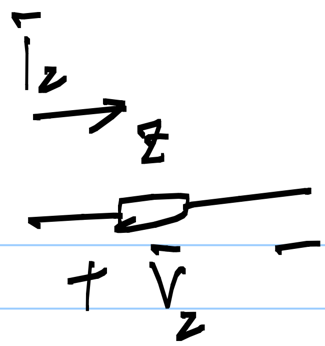
EC1010: Lecture 39



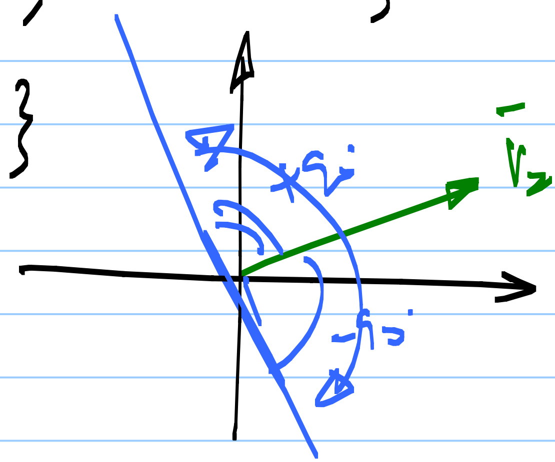
3 phase systems:

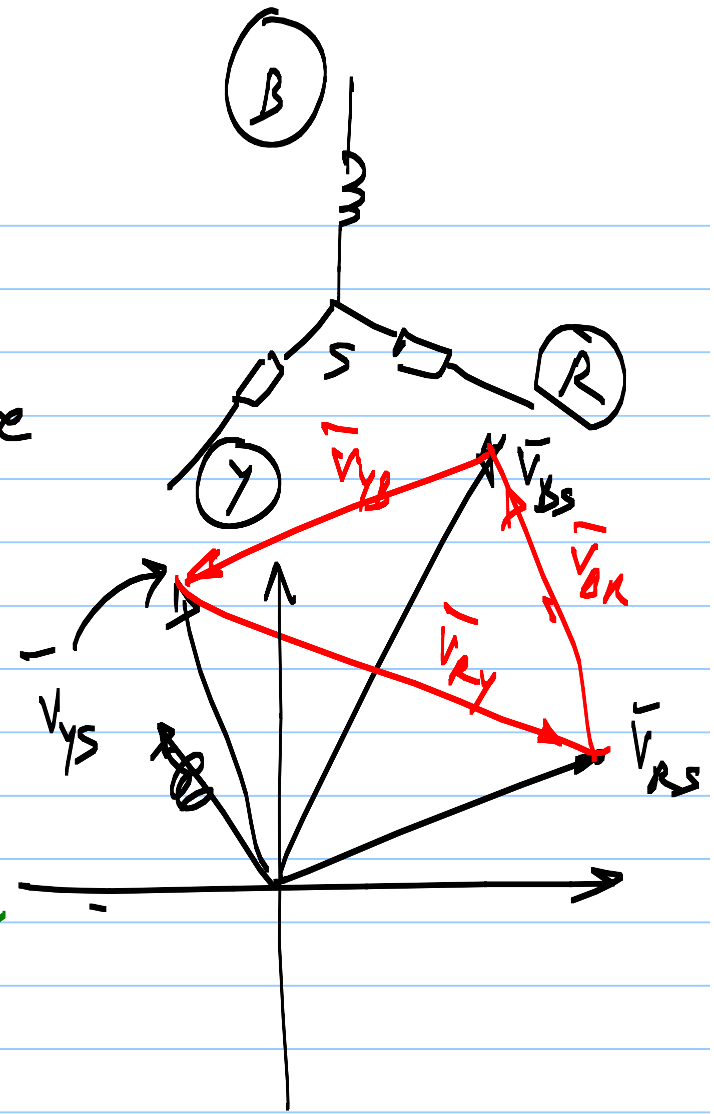
* Source: balanced.

