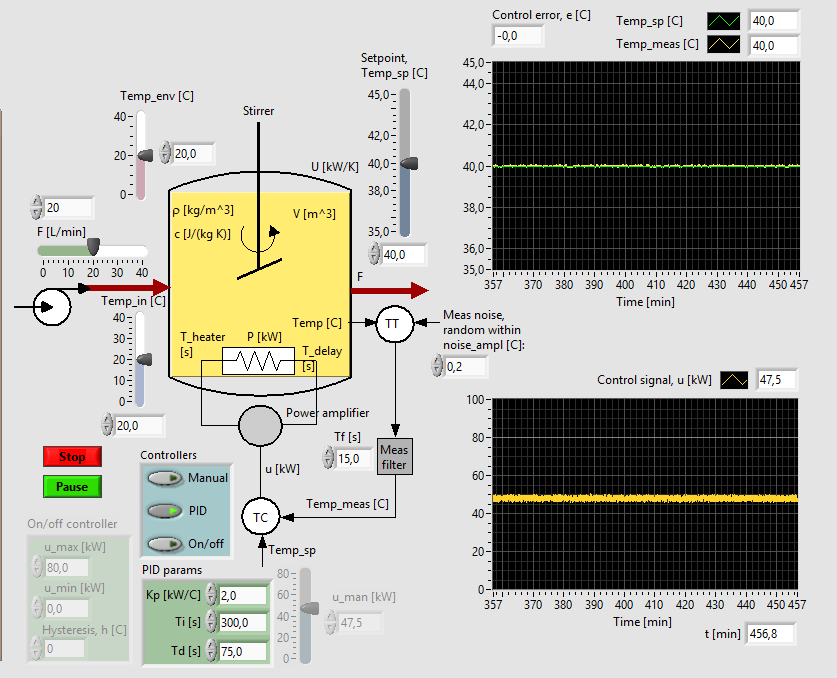
Compulsory exercise to lessons in lecture 1

Aleksander Hykkerud

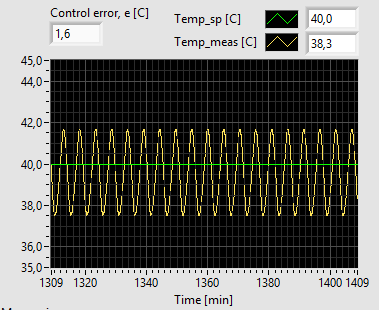
1. **feedback control basics**
   1. The process becomes sensitive to changes in the measured temperature and overcompensates its control signal. This can lead to oscillations and in the extreme case increasing oscillations, eventually becoming highly unstable.

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| --- | --- |
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* 1. The filter time constant I found to give a stable control signal was around 15.0s for a noise level amplitude of 0.2 C and differential term Td = 75 as show below.



* 1. From visual inspection the mean value of the control error during the on/off controller seems to be zero.



1. **Simulation of transfer function**
   1. **Derive the transfer function H(s), from force F to position y.**

Dampening and spring force equations:

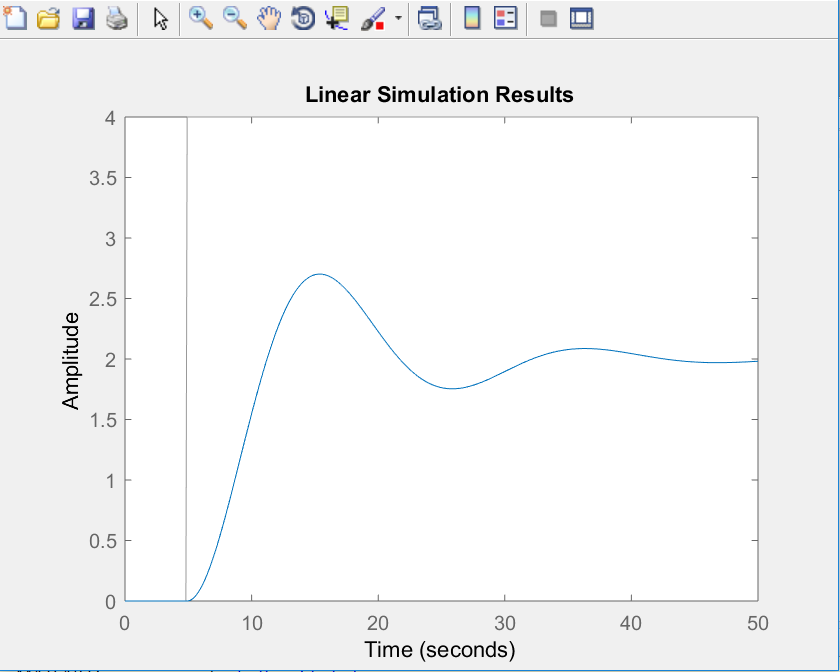
Newtons second law for the spring dampening system

