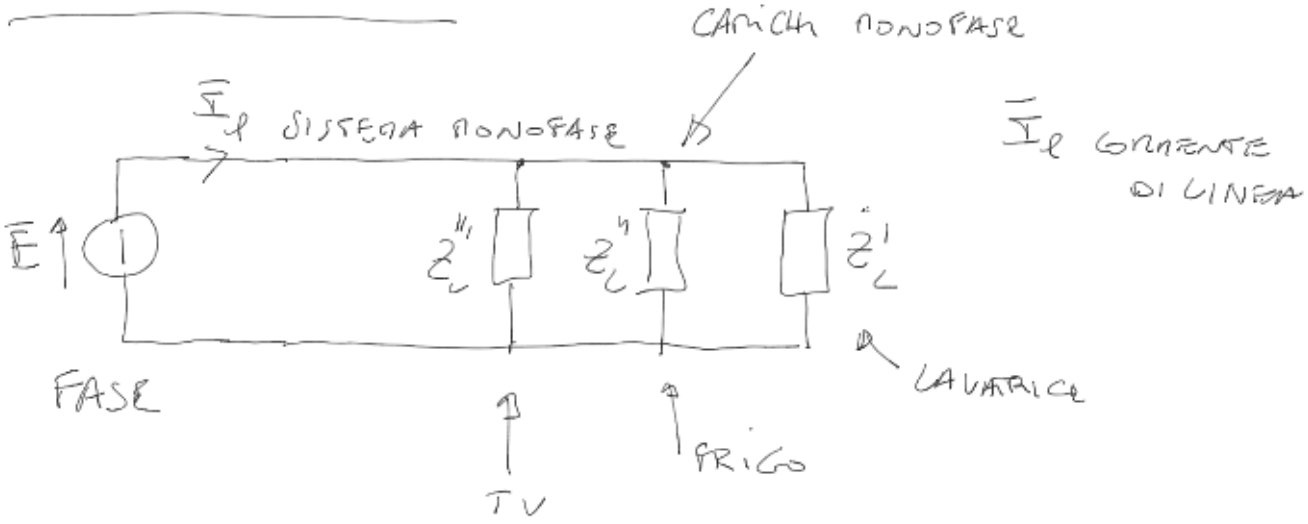
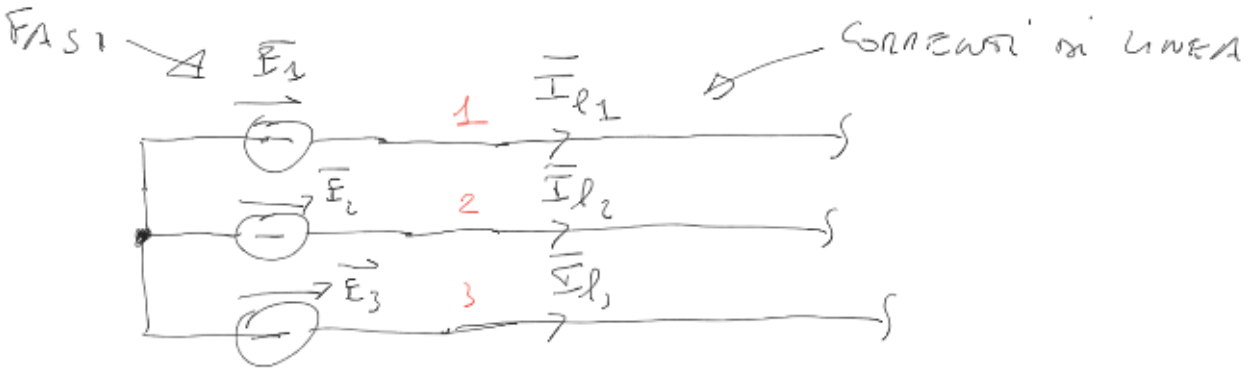
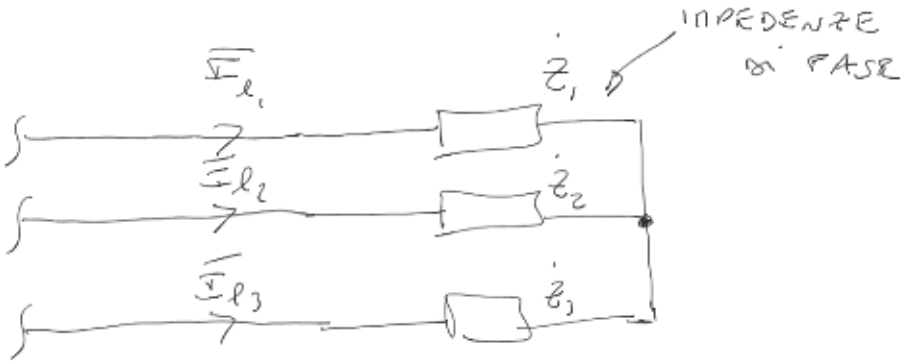
Lezione 28