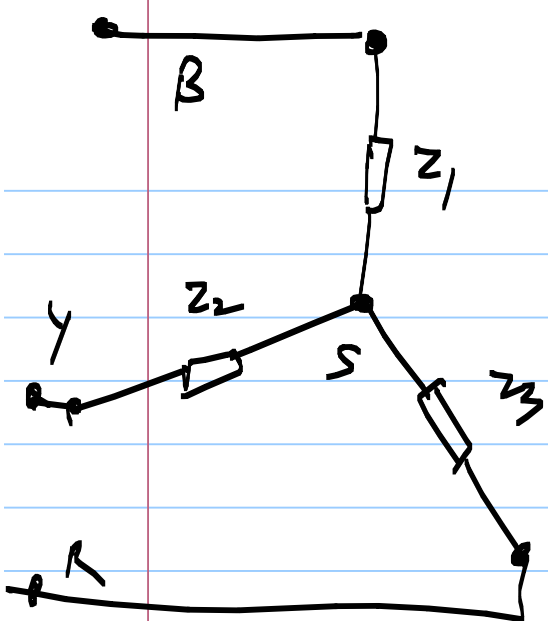
* Load: {star, delta} — 3 wire

{balanced, unbalanced}

{3, 4 wire}



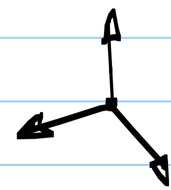




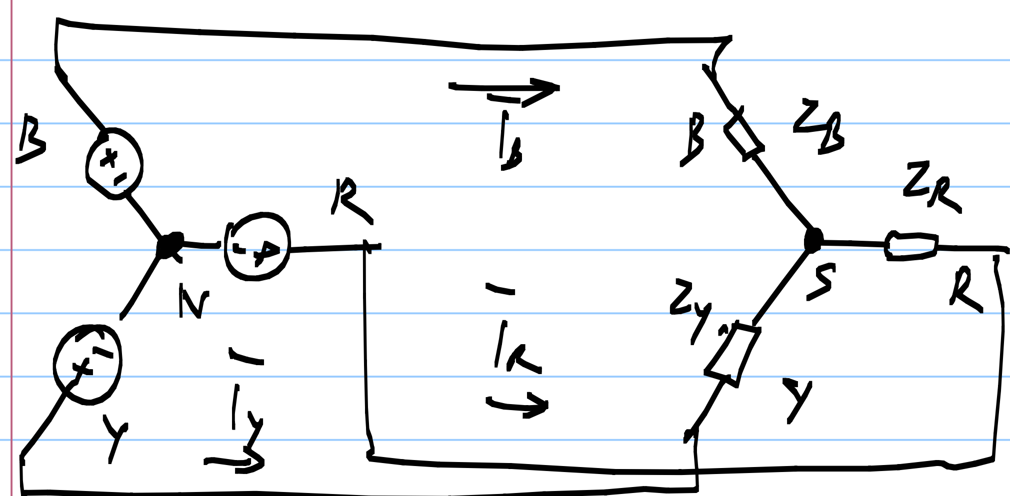
$\bar{V}_{RN}$, $\bar{V}_{YN}$ & $\bar{V}_{BN}$

