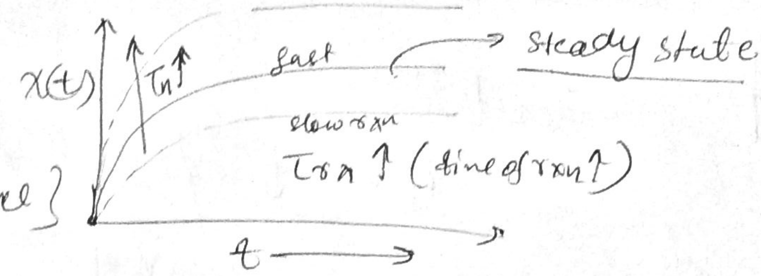
Time scales



$$\tau_{rxn} = 1/k \ \{\text{residence time}\}$$

$$\tau_n = V/F \ \{\text{rxn time}\}$$

$$\dot{In} - \dot{Out} + \dot{Gen} = \dot{Acc}$$

$$FC_{A0} - FC_A - kC_AV = V\left(\frac{dC_A}{dt}\right)$$

$$F\left(C_{A0} - C_{A0}(1 - X(t))\right) - kVC_{A0}(1 - X(t)) = V\frac{dC_A}{dt}$$

$$FC_{A0}(X(t)) - kVC_{A0}(1 - X(t)) = V\frac{dC_A}{dt}$$

$$X(t) - k\left(V/F\right)(1 - X(t)) = \left(V/F\right)\frac{dX(t)}{dt}$$

$$X - \frac{(V/F)}{(1/k)}(1 - X) = (V/F)\frac{dx}{dt}$$

$$X - \left(\frac{\tau_n}{\tau_{xn}}\right)(1 - x) = \tau_n\frac{dx}{dt}$$

$$\frac{\tau_n}{\tau_{rxn}} - x\left(\frac{\tau_n}{\tau_{rxn}} + 1\right) = \tau_n\left(\frac{dx}{dt}\right)$$

$$\int_0^t dt = \int_0^x \frac{\tau_n \, dx}{\frac{\tau_n}{\tau_{rxn}} - x\left(\frac{\tau_n}{\tau_{rxn}} + 1\right)}$$

$$\int_0^t dt = \int_0^x \frac{dx}{\beta - \alpha x}$$

$$\beta = \left(1/\tau_{rxn}\right)$$

$$\alpha = \left(\frac{1}{\tau_{rxn}} + \frac{1}{\tau_n}\right)$$