SISTEMI TRIFASE



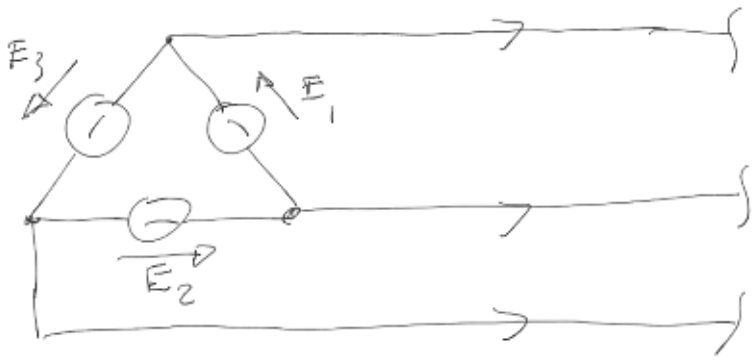


GENERATORE TRIFASE
(STELLA)



CARICO TRIFASE
(STELLA)

CARICO TRIFASE (TRIANGOLO)



GENERATORE TRIFASE (TRIANGOLO)

ESEMPIO

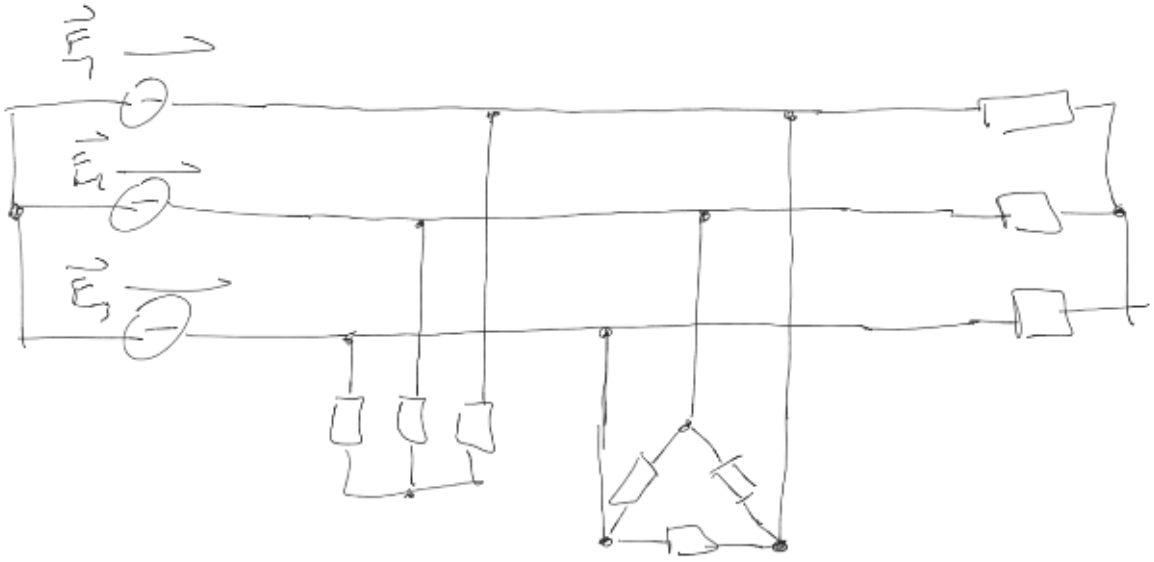
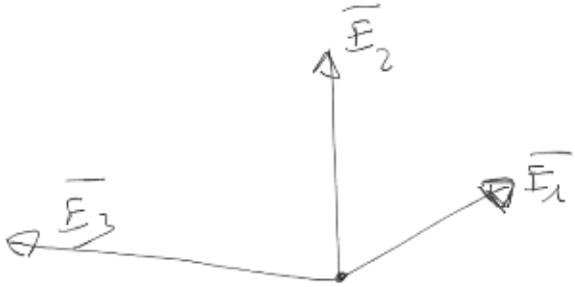
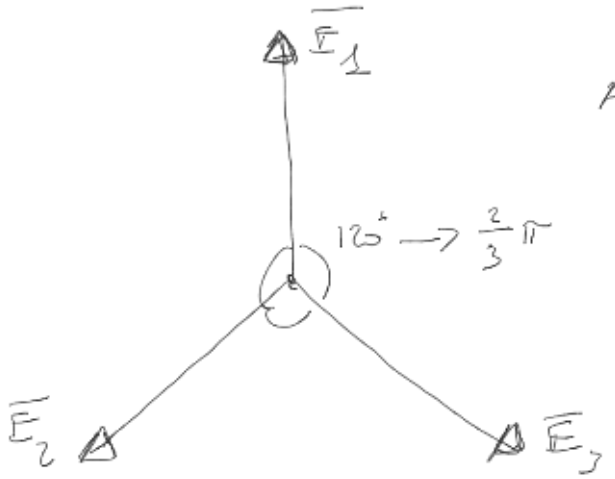