Laplace transformation of the spring dampening systems governing equation

Transfer function of the spring dampening system from force to position

* 1. **Replication of figure 2.8 using the lsim function**

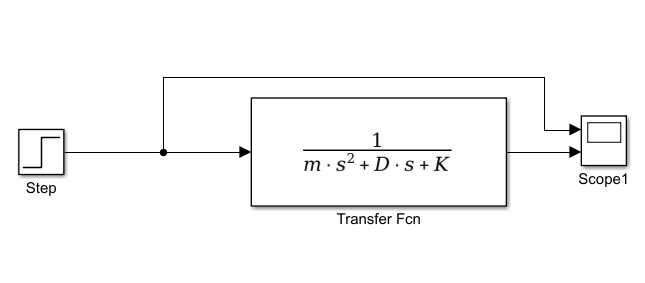
Transfer function was entered into a matlab script and simulated using lsim giving the following result



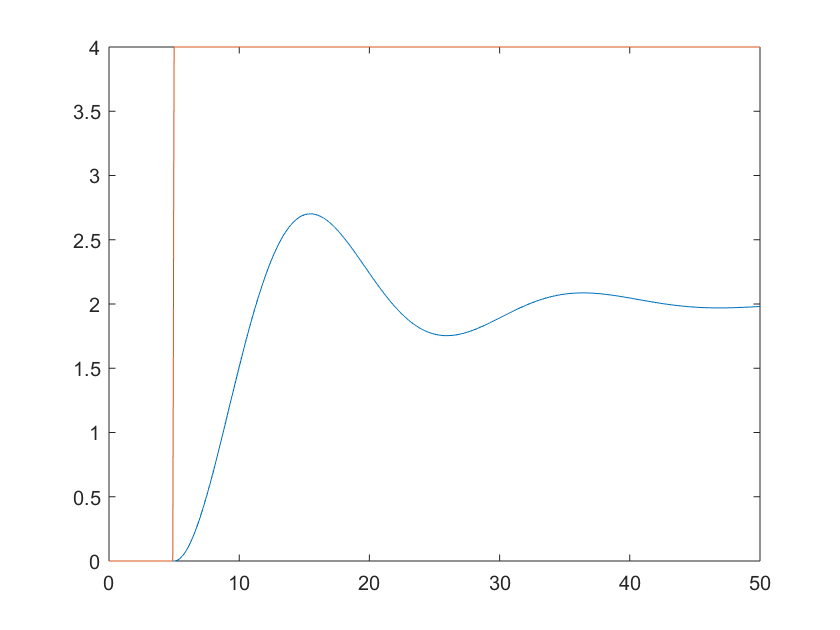
Generated with the code in file "exercise\_2b.m"

* 1. **Implementation of simulator in Simulink**

The transfer function was implemented in the Simulink model as shown below.