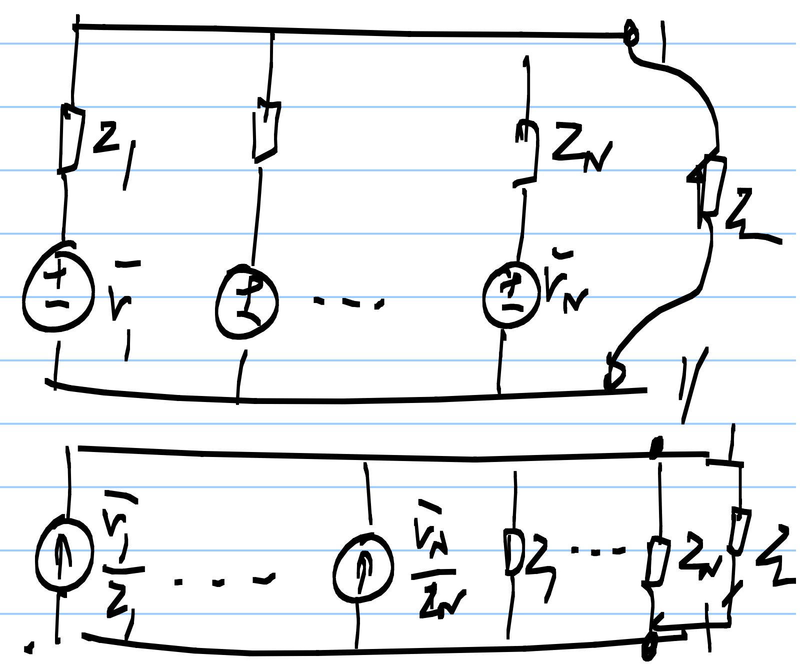
$$\bar{V}_{SN} = \frac{\left(\bar{V}_{RN}/Z_R + \bar{V}_{YN}/Z_Y + \bar{V}_{BN}/Z_B\right)}{1/Z_R + 1/Z_Y + 1/Z_B + 1/Z_L}$$

$\bar{V}_{RS}, \bar{V}_{YS}, \bar{V}_{BS}$

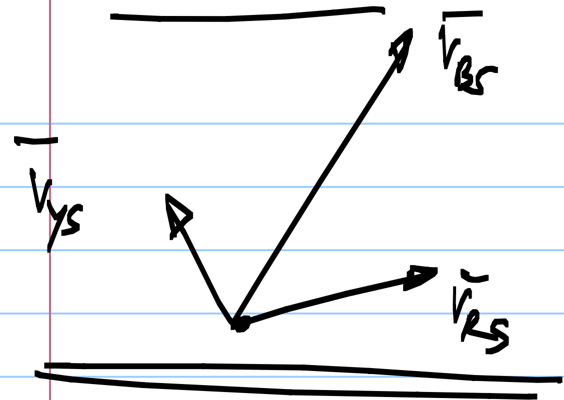


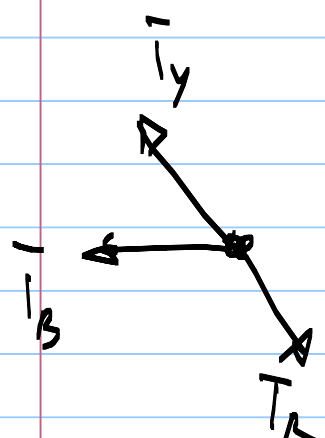
Unbal.