DIAGRAMMA FASORIALE DI UN GENERICO GENERATORE TRIFASE



GENER. TRIFASE SIMMETRICO:

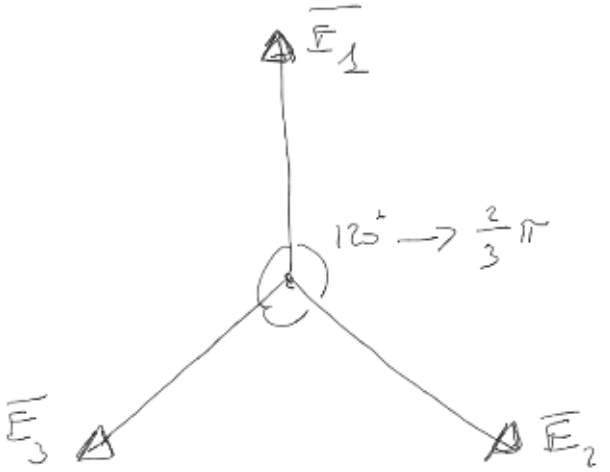


NUMERAZIONE ANTIORARIA

↓

TERNA INVERSA

MODULI UGUALI E SFASAMENTO DI 120° $\left(\frac{2}{3}\pi\right)$



TERNA DIRETTA

LE RISPETTIVE ESPRESSIONI SONO:

$$\left.\begin{aligned}
\overline{E}_1 &= E_n e^{j\varphi} \\
\overline{E}_2 &= E_n e^{j\left(\varphi+\frac{2}{3}\pi\right)} \\
\overline{E}_3 &= E_n e^{j\left(\varphi+\frac{4}{3}\pi\right)}
\end{aligned}\right\} \text{TERNA SIMMETRICA INVERSA}$$

$$\left.\begin{aligned}\overline{E}_1 &= E_n e^{j\varphi}\\ \overline{E}_2 &= E_n e^{j(\varphi-\frac{2}{3}\pi)}\\ \overline{E}_3 &= E_n e^{j(\varphi-\frac{4}{3}\pi)}\end{aligned}\right\}\ \text{TERNA SIMMETRICA DIRETTA}$$

