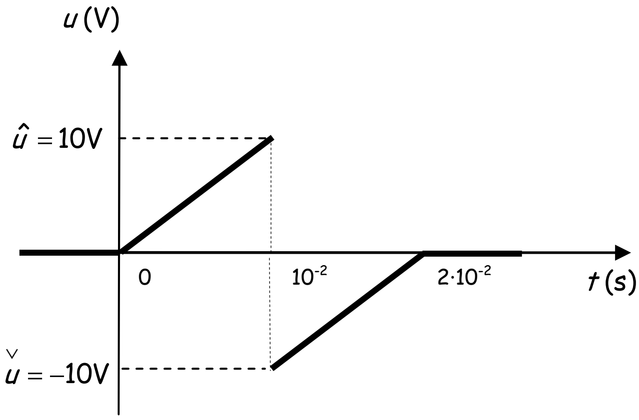
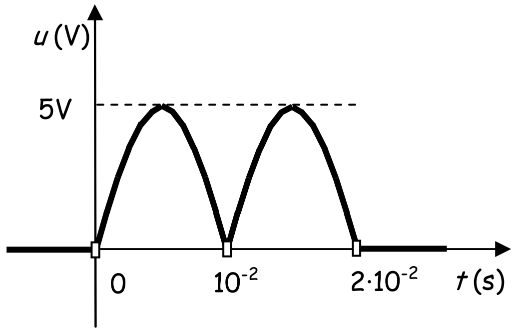
1 Determínense los valores asociados a la forma de onda: $i = 4\sqrt{2}\sin^2 100\pi t\ A$,

2 Defínanse de forma analítica las formas de onda de las siguientes figuras:





Los bucles son sinusoidales

3 Obténgase el factor de forma y la frecuencia de las formas de onda anteriores.

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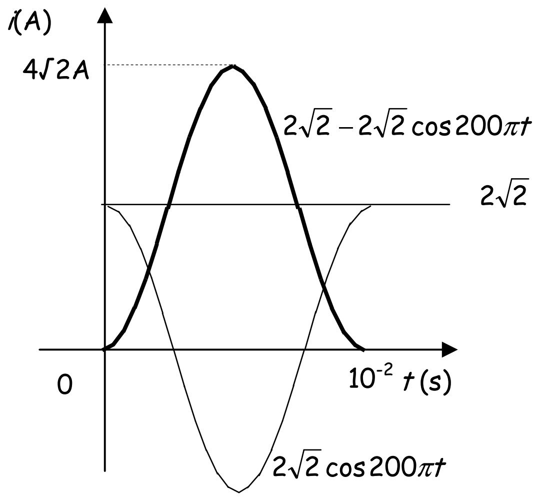


$$i = 4\sqrt{2}\sin^2 100\pi t\ A;\ \sin^2 \alpha = \frac{1-\cos 2\alpha}{2};$$

$$i = 4\sqrt{2}\left(\frac{1-\cos 200\pi t}{2}\right) = i = 2\sqrt{2} - 2\sqrt{2}\cos 200\pi t\ A$$

$$T = 10\text{ms};\ f = \frac{1}{10{\cdot}10^{-3}} = 100\text{Hz}$$

$$\hat{i} = 4\sqrt{2}A$$

$$\check{i} = 0A$$

Al ser i definida positiva, el valor medio de la onda coincide con el valor medio rectificado:

$$\overline{|i|} = \bar{i} = \frac{1}{10^{-2}}\int_0^{10^{-2}} 4\sqrt{2}\sin^2 100\pi t\ dt = 400\sqrt{2}\int_0^{10^{-2}} \frac{1-\cos 200\pi t}{2} dt =$$

$$200\sqrt{2}\left[t - \frac{\sin 200\pi t}{200\pi}\right]_0^{10^{-2}} = \frac{200\sqrt{2}}{100} = 2\sqrt{2}A$$

