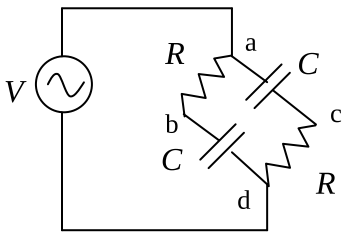


En el circuito de la figura, la fuente de tensión es de voltaje (pico) V constante pero frecuencia variable.
Determinar V_{bc} y graficar el fasor correspondiente.

Como $\mathbf{Z}_{\text{abd}} = \mathbf{Z}_{\text{acd}}$ y están en paralelo (entonces V es igual), según la ley de Ohm por los dos circula la misma corriente ($I' + I' = I_{\text{fuente}}$) → $I' = I_{\text{fuente}} / 2$.

$\boldsymbol{V}_{\text{bc}}$ = (recorrer de c a b) $= \boldsymbol{I'} \,.\, \mathbf{Z_C} - \boldsymbol{I'} \,.\, \mathbf{Z_R} = -\boldsymbol{I'} \,.\, R - \boldsymbol{I'}\, \boldsymbol{j}/(wC) = -\boldsymbol{I'}\,[R + \boldsymbol{j}/(wC)]$

$\boldsymbol{V}_{\text{bc}} = -\,1/2\; \boldsymbol{I}\,[R + \boldsymbol{j}/(wC)] = -\,\boldsymbol{I'}\,[R + \boldsymbol{j}/(wC)]$

Por otro lado, $\boldsymbol{V} = \boldsymbol{V}_{\text{ad}} = \boldsymbol{I'} \,.\, \mathbf{Z}_{\text{abd}} = \boldsymbol{I'} \,.\, (\mathbf{Z_R} + \mathbf{Z_C}) = \boldsymbol{I'} \,.\, [R - \boldsymbol{j}/(wC)]$
$\Rightarrow \boldsymbol{I'} = \boldsymbol{V} / [R - \boldsymbol{j}/(wC)]$

$$\therefore \boldsymbol{V}_{\text{bc}} = -\boldsymbol{V}\,\frac{R + \boldsymbol{j}/wC}{R - \boldsymbol{j}/wC}$$

Multiplicando y dividiendo por [R + $\boldsymbol{j}/(wC)$], resulta:

$$\boldsymbol{V}_{\text{bc}} = -\boldsymbol{V}\,\frac{R^2 - \dfrac{1}{(wC)^2} + \boldsymbol{j}\,\dfrac{2R}{wC}}{R^2 + \dfrac{1}{(wC)^2}}$$

Considerando $arg(\boldsymbol{V}) = 0$:

$$arg(\boldsymbol{V}_{\text{bc}}) = \operatorname{arctg}\left\{\frac{\dfrac{-2R}{wC}}{-R^2 + \dfrac{1}{(wC)^2}}\right\} = \operatorname{arctg}\left\{\frac{-2RwC}{1-(wCR)^2}\right\}$$

Considerando $wCR < 1$ resulta $arg(\boldsymbol{V}_{\text{bc}}) < 0$.

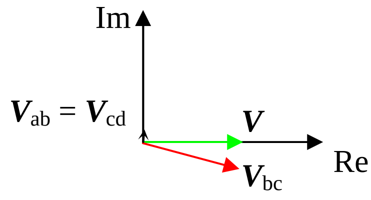
$$V_{\text{bc}} = |\boldsymbol{V}_{\text{bc}}| = \frac{V}{R^2 + \dfrac{1}{(wC)^2}} \cdot \sqrt{\left[R^2 - \frac{1}{(wC)^2}\right]^2 + \left(\frac{2R}{wC}\right)^2}$$

$$= \frac{V}{R^2 + \dfrac{1}{(wC)^2}} \cdot \sqrt{R^4 + \frac{1}{(wC)^4} - \frac{2R^2}{(wC)^2} + \frac{4R^2}{(wC)^2}}$$

$$= \frac{V}{R^2 + \dfrac{1}{(wC)^2}} \cdot \sqrt{R^4 + \frac{1}{(wC)^4} + \frac{2R^2}{(wC)^2}}$$

$$= \frac{V}{R^2 + \frac{1}{(wC)^2}} \cdot \sqrt{\left(R^2 + \frac{1}{(wC)^2} \right)^2}$$

$$V_{bc} = |\boldsymbol{V}_{bc}| = V \frac{R^2 + \frac{1}{(wC)^2}}{R^2 + \frac{1}{(wC)^2}}$$



$\boxed{V_{bc} = |\boldsymbol{V}_{bc}| = V}$

<u>Notar que:</u>

$\boldsymbol{V}_{bc} = -\boldsymbol{I}' \, [R + \boldsymbol{j}/(wC)]$

$\boldsymbol{V}_{ab} = \boldsymbol{I}' \, R$

$\boldsymbol{V}_{cd} = \boldsymbol{I}' \, R$

$\boldsymbol{V}_{ab} + \boldsymbol{V}_{bc} + \boldsymbol{V}_{cd} = \boldsymbol{I}' \, (R - R - \boldsymbol{j}/(wC) + R) = \boldsymbol{I}' \, (R - \boldsymbol{j}/(wC)) = \boldsymbol{V}_{ad} = \mathbf{V}$