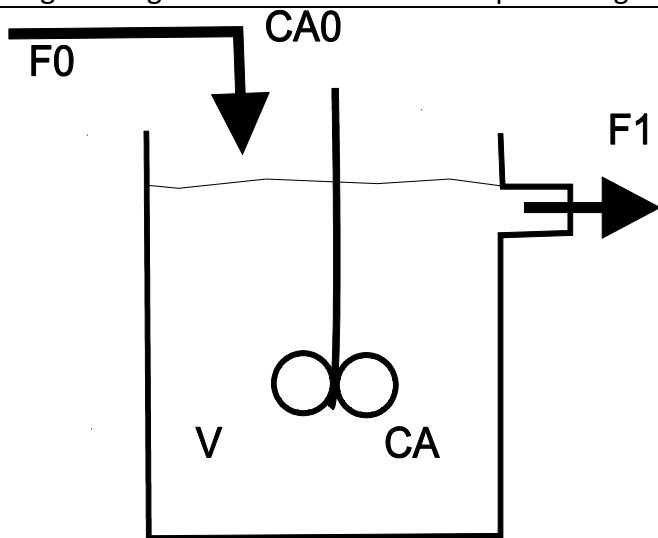


Modelling and control summaries

by Anthony Rossiter

MATLAB GUIs – mixing tank

ASSUMPTION: Students should understand the context of mixing tanks within chemical engineering. Here the focus is on simple mixing with no reaction.



For tank volume V , flow rate F_0 (input and output flows equal), input concentration C_{A0} and tank concentration C_A (assuming perfect mixing), the simplified model is:

$$\frac{V}{F_0} \frac{dC_A}{dt} + C_A = C_{A0}$$

The GUI allows the user to select all the parameters in this model.

Users can investigate of:

1. the impact of changes in input concentration (set initial tank concentration $C_A(0)$ different from inlet concentration C_{A0}).
2. the impact of changes in tank volume V on the dynamics.
3. the impact of changes in flow rate F_0 on the dynamics.
4. the effect of changing the initial difference between $C_A(0)$ and C_{A0} .

ILLUSTRATIONS – the simulation runs fast compared to real time and students will see the tank concentration changing over about 10sec.

FILENAMEs are **mixingtank.p, mixingtank.fig**

The colours of the filled tank change during the simulation so students get a visual perception of the changing concentration.

Users can overlay responses as parameters are changed – better to just focus on impact of one parameter at a time.

Option 1:

