Usando nºs complexos, podemos escrever

$$A\cos(\omega t+\phi) = \frac{A\, e^{j(\omega t+\phi)} + e^{-j(\omega t+\phi)}}{2}$$

$$= \mathrm{Re}\{A\, e^{j(\omega t+\phi)}\}$$

No nosso problema

$$i_R(t) = 0{,}18\cos(2\pi 60t + 30°)$$

$$= \mathrm{Re}\{0{,}18\, e^{j(2\pi 60t+30°)}\}$$

$$= \mathrm{Re}\{0{,}18\, e^{j30°}\, e^{j2\pi 60t}\}$$

$$i_C(t) = 0{,}06786\cos(2\pi 60t - 240°)$$

$$= \mathrm{Re}\{0{,}06786\, e^{j(2\pi 60t-240°)}\}$$

$$= \mathrm{Re}\{0{,}06786\, e^{-j240°}\, e^{j2\pi 60t}\}$$

Somando os dois termos

$$i_o(t) = \mathrm{Re}\{(0{,}18e^{j30°} + 0{,}06786e^{-j240°})\, e^{j2\pi 60t}\}$$

$$0{,}18[\cos 30° + j\,\mathrm{sen}\,30°] + 0{,}06786[\cos 240° - j\,\mathrm{sen}\,240°]$$
$$= 0{,}1220 + j\,0{,}1488 = 0{,}1924\, e^{j50{,}656°}$$

$$i_o(t) = \mathrm{Re}\{0{,}1924\, e^{j50{,}656°}\, e^{j2\pi 60t}\}$$

$$= 0{,}1924\cos(2\pi 60t + 50{,}656°)$$

Ao somar duas funções senoidais de mesma freq o sinal será senoidal de mesma freq.

Ex: $i_1(t) = I_1 \cos(\omega t + \phi_1)$

$i_2(t) = I_2 \cos(\omega t + \phi_2)$

$i_3(t) = i_1(t) + i_2(t)$

$= I_3 \cos(\omega t + \phi_3)$

$$\mathrm{Re}\{\underbrace{I_3 e^{j\phi_3}}_{\hat{I}_3} e^{j\omega t}\} = \mathrm{Re}\{(\underbrace{I_1 e^{j\phi_1}}_{\hat{I}_1} + \underbrace{I_2 e^{j\phi_2}}_{\hat{I}_2}) e^{j\omega t}\}$$

$$I_3 e^{j\phi_3} = I_1 e^{j\phi_1} + I_2 e^{j\phi_2}$$

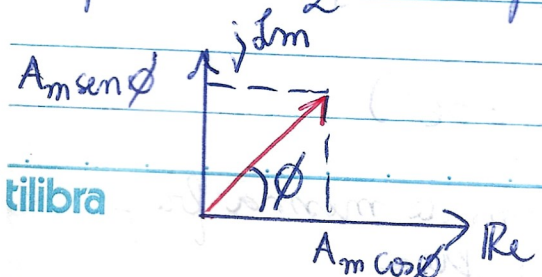
$$\hat{I}_3 = \hat{I}_1 + \hat{I}_2 \rightarrow \text{fasores}$$

De modo geral

$f(t) = A_m \cos(\omega t + \phi)$ $\quad A_m > 0$, $\phi \rightarrow$ graus

$$\hat{F} = A_m e^{j\phi} = A_m \angle \phi \rightarrow \text{fasor}$$

Representação no plano complexo



T. fasores relacionados ao exemplo

Exemplos

①

$$v(t) = v_1(t) + v_2(t)$$

$$= 10\cos(500t + 30°) + 5\cos(500t - 45°)$$

$$\hat{A}_1 = 10 \angle 30°$$

$$\hat{A}_2 = 5 \angle -45°$$

$$\omega = 500 \text{ rad/s}$$

$$\hat{A}_1 + \hat{A}_2 = 10 \angle 30° + 5 \angle -45°$$

$$= 10 e^{j30°} + 5 e^{-j45°}$$

$$= 10(\cos(30°) + j\,\text{sen}(30°)) + 5(\cos(45°) - j\,\text{sen}(45°))$$

$$= 10\frac{\sqrt{3}}{2} + j\frac{10}{2} + 5\frac{\sqrt{2}}{2} - j\,5\frac{\sqrt{2}}{2}$$

$$= 12,1958 + j\,1,4645 =$$

$$= 12,2834 \angle 6,8473° = 12,2834\, e^{j6,8473°}$$

$$v(t) = 12,2834 \cos(500t + 6,8473°)$$

(2) Determine se existirem os fasores que representam as funções

$i(t) = -8\cos(10t + 240°) = 8\cos(10t + 240° - 180°)$

$240° - 180° = 60°$

$-\cos(x) = \cos(x - 180°)$

$\hat{I} = 8 \angle 60°$ $(\omega = 10 \text{ rad/s})$

$v(t) = 10 \operatorname{sen} 10t + 20 \cos 20t$

$\hat{V} = ?$ Não existe (soma de senóides de freqs. diferentes)

$i(t) = -10 \operatorname{sen}(10t + 45°) = 10\cos(10t + 45° + 90°)$

$= 10\cos(10t + 135°)$

$-\operatorname{sen} x = \cos(x + 90°)$

$\hat{I} = 10 \angle 135°$ $(\omega = 10 \text{ rad/s})$