

Day-18

→ CSTR :

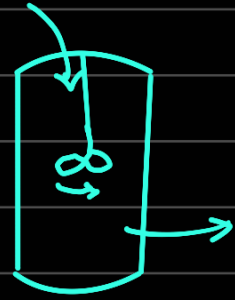
$$F_{j0} - F_j + \int_V r_j dV = \frac{dN_j}{dt}$$

In steady state, $\frac{dN_j}{dt} = 0$

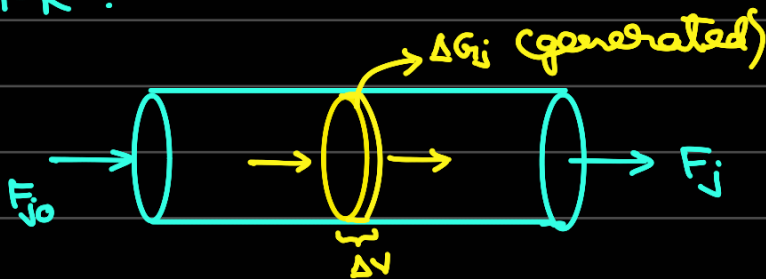
and $r_j \rightarrow \text{constant}$

$$\Rightarrow F_{j0} - F_j + r_j V = 0$$

$$\Rightarrow V = \frac{F_{j0} - F_j}{-r_j}$$



→ PFR :



Steady state: $\frac{dN_j}{dt} = 0$

$$\Rightarrow F_{j0} - F_j + \int_{\Delta V} r_j dV = 0$$

$$\Delta G_j = \int_{\Delta V} r_j dV = r_j \Delta V$$

$$F_j(V) - F_j(V + \Delta V) + r_j \Delta V = 0$$

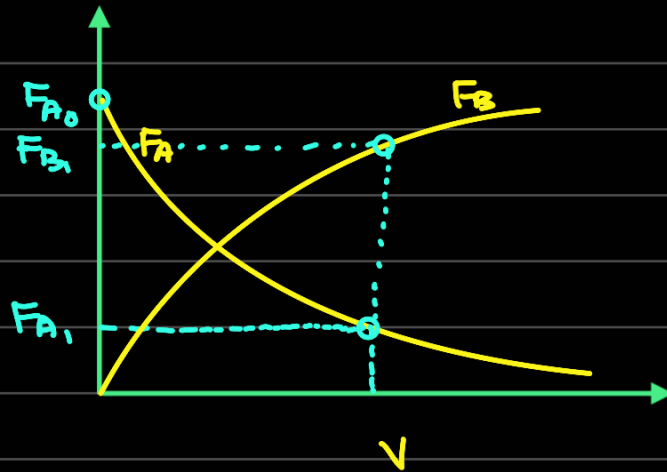
$$\Rightarrow r_j = \frac{F_j(V + \Delta V) - F_j(V)}{\Delta V}$$

$$\text{As } \Delta V \rightarrow 0, \quad r_j = \frac{dF_j}{dV}$$

Eg: $A \rightarrow B$

$$\text{So } V = \int_{F_A}^{F_{A0}} \frac{dF_A}{-r_A}$$

($F_{A0} \rightarrow$ initial mole rate at the entry
 $F_A \rightarrow$ desired mole flow rate at the exit)



→ Packed Bed Reactor (PBR) –

- Heterogeneous (fluid – solid)

