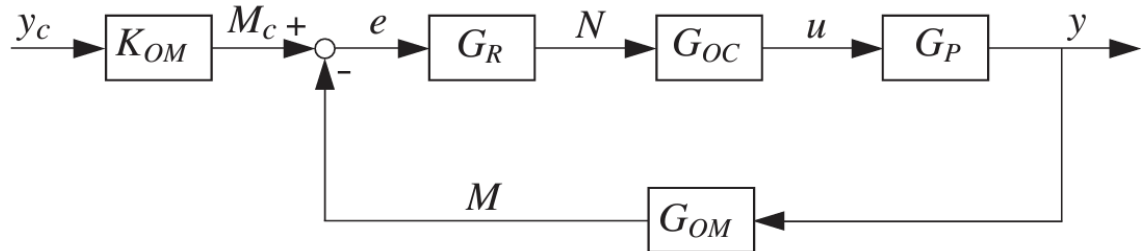


Series 11

Exercise 1

Consider the following looped system:



With the transfer functions:

Process to control

$$G_P = \frac{5}{(s+2)(s+3)}$$

Control unit

$$G_{OC} = \frac{10}{0.01s+1}$$

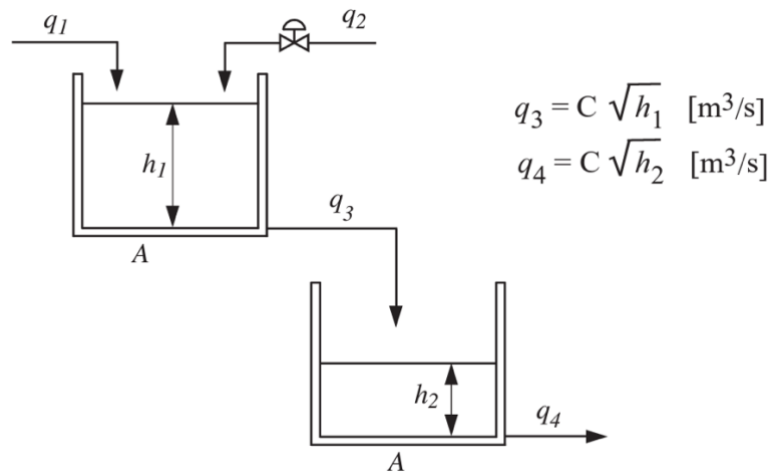
Measuring unit

$$G_{OM} = K_{OM} = 2$$

- Study the stability of the looped system as a function of K_R , the gain of a proportional controller. Propose a numerical value for K_R .
- Numerically calculate the transfer function of the looped system. Is it linear? stationary? What is his order?
- Indicate in detail the *procedure* to be followed to develop a *PID* controller.

Exercise 2

Consider the following system of two tanks in series:



The control consists in regulating h_2 around a set value despite disturbances in q_1 , and this, by manipulating the flow rate q_2 .

- a) Draw the block diagram of an FB/FF control structure (q_1 and h_2 are the two measurable quantities).
- b) Give the control law FF.

Exercise 3

For the same system of reservoirs in series and the same control objective as in the previous exercise, propose a cascade control structure that quickly eliminates the effect of variations in q_1 (h_1 and h_2 are the two measurable quantities).