

## Series 5

### Exercise 1

Consider:

$$F(s) = \frac{10}{s-3}$$

Calculate the final value of  $f(t)$ , i.e.  $\lim_{t \rightarrow \infty} f(t)$ , and discuss the result obtained.

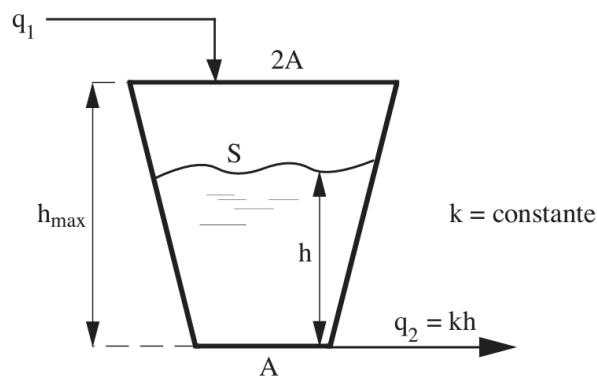
### Exercise 2

Consider a tank for which the cross-sectional area  $S$  is proportional to the height  $h$ :

$$S(h) = A \left(1 + \frac{h}{h_{max}}\right)$$

At the stationary state,  $\bar{q}_1 = 0.5 \text{ [m}^3/\text{min}]$  et  $\bar{h} = 1 \text{ m}$ .

- Model this dynamic system by indicating the simplifying assumptions.
- Calculate the transfer function  $H(s)/Q_1(s)$  knowing that  $A = 1 \text{ m}$  and  $h_{max} = 2 \text{ m}$ .



### Exercise 3

Calculate the step response of the following dynamic system:

$$\ddot{c}(t) + 7\dot{c}(t) + 6c(t) = u(t) \quad c(0) = 1, \dot{c}(0) = 2$$