
Généralités

$$\omega = \frac{2\pi}{T} = 2\pi F \quad (F \text{ fréquence fondamentale})$$

$$v(t) = V_0 + \sum_{n=1}^{\infty} \left(A_n \cos n\omega t + B_n \sin n\omega t \right)$$

$$v(t) = V_0 + \sum_{n=1}^{\infty} V_n \sin n\omega t \quad \text{si } v(t) \text{ impaire}$$

$$v(t) = V_0 + \sum_{n=1}^{\infty} V_n \cos n\omega t \quad \text{si } v(t) \text{ paire}$$

$$A_n = \frac{2}{T} \int_{(T)} v(t) \cos(n\omega t)\, dt \quad \text{(partie réelle)}$$

$$B_n = \frac{2}{T} \int_{(T)} v(t) \sin(n\omega t)\, dt \quad \text{(partie imaginaire)}$$

$$V_0 = \langle v \rangle = \frac{1}{T} \int_{(T)} v(t)\, dt = \frac{A_0}{2}$$

si n impair, on pose : $n = 2k + 1$

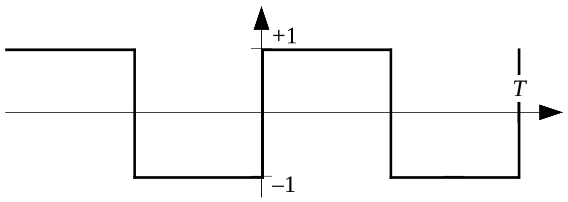
$$\sin\left[(2k+1)\left(\omega t + \frac{\pi}{2} \right) \right] = (-1)^k \cos\left((2k+1)\omega t \right)$$

$$\cos\left[(2k+1)\left(\omega t - \frac{\pi}{2} \right) \right] = (-1)^k \sin\left((2k+1)\omega t \right)$$

$$\sin\left(n\omega t + n\pi \right) = (-1)^n \sin\left(n\omega t \right)$$

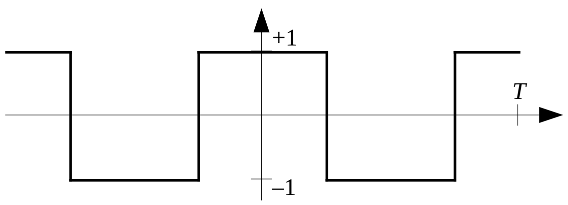
Séries de Fourier

Carré :



$$v(t) = \sum_{k=0}^{\infty} V_{2k+1} \sin\left((2k+1)\omega t \right)$$

$$V_{2k+1} = \frac{4}{\pi} \frac{1}{2k+1}$$



$$v(t) = \sum_{k=0}^{\infty} (-1)^k V_{2k+1} \cos\left((2k+1) \right)\omega t$$

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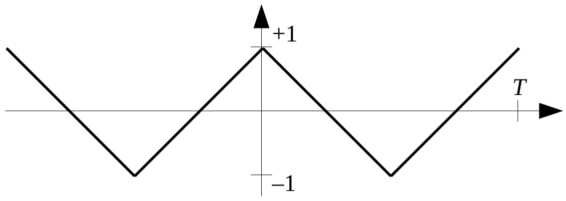
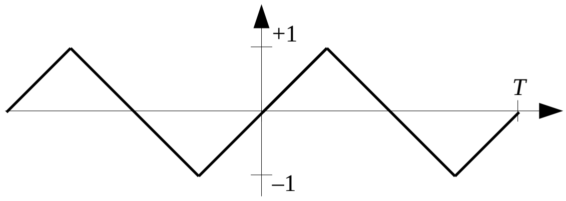
Triangle :



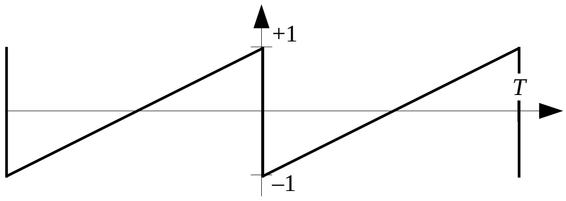
$$v(t)=\sum_{k=0}^{\infty}V_{2k+1}\cos\big((2k+1)\omega t\big)$$

$$V_{2k+1}=\frac{8}{\pi^2}\frac{1}{(2k+1)^2}$$



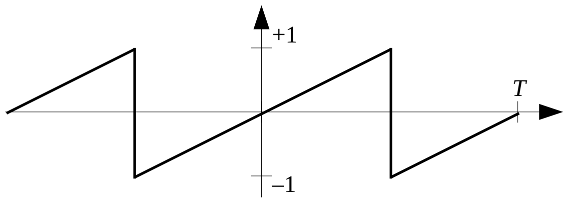
$$v(t)=\sum_{k=0}^{\infty}(-1)^k V_{2k+1}\sin\big((2k+1)\omega t\big)$$

