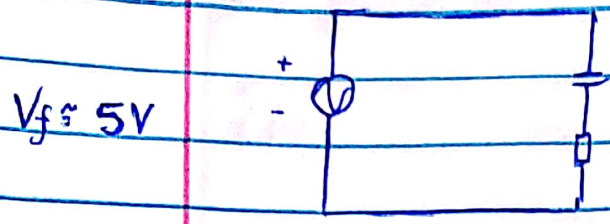
$[\omega = 2\pi f]$



1) $f = 500Hz$; $V_f = 5,082\,V \angle 5,082\angle 0°$

$$Z_{eq} = Z_R + Z_C = R - \frac{j}{\omega . C} = (15.10^3) - (14.468)j$$

$$|Z_{eq}| = \sqrt{(15.10^3)^2 + (14.468)^2} = 20840\,\Omega$$

$$\phi = tg^{-1}\left(\frac{-14.468}{15\,000}\right) = \boxed{-43,9°}$$

$$\therefore Z_{eq} = 20840 \angle -43,9°$$

- No Resistor

$$\hat{V}_R = \frac{\hat{V}_f . Z_R}{(Z_{eq})} = \frac{5\angle 0° . 15.10^3 \angle 0°}{20840 \angle -43,9} = \boxed{3,59 \angle 43,9°}$$

- No Capacitor

$$\hat{V}_C = \frac{\hat{V}_f . Z_C}{(Z_{eq})} = \frac{\hat{V}_f . 1/j\omega C}{(R + 1/j\omega C)} = \frac{V_f}{(j\omega RC + 1)}$$

$$\therefore \hat{V}_C = 5\angle 0° / 1,44 \angle 46° = \boxed{3,47 \angle -46°}$$

2) $f = 10^3 Hz$; $V_f = 5,09 V = 5,09 \angle 0°$

$$Z_{eq} = Z_R + Z_C = R - \frac{j}{w.C} = (15.10^3) - (7234)j$$

$$|Z_{eq}| = \sqrt{(15.10^3)^2 + (-7234)^2} = 16653\,\Omega$$

$$\phi = tg^{-1}\left(\frac{-7234}{15000}\right) = -25,7°$$

$$\therefore Z_{eq} = 16653 \angle 25,7°$$

- No Resistor

$$\hat{V}_R = \frac{\hat{V}_f \, Z_R}{(Z_{eq})} = \frac{5,09 \angle 0° \cdot 15.10^3 \angle 0°}{16653 \angle -25,7°} = \boxed{4,58 \angle 25,7°}$$

- No Capacitor

$$\hat{V}_C = \frac{\hat{V}_f \cdot Z_C}{Z_{eq}} = \frac{V_f \cdot 1/jwc}{(R + 1/jwc)} = \frac{V_f}{(jwRC + 1)}$$

$$1 + jwRC = 1 + 2,07j \begin{cases} |1| = \sqrt{(1)^2 + (2,07)^2} = 2,29 \\ \phi = 64,2° \end{cases}$$

$$\therefore \hat{V}_C = 5,09 \angle 0° / 2,29 \angle 64,2° = \boxed{2,22 \angle -64,2°}$$

3) $f = 10^4 Hz$; $V_f = 5,09V = 5,09 \angle 0^\circ$

$$Z_{eq} = Z_R + Z_C = R - \frac{j}{\omega C} = (15.10^3) - (723)j$$

$$|Z_{eq}| = \sqrt{(15.10^3) + (-723)^2} = 15017\,\Omega$$

$$\phi = tg^{-1}\left(\frac{-723}{15000}\right) = -2,76^\circ$$

$$\therefore Z_{eq} = 15017 \angle -2,76^\circ$$

- No Resistor

$$\hat{V}_R = \frac{\hat{V}_f \, Z_R}{Z_{eq}} = \frac{5,09 \angle 0^\circ \cdot 15.10^3 \angle 0^\circ}{15017 \angle -2,76^\circ} = 5,08 \angle +2,76^\circ$$

- No Capacitor

$$\hat{V}_C = \frac{\hat{V}_f \cdot Z_C}{(Z_{eq})} = \frac{V_f \cdot 1/j\omega C}{(R + 1/j\omega C)} = \frac{V_f}{(j\omega RC + 1)}$$

$$1 + j\omega RC = 1 + 20,7j \begin{cases} |1| = 20,7 \\ \phi = 87,2^\circ \end{cases}$$

$$\therefore \hat{V}_C = 5,09 \angle 0^\circ \,/\, 20,7 \angle 87,2^\circ = 0,25 \angle -87,2^\circ$$

Verificando Lei de Kirchhoff [500Hz]

$$\hat{V}_f = \hat{V}_C + \hat{V}_R$$

$$5\angle 0^\circ = 3{,}47\angle -46^\circ + 3{,}59\angle 43{,}9^\circ$$

$$5(1+0j) = 3{,}47(\cos(-46^\circ) + j\,\mathrm{sen}(-46^\circ)) + 3{,}59(\cos(43{,}9) + j\,\mathrm{sen}(43{,}9^\circ))$$

$$5(1+0j) = 5(1+0j)$$

Portanto é válida a Lei de Kirchhoff.