OSSERVAZIONE

IN UNA TERNA DI TENSIONI SIMMETRICA HO CHE:

$$\boxed{\overline{E}_1+\overline{E}_2+\overline{E}_3=0}$$

QUINDI ANCHE NEL DOMINIO DEL TEMPO SE

$e_1(t)\rightarrow\overline{E}_1$, $e_2(t)\rightarrow\overline{E}_2$, $e_3(t)\rightarrow\overline{E}_3$

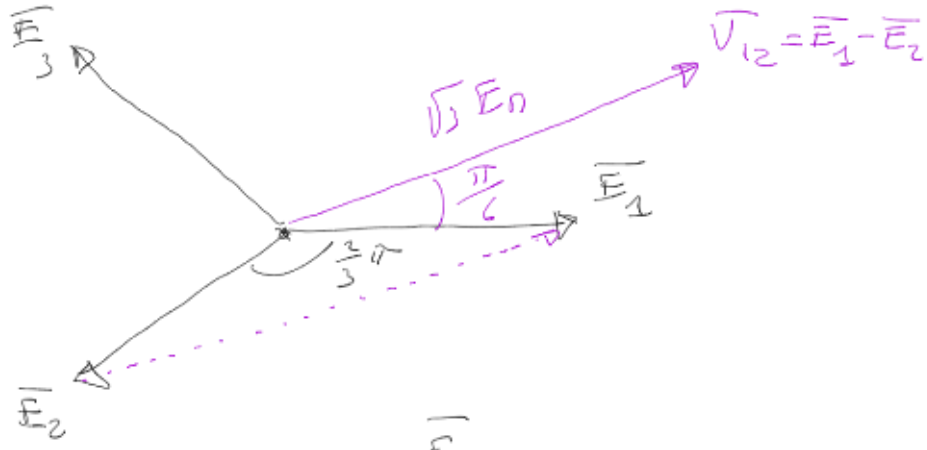
SI HA:

$$\boxed{e_1(t)+e_2(t)+e_3(t)=0}$$

DEFINIZIONE DI TENSIONE CONCATENATA

$$\left.\begin{aligned}\bar{V}_{12} &= \bar{E}_1 - \bar{E}_2 \\ \bar{V}_{23} &= \bar{E}_2 - \bar{E}_3 \\ \bar{V}_{31} &= \bar{E}_3 - \bar{E}_1\end{aligned}\right\}$$ TENSIONI CONCATENATE

RELAZIONE TRA TENSIONI DI FASE E TENSIONI CONCATENATE IN UNA TERNA SIMMETRICA:



$$\bar{V}_{12} = \bar{E}_1 - \bar{E}_2 = E_M - E_n\left[\underbrace{\cos\left(-\tfrac{2}{3}\pi\right)}_{-\frac{1}{2}} + j\underbrace{\operatorname{sen}\left(-\tfrac{2}{3}\pi\right)}_{-\frac{\sqrt{3}}{2}}\right]$$

($\bar{E}_1$ = E_M, $\bar{E}_2$ = $E_n\left[\cos\left(-\frac{2}{3}\pi\right) + j\operatorname{sen}\left(-\frac{2}{3}\pi\right)\right]$)

$$\bar{V}_{12} = E_M\left(1 + \frac{1}{2} + j\frac{\sqrt{3}}{2}\right) = \frac{3}{2}E_M + j\frac{\sqrt{3}}{2}E_n$$

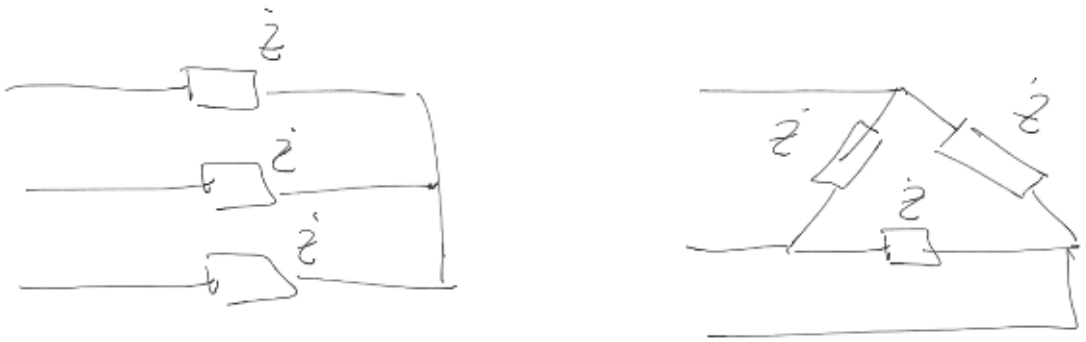
$$\boxed{|\bar{V}_{12}| = \sqrt{\frac{3}{4}E_n^2 + \frac{3}{4}E_M^2} = \sqrt{3}\,E_M}$$