Un bal. load



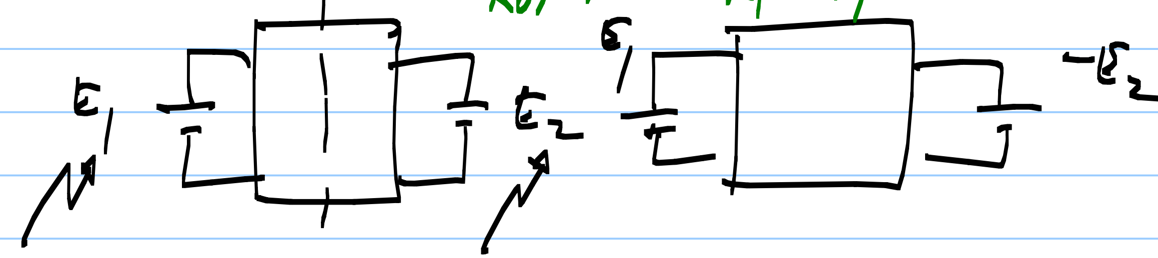


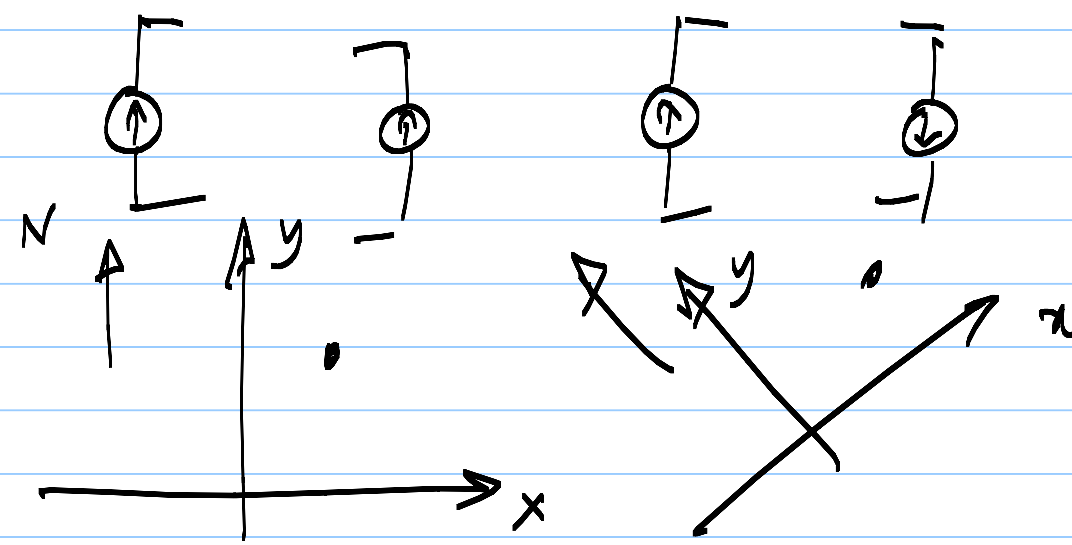
v_1, v_2 ; $\left(\frac{v_1+v_2}{2}\right)$ $\left(\frac{v_1-v_2}{2}\right)$