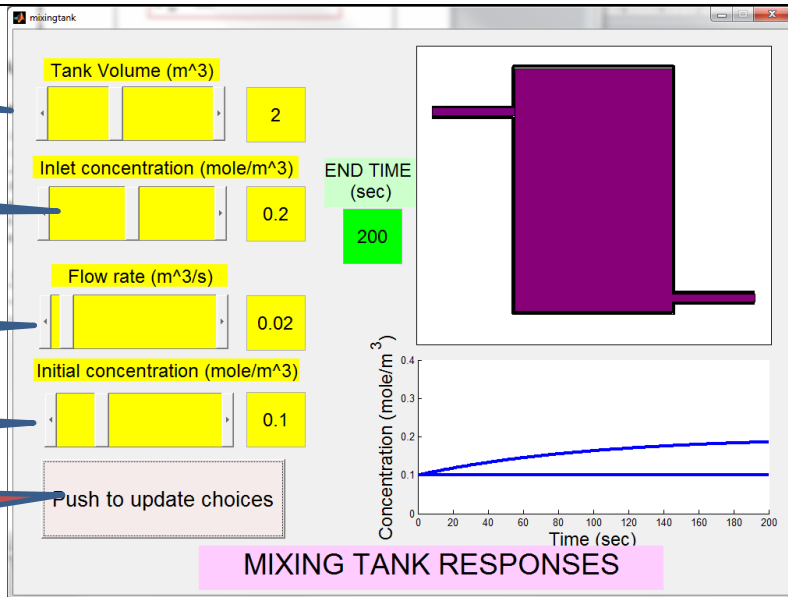
Tank volume at 2

$C_{A0} = 0.2$

$F_0 = 0.02$

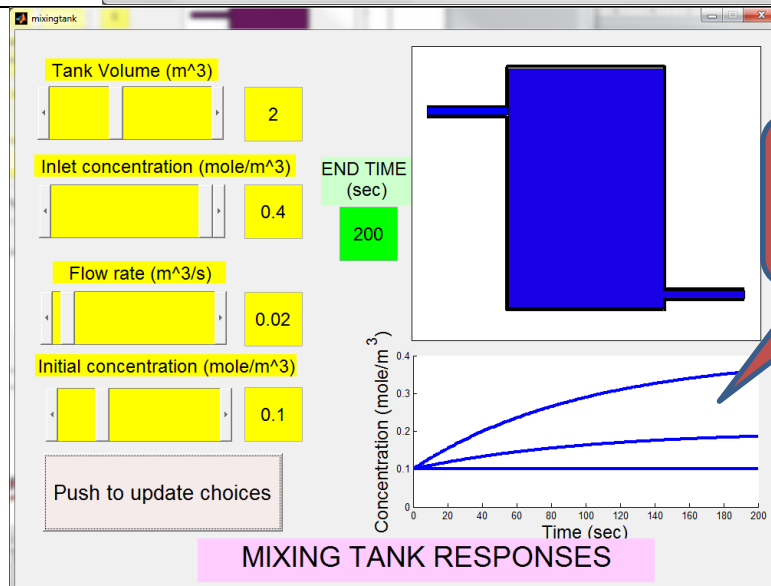
$C_A(0) = 0.1$

Run button here.



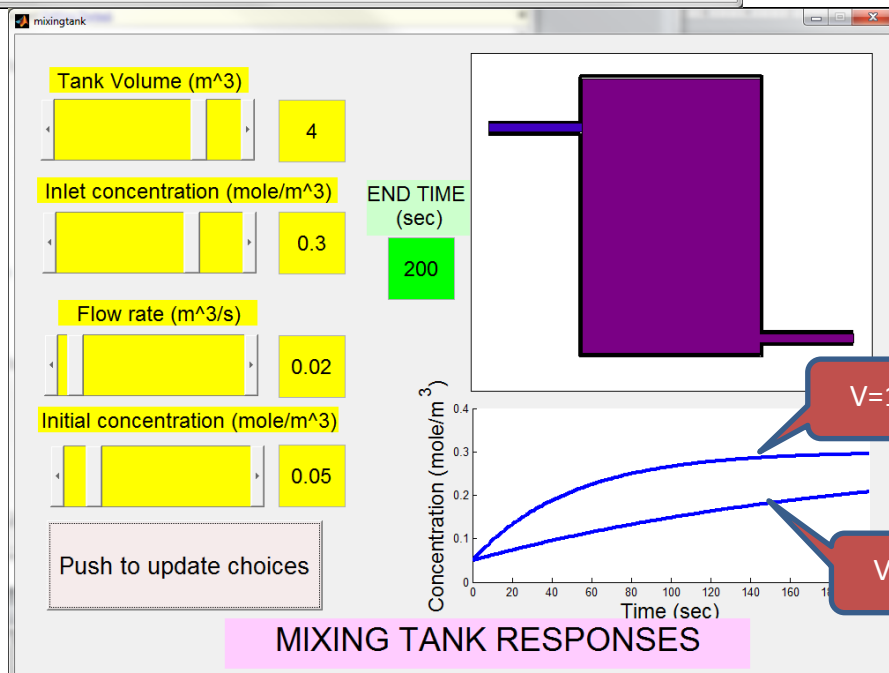
When a user changes an option and runs again, the new response is overlaid so they can compare more easily.

To clear the screen, close the GUI and run again.



Overlay $C_{A0} = 0.1, 0.2$ and $C_{A0} = 0.4$.

This figure shows an overlay of two runs with different tank volumes.



V=1

V=4