POLITECNICO MILANO 1863

Dynamics and Control of Chemical Processes

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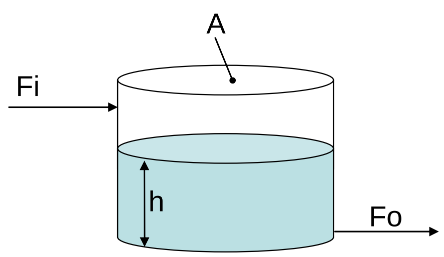
Lab #2

Exercise 1

A cylindrical tank with a section area $A = 30\,\mathrm{m}^2$ receive an inlet flowrate of $F_i = 7.5\,\mathrm{m}^3/\mathrm{s}$. The outlet flowrate is proportional to the liquid height in the tank as follows: $F_o = h/r$, where $r = 0.4\,\mathrm{s}/\mathrm{m}^2$ is the resistance. The tank is in stationary conditions.

1) Evaluate the height dynamics of the tank after a step disturbance on the inlet flowrate, so to reduce it to half of the initial value.

2) Evaluate the height dynamics of the tank after a linear decrease of the inlet flowrate that occurs in 30 s (*i.e.* ramp) so to reduce it to half of the initial value.



Exercise 2

Two tanks can be arranged as shown in Figure 1 and 2. In the second case, the outlet flowrate from the first tank depends on the liquid height of both tanks.

Evaluate the height dynamics of the two tanks, in both arrangements, when there is a step disturbance on the inlet flowrate so to half its initial value.

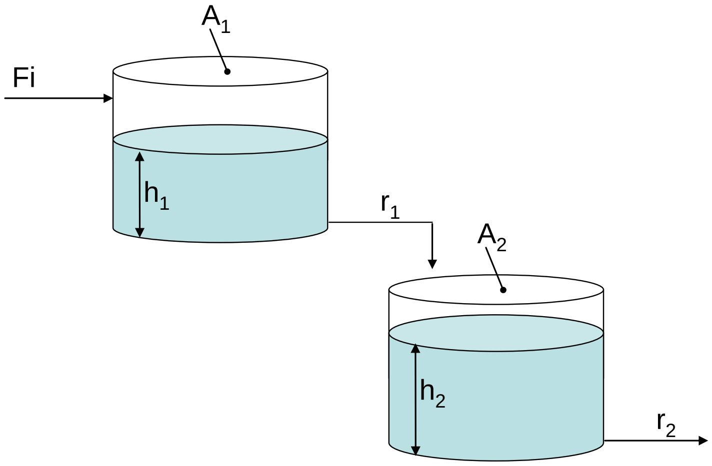


Figure 1: non-interacting tanks

Tank 1:

$A_1 = 30\,\mathrm{m}^2$

$r_1 = 1.2\,\mathrm{s/m}^2$

Tank 2:

$A_2 = 50\,\mathrm{m}^2$

$r_2 = 0.7\,\mathrm{s/m}^2$

Inlet flowrate:

$F_i = 9.4\,\mathrm{m}^3/\mathrm{s}$

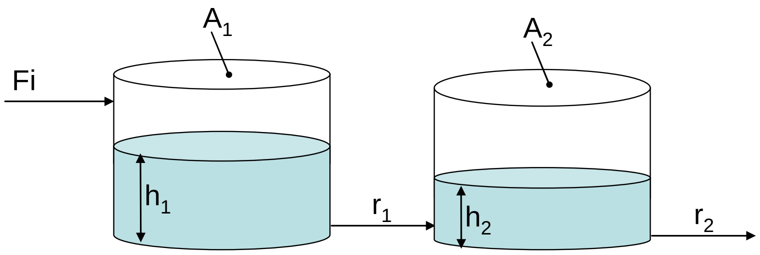


Figure 2: interacting tanks