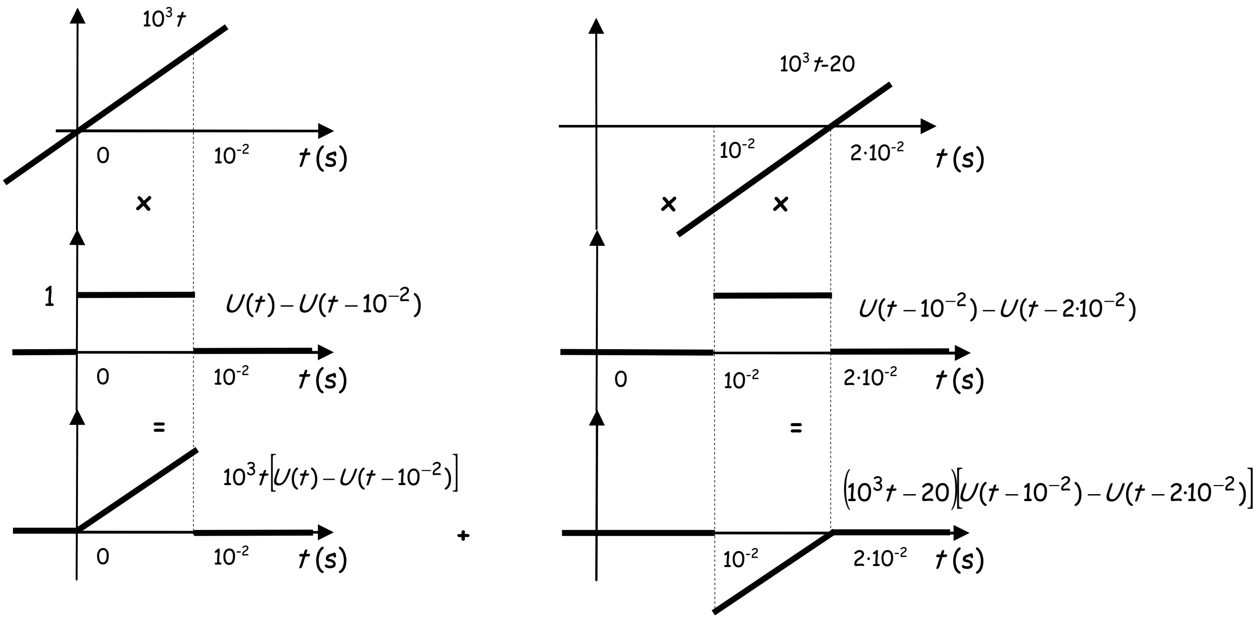
Otra forma de determinara el valor medio de i.

Partimos de la expresión: $i = 2\sqrt{2} - 2\sqrt{2}\cos 200\pi t\ A$ como el valor medio del segundo sumando ($2\sqrt{2}\cos 200\pi t$) es nulo, entonces el valor medio es la constante $2\sqrt{2}$, $\bar{i} = 2\sqrt{2}A$

Forma de onda triangular:

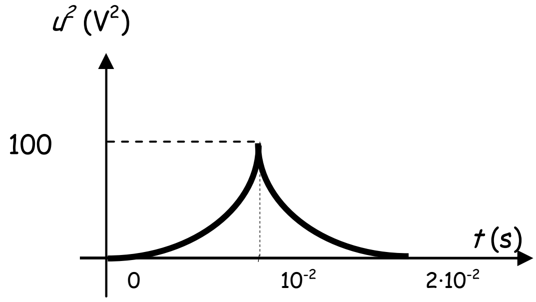
$$u(t)=\begin{cases} 0 \geq t\,\text{s} & u(t)=0\text{ V} \\ 0 \leq t < 10^{-2}\text{s} & u(t)=10^{3}t\text{ V} \\ 10^{-2} < t \leq 2{\cdot}10^{-2}\text{s} & u(t)=10^{3}t-20 \\ t \geq 2{\cdot}10^{-2}\text{s} & u(t)=0\text{ V} \end{cases}\text{ V}$$

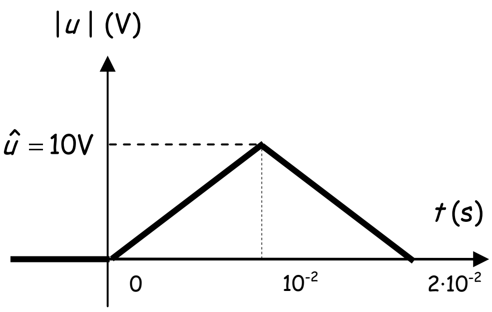
Es un impulso no tiene frecuencia por no ser una onda periódica.



Luego: $u = 10^{3}t\left[U(t)-U(t-10^{-2})\right]+\left(10^{3}t-20\right)\left[U(t-10^{-2})-U(t-2{\cdot}10^{-2})\right]$ V