$V_{R01} = V_{y0}$ $V_{R1} = -V_{y1}$

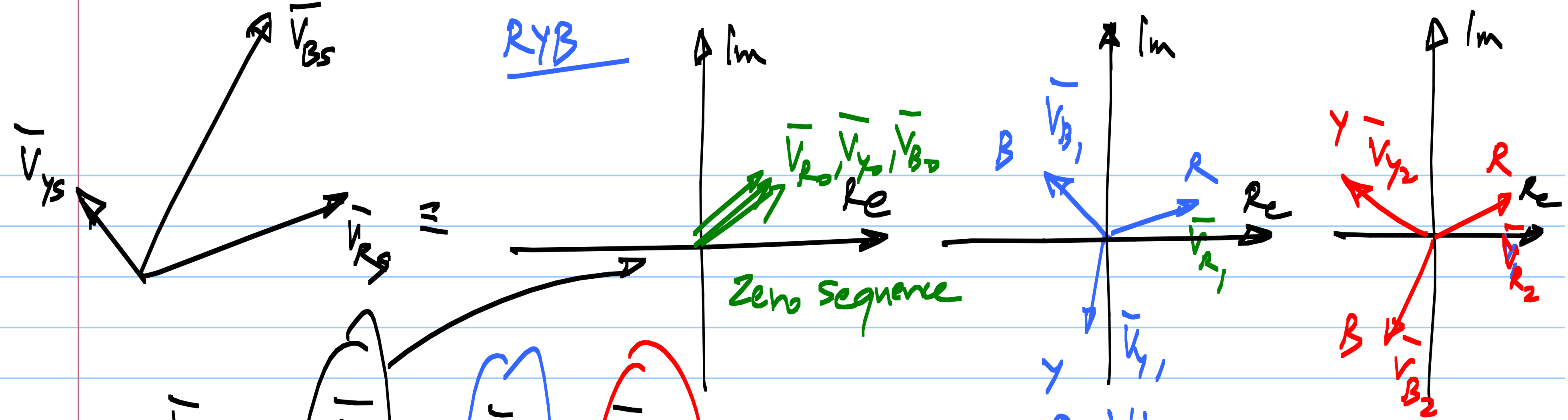
$v_1 = v_{R0} + v_{R1}$

$v_2 = v_{y0} + v_{y1}$





RYB



$$\bar{V}_{RS} = \bar{V}_{R0} + \bar{V}_{R1} + \bar{V}_{R2}$$

$$\bar{V}_{YS} = \bar{V}_{Y0} + \bar{V}_{Y1} + \bar{V}_{Y2}$$

$$\bar{V}_{BS} = \bar{V}_{B0} + \bar{V}_{B1} + \bar{V}_{B2}$$

$$\bar{V}_y = \bar{V}_{y_0} + \bar{V}_{y_1} + \bar{V}_{y_2} \qquad \alpha = \exp\left(j\frac{2\pi}{3}\right) \qquad \alpha^2 = \exp\left(j\frac{4\pi}{3}\right) = \exp\left(-j\frac{2\pi}{3}\right)$$

$$= \bar{V}_{R_0} + \exp\left(-j\frac{2\pi}{3}\right)\bar{V}_{R_1} + \exp\left(-j\frac{4\pi}{3}\right)\bar{V}_{R_2} \qquad \begin{bmatrix} V_1 \\ V_2 \end{bmatrix} = \begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix} \begin{bmatrix} \frac{V_1+V_2}{2} \\ \frac{V_1-V_2}{2} \end{bmatrix}$$

$$\alpha^2 = \alpha^*$$

$$1 + \alpha + \alpha^2 = 0$$

$$= \bar{V}_{R_0} + \alpha^2 \bar{V}_{R_1} + \alpha \cdot \bar{V}_{R_2}$$

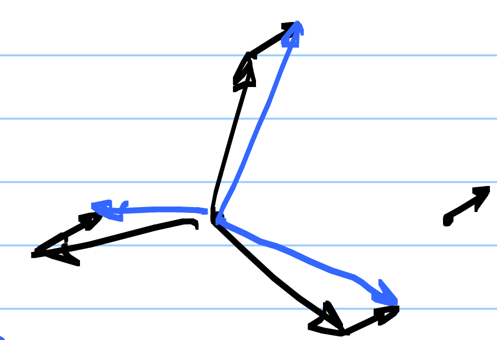
$$\underbrace{\begin{bmatrix} \bar{V}_R \\ \bar{V}_y \\ \bar{V}_B \end{bmatrix}} = \begin{bmatrix} 1 & 1 & 1 \\ 1 & \alpha^2 & \alpha \\ 1 & \alpha & \alpha^2 \end{bmatrix} \begin{bmatrix} \bar{V}_{R_0} \\ \bar{V}_{R_1} \\ \bar{V}_{R_2} \end{bmatrix} = [\Lambda]$$

$$[A] = \begin{bmatrix} 1 & 1 & 1 \\ 1 & \alpha^2 & \alpha \\ 1 & \alpha & \alpha^2 \end{bmatrix} \qquad [A]^{-1} = \frac{1}{3}\begin{bmatrix} 1 & 1 & 1 \\ 1 & \alpha & \alpha^2 \\ 1 & \alpha^2 & \alpha \end{bmatrix}$$

Positive seq: $\bar{V}_{Y_1} = \bar{V}_{R_1} \cdot \exp(-j2\pi/3)$; $\bar{V}_{B_1} = \bar{V}_{R_1} \exp\left(-j\frac{4\pi}{3}\right)$

$$\bar{V} = [A] \cdot \bar{V}_S \qquad \begin{bmatrix} \bar{V}_{R_0} \\ \bar{V}_{R_1} \\ \bar{V}_{R_2} \end{bmatrix}$$

$$\bar{V}_S = [A]^{-1}\, \bar{V}$$



$$\begin{bmatrix} \bar{V}_R \\ \bar{V}_Y \\ \bar{V}_B \end{bmatrix}$$