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CHEMICAL ENGINEERING

17/ENG01/011

ENG 282

Assignment: 4

It was discovered that 600ft^3/min of fresh air flows into a room containing 20000ft^3 of air. The mixture, which is made pratically uniform by circulating fans, is exhausted at a rate of 600 cubic feet per minute (cfm). If the room contains no fresh air initially,

a.) develop a Model for the amount of fresh air in the room at any time t.

b) Calculate the time at which 90% of the air in the room will become fresh.

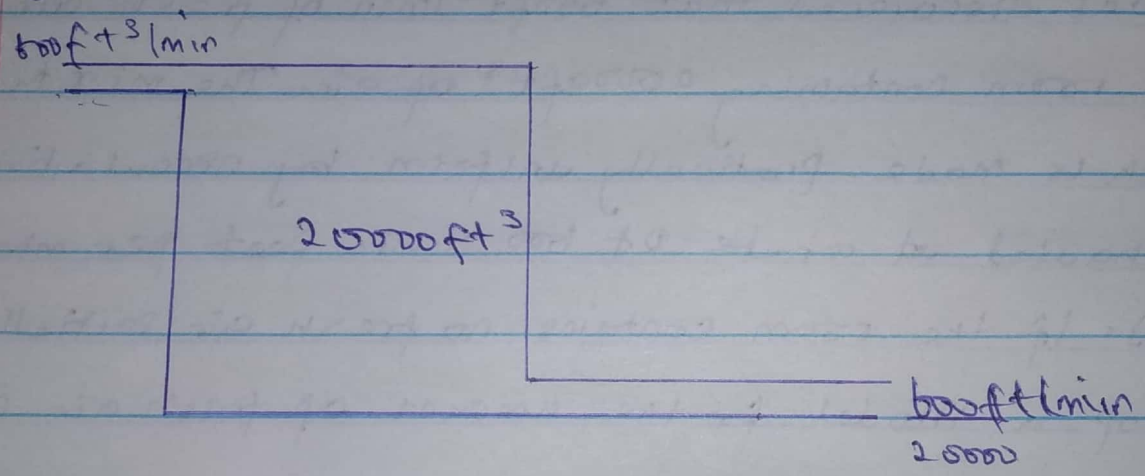
c.) With the aid of MATLAB, plot the dynamic response of the amount of fresh air in the room for t=0 to t=thr using a step time of 5 min.

d.) determine the steady-state value of the amount of fresh air in the room, and

e.) Comment on the result obtained in (d.).

$$\frac{dy}{dt} = y_{in} - y_{out}$$

$$\frac{dy}{dt} = 600\,ft^3/min - \frac{600}{20000} \times y$$



$$\frac{dy}{dt} = 600 - 0.03y$$

At time $t = 0$, $y = 0$

$0 - 20000 = y_0 - e^{-0.03(0)}$

$-20000 = y_0 \cdot 1$

$y_0 = -20000 \text{ ft}^3/\text{min}$

$\therefore y - 20000 = -20000 \cdot e^{-0.03t}$

-0.03

$t = 76.6 \text{ mins}$

C. Commandwindow

Clear

d. The steady value is $2 \times 10^{4}\ ft^3$ at $t = 180$ mins

e. At time $t = 180$ mins, the room is filled with $20\,000\ ft^3$ of fresh air and it is maintained till the 360 min ie the (6th hour).