$$K_F=\frac{U}{\overline{|u|}}$$





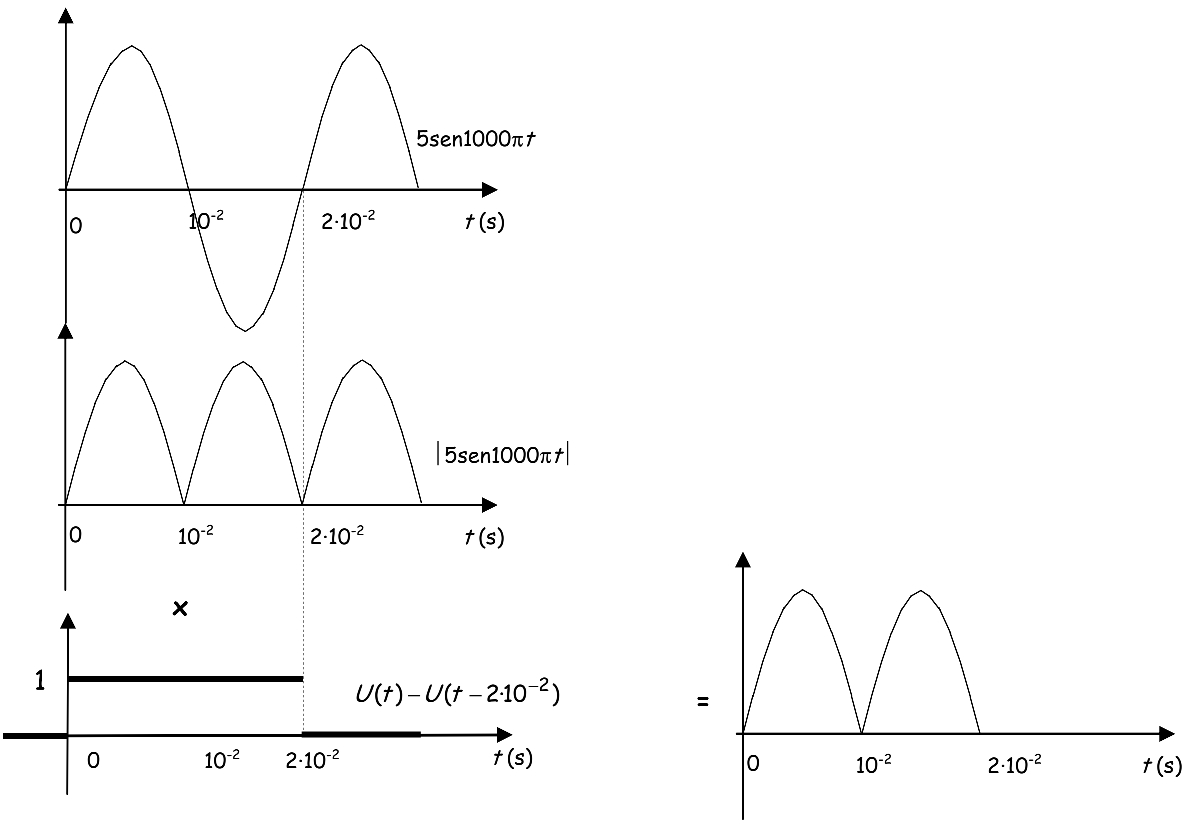
$$K_F = \frac{\sqrt{\dfrac{\frac{1}{3}100 \cdot 10^{-2}}{10^{-2}}}}{\dfrac{\frac{1}{2}10 \cdot 10^{-2}}{10^{-2}}} = \frac{\frac{10}{\sqrt{3}}}{\frac{1}{2}10} = \frac{2}{\sqrt{3}}$$

Forma de onda sinusoidal rectificada.

$T = 2 \cdot 10^{-2}\,s$

$$\omega\, T = 2 \cdot \pi \longrightarrow \omega = \frac{2\pi}{2 \cdot 10^{-2}} = 1000\,\frac{\text{rad}}{s}$$

$$u(t) = \begin{cases} 0 \geq t\, s & u(t) = 0\text{ V} \\ 0 \leq t \leq 10^{-2} s & u(t) = 5\text{sen}1000\pi t\text{ V} \\ 10^{-2} \leq t \leq 2 \cdot 10^{-2} s & u(t) = -5\text{sen}1000\pi t\text{ V} \\ t \geq 2 \cdot 10^{-2} s & u(t) = 0\text{ V} \end{cases}$$



La ecuación de la forma de onda:

$$u = |5\text{sen}1000\pi t|\left[U(t) - U\left(t - 2 \cdot 10^{-2}\right)\right]$$

Valor eficaz.

$$U=\sqrt{\frac{1}{\pi}\int_0^{\pi} 25\mathrm{sen}^2\alpha\,\mathrm{d}\alpha}=\sqrt{\frac{25}{\pi}\int_0^{\pi}\left(\frac{1-\cos 2\alpha}{2}\right)\mathrm{d}\alpha}=\sqrt{\frac{25}{2\pi}\left[\alpha+\frac{\mathrm{sen}2\alpha}{2}\right]_0^{\pi}}=\sqrt{\frac{25}{2}}=\frac{5}{\sqrt{2}}\,\mathrm{V}$$

Otra forma de obtener el valor eficaz:

$$u^2=25\mathrm{sen}^2\alpha=25\left(\frac{1-\cos 2\alpha}{2}\right)=\frac{25}{2}-\frac{25}{2}\cdot\cos 2\alpha$$

$$\overline{u^2}=\frac{25}{2}\mathrm{V}^2$$

$$U=\sqrt{\overline{u^2}}=\sqrt{\frac{25}{2}}=\frac{5}{\sqrt{2}}\mathrm{V}$$

Valor medio rectificado:

$$\overline{|u|}=\frac{1}{\pi}\int_0^{\pi}5\mathrm{sen}\alpha\ \mathrm{d}\alpha=\frac{1}{\pi}5(-\cos\alpha)_0^{\pi}=\frac{10}{\pi}$$

Factor de forma: $K_F=\dfrac{\frac{5}{\sqrt{2}}}{\frac{10}{\pi}}=\dfrac{\pi}{2\sqrt{2}}=\dfrac{\pi\sqrt{2}}{4}$