$$\arg(\bar{V}_{12}) = \arctg\left(\frac{\frac{\sqrt{3}}{2}E_{fn}}{\frac{3}{2}E_{fn}}\right) = \arctg\left(\frac{\sqrt{3}}{3}\right)$$

$$\arg(\bar{V}_{12}) = \frac{\pi}{6}\ (30^\circ)$$

CARICO TRIFASE EQUILIBRATO

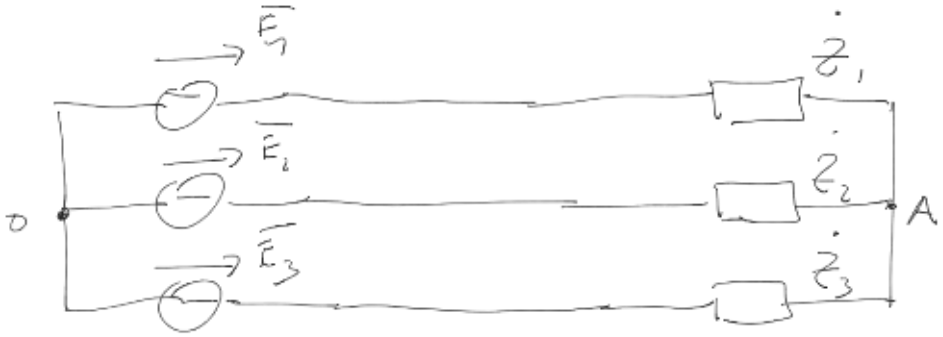
UN CARICO TRIFASE SI DICE EQUILIBRATO QUANDO LE TRE IMPEDENZE SONO UGUALI



CARICHI EQUILIBRATI

UN SISTEMA TRIFASE SI DICE SIMMETRICO ED EQUILIBRATO SE IL GENERATORE È SIMMETRICO E IL CARICO EQUILIBRATO.

UNICITÀ DEL CENTRO STELLA



USIAMO IL METODO DEI NODI PER CALCOLARE V_{AO}. USO O COME NODO DI SALDO E SMVO:

$$\left[\dot{Y}_1 + \dot{Y}_2 + \dot{Y}_3\right]\left[\bar{V}_A\right] = \left[\dot{Y}_1\bar{E}_1 + \dot{Y}_2\bar{E}_2 + \dot{Y}_3\bar{E}_3\right]$$

$$\bar{V}_A = \frac{\left[\dot{Y}_1\bar{E}_1 + \dot{Y}_2\bar{E}_2 + \dot{Y}_3\bar{E}_3\right]}{\left[\dot{Y}_1 + \dot{Y}_2 + \dot{Y}_3\right]}$$

SE IL SISTEMA È SIMMETRICO ED EQUILIBRATO AVRÒ:

$$\bar{V}_A = \frac{\left[\dot{Y}_1\bar{E}_1 + \dot{Y}_2\bar{E}_2 + \dot{Y}_3\bar{E}_3\right]}{\left[\dot{Y}_1 + \dot{Y}_2 + \dot{Y}_3\right]} = \frac{\dot{Y}\left[\bar{E}_1 + \bar{E}_2 + \bar{E}_3\right]}{3\dot{Y}}$$

$$\bar{V}_A = \frac{\overbrace{\left[\bar{E}_1 + \bar{E}_2 + \bar{E}_3\right]}^{\emptyset}}{3} = \emptyset$$

SISTEMA SIMMETRICO ED EQUILIBRATO