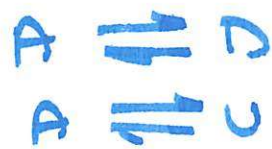


P 8-3



①

(a) Balance equations

$$\frac{dC_A}{dt} = -k_1 \left[C_A - \frac{C_D}{K_{1A}} \right] + k_2 \left[C_A - \frac{C_C}{K_{2A}} \right]$$

$$\frac{dC_D}{dt} = k_1 \left[C_A - \frac{C_D}{K_{1A}} \right]$$

$$\frac{dC_C}{dt} = k_2 \left[C_A - \frac{C_C}{K_{2A}} \right]$$

$$k_1 = 1.0$$

$$k_2 = 100$$

$$\cancel{k_1} K_{1A} = 1.0$$

$$K_{2A} = 1.5$$

$$C_{A0} = 1$$

$$x = 1 - \frac{C_A}{C_{A0}}$$

⇒ Solve using ODE ~~sto~~ solver,
for time profile

b) C_C is max. at $t = \cancel{0.31} \text{ min}$ ($C_A = \cancel{0.33}$) $0.59 \frac{\text{mol}}{\text{dm}^3}$
 0.04 min

(c) $C_{Ae} = 0.08 \text{ mol/dm}^3$
 $C_{De} = 0.8 \text{ mol/dm}^3$
 $C_{Ue} = 0.12 \text{ mol/dm}^3$

(d) CSTR

$$\tau = \frac{C_{A0} - C_A}{-r_A)_{\text{exit}}}$$

⇒ Algebraic equations

$$1) C_{A0} - C_A - \tau \left[k_1 \left(C_A - \frac{C_D}{K_{1A}} \right) + k_2 \left(C_A - \frac{C_U}{K_{2A}} \right) \right] = 0$$

$$2) -C_D + \tau \left[k_1 \left(C_A - \frac{C_D}{K_{1A}} \right) \right] = 0$$

$$3) -C_U + \tau \left[k_2 \left(C_A - \frac{C_U}{K_{2A}} \right) \right] = 0$$

⇒ Solve simultaneously, with $\tau = 1, 10, 100 \text{ min}$

$$\tau = 10 \text{ min} \rightarrow C_A = 0.13 ; C_D = 0.67 ; C_U = 0.2 \frac{\text{mol}}{\text{dm}^3}$$