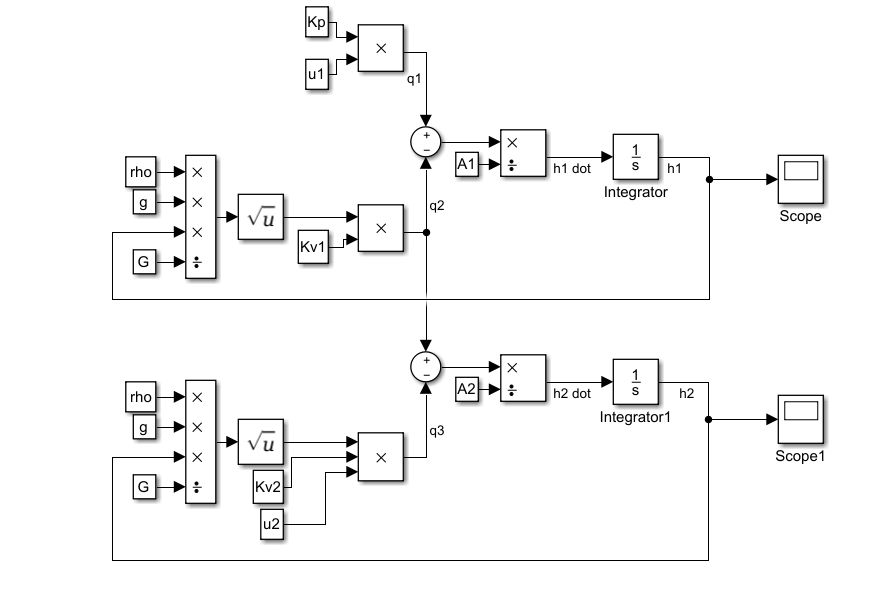
This gave the result as show below



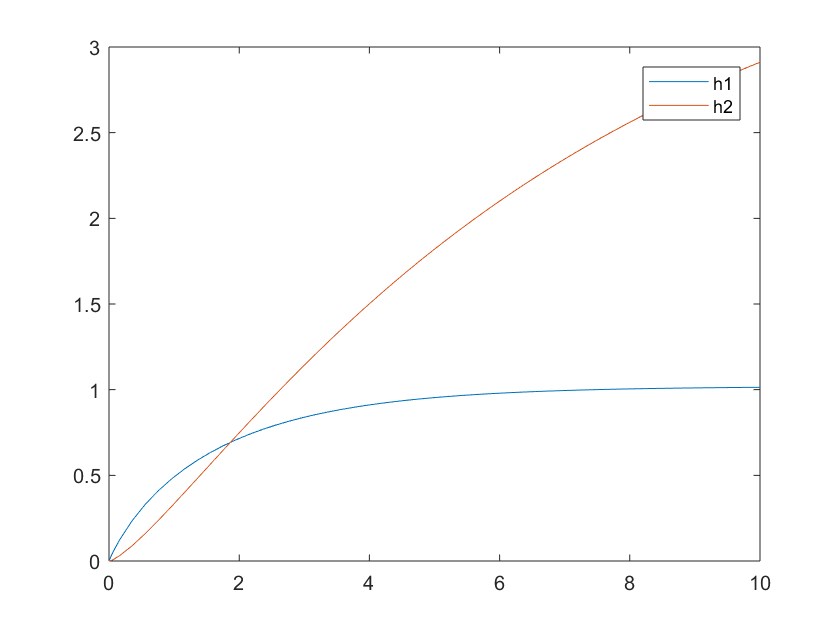
Generated with the code in the file "exercise\_2c.m" using the model file "exercise\_2c\_model.xls"

1. **Simulation of state-space model represented as a block diagram**
   1. state space model

The model implemented in SIMULINK is as follows



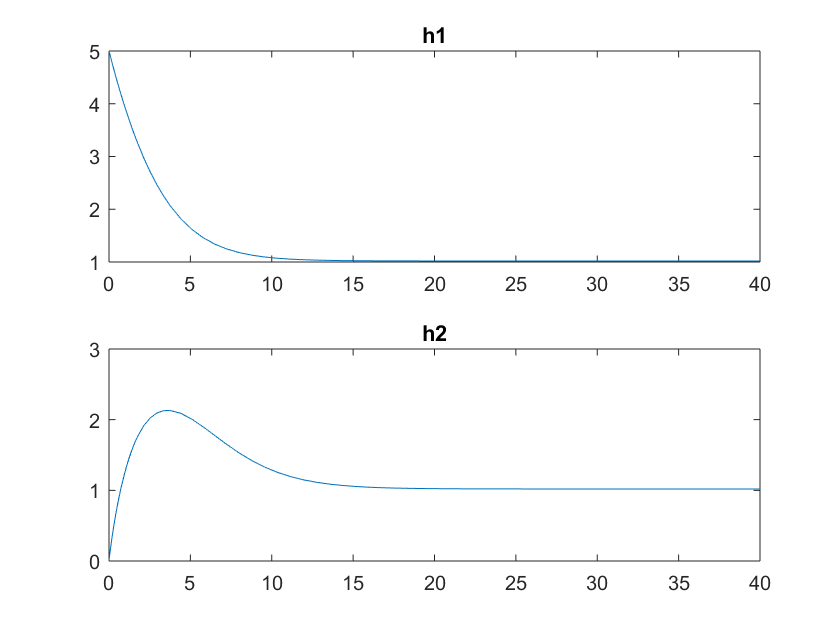
Giving the following result when run in matlab



Generated with the script "exercise\_3a.m" using the model "exercise\_3a\_model.slx"

* 1. **u2 constant and u1 with as a step function**

The following result was obtained using the script "exercise\_3b.m" with the model "exercise\_3b\_model.xls"



* 1. **Validating the simulated values with the static response**

Setting and to zero and solving for and gives

The differences between the steady state calculations and the final values of the simulation were less than and I consider that to be a valid simulation.

Confirmed using the script "exercise\_3c.m" with the model exercise\_3c\_model.xls"