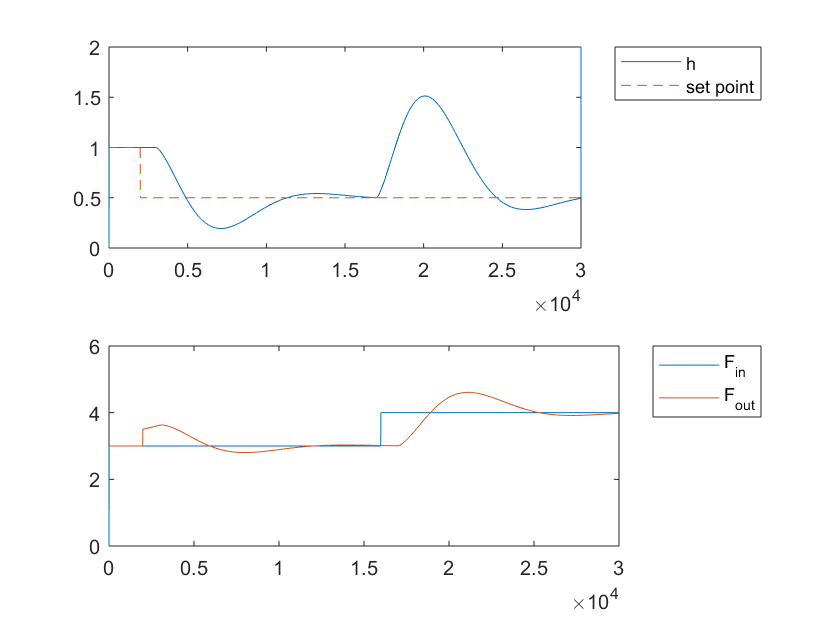


# Process with time delay

The process with time delay is set up the same way as the one without, but the sensor collects values at a displaced time equal to the time delay. The skogestad tuning formula also changes to the following

The script file is called *mandatory3\_part2.m*.

A simulation done with a set point response and a response is shown below.



The dead time right after the set point change and step shows the time delay of the process.

# Remarks and conclusions

The results of the matlab implementation are comparable to the labview implementation. The skogestad tuning gives satisfactory results for this process.

There are however several checks that would be nice to implemented in the script, like float comparison fixes, better array handling and optimization.