Example *Obtain the symmetrical components of unbalanced current* Ia=1,6∠25, Ib=1,0∠180 ,*and* Ic=0.9∠132

Solution:

$$Ia^0=\frac{(1.6\angle 25^0)+(1.0\angle 180^0)+(0.9\angle 132^0)}{3}=0{,}45\angle 96.5^0$$

$$Ia^1=\frac{(1.6\angle 25^0\ )+a(1.0\angle 180^0)+a^2(0.9\angle 132^0)}{3}=0{,}94\angle-0.1^0$$

$$Ia^2=\frac{(1.6\angle 25^0\ )+a^2(1.0\angle 180^0)+a(0.9\angle 132^0)}{3}=0{,}6\angle 22.3^0$$

Example :

The symmetrical components of a set of unbalanced $3-ph$ *voltage are* $V^0=0{,}6\angle 25^0$, $V^1=1\angle 30^0$, *and* $V^2=0{,}8\angle-30^0$ *obtain the original unbalanced phasors.*

Solution: $Va=(0{,}6\angle 90^0)+(1.0\angle 30^0)+(0.8\angle-30^0)=1.7088\angle 24.2^0$

$$Vb=(0{,}6\angle 90^0)+a^2(1.0\angle 30^0)+a(0.8\angle-30^0)=0{,}4\angle 90^0$$

$$Vc=(0{,}6\angle 90^0)+a(1.0\angle 30^0)+a^2(0.8\angle-30^0)=1{,}7088\angle 155.8^0$$

Power in terms of symmetrical components: *For* 3–*ph unbalanced network ,the total power fed given by*

P=real of $\{VaIa^*+VbIb^*+VcIc^*\}$ *Where* Va,Vb,Vc *phase voltage* Ia^*,Ib^*,Ic^**congugate of currents* Ia,Ib,Ic *But*

$$Va = Va^0 + Va^1 + Va^2$$

$$Vb = Va^0 + a^2Va^1 + aVa^2$$

$$Vc = Va^0 + aVa^1 + a^2Va^2$$

And

$$Ia = Ia^0 + Ia^1 + Ia^2$$

$$Ib = Ia^0 + a^2Ia^1 + aIa^2$$

$$Ic = Ia^0 + aIa^1 + a^2Ia^2$$

$$Ia^* = Ia^{0^*} + Ia^{1^*} + Ia^{2^*}$$

$$Ib^* = Ia^{0^*} + aIa^{1^*} + a^2Ia^{2^*}$$

$$Ic^* = Ia^{0^*} + a^2Ia^{1^*} + aIa^{2^*}$$

$$p = real\,[(Va^0 + Va^1 + Va^2)(Ia^{0*} + Ia^{1*} + Ia^{2*}$$

$$+(Va^0 + a^2Va^1 + aVa^2)(Ia^{0*} + aIa^{1*} + a^2Ia^{2*}$$

$$+(Va^0 + aVa^1 + a^2Va^2)(Ia^{0*} + a^2Ia^{1*} + aIa^{2*}$$

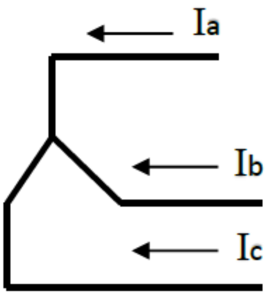
$$p = Real[3Va^0Ia^{0*} + 3Va^1Ia^{1*} + 3Va^2Ia^{2*}]$$

Identically, it may be mentioned that the complex power may be related as

$$s = p + jQ = 3[Va^0 Ia^{0*} + Va^1 Ia^{1*} + Va^2 Ia^{2*}]$$

Example: prove that for any 3-ph, 3-wire system, star connected and for (abc0

Sequence



$$Ib^2 = \frac{1}{\sqrt{3}}[Ia\angle 30 + Ic\angle 90]\angle 120$$

Solution:

$$\begin{bmatrix} Ia^0 \\ Ia^1 \\ Ia^2 \end{bmatrix} = \frac{1}{3}\begin{bmatrix} 1 & 1 & 1 \\ 1 & a & a^2 \\ 1 & a^2 & a \end{bmatrix}\begin{bmatrix} Ia \\ Ib \\ Ic \end{bmatrix}$$

$$Ia^2 = \frac{1}{3}[Ia + a^2 Ib + aIc$$

For 3-wire system

$$Ia + Ib + Ic = 0$$

$$Ib = -Ia - Ic$$

$$Ia^2 = \frac{1}{3}[Ia + a^2(-Ia - Ic) + aIc]$$

$$= \frac{1}{3}[91 - a^2)Ia + (a - a^2)Ic]$$

$$Ia^2 = \frac{1}{3}\sqrt{3}\, Ia\angle 30 + \sqrt{3}Ic\angle 90]$$

$$= \frac{1}{\sqrt{3}}[Ia\angle 30 + Ic\angle 90]$$

$$since\ Ib^2 = aIa^2 = 1\angle 120 Ia^2$$

$$\therefore Ib^2 = \frac{1}{\sqrt{3}}[Ia\angle 30 + Ic\angle 90]\angle 120$$