Rampe :



$$v(t)=-\sum_{n=1}^{\infty}V_n\sin(n\omega t)$$

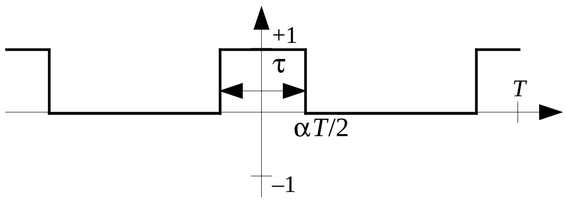
$$V_n=\frac{2}{\pi}\frac{1}{n}$$



$$v(t)=-\sum_{n=1}^{\infty}(-1)^n V_n\sin(n\omega t)$$

***Créneaux** (rapport cyclique α) :*

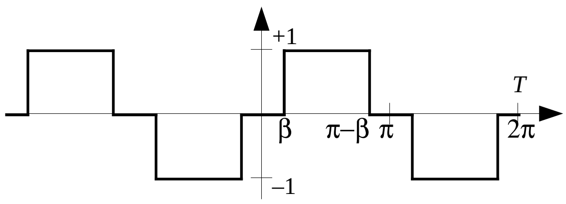
$\alpha=\dfrac{\tau}{T}$



$$v(t)=V_0+\sum_{n=1}^{\infty}V_n\cos\big(n\omega t\big)$$

$$V_0=\alpha\ ;\ V_n=2\alpha\frac{\sin\big(\pi n\alpha\big)}{\pi n\alpha}$$

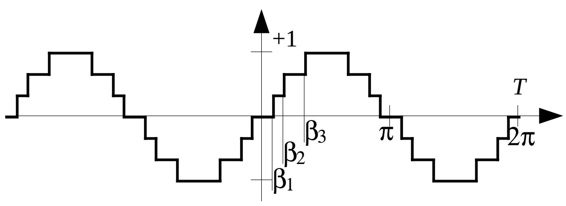
Commande décalée :



$$v(t)=\sum_{k=0}^{\infty}V_{2k+1}.\sin(2k+1)\omega t$$

$$V_{2k+1}=\frac{4}{\pi}\frac{\cos(2k+1)\beta}{2k+1}$$

***Marches d'escaliers** (marches de hauteurs égales) :*



$$v(t)=\sum_{k=0}^{\infty}V_{2k+1}.\sin(2k+1)\omega t$$

$$V_{2k+1}=\frac{4}{\pi}\frac{1}{2k+1}\frac{1}{i_{max}}\sum_{i=1}^{i_{max}}\cos(2k+1)\beta_i$$

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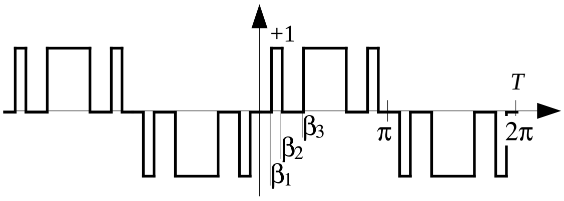
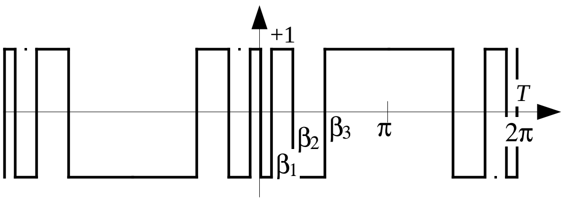
MLI unipolaire :



$$v(t)=\sum_{k=0}^{\infty}V_{2k+1}.\sin(2k+1)\omega t$$

$$V_{2k+1}=\frac{4}{\pi}\frac{1}{2k+1}\sum_{i=1}^{i_{max}}(-1)^{i-1}\cos(2k+1)\beta_i$$

MLI bipolaire :

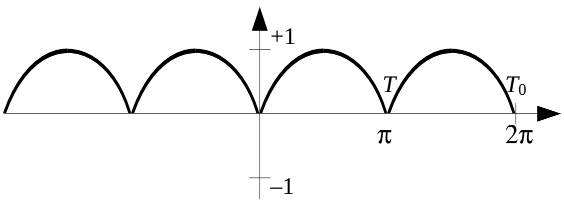


$$v(t)=\sum_{k=0}^{\infty}V_{2k+1}.\sin(2k+1)\omega t$$

$$V_{2k+1}=\frac{4}{\pi}\frac{1}{2k+1}\left(-1+2\sum_{i=1}^{i_{max}}(-1)^{i-1}\cos(2k+1)\beta_i\right)$$

Monophasé redressé double alternance : $v(t)=\left|\sin\omega_0 t\right|=\left|\sin\frac{2\pi}{T_0}t\right|$

$T_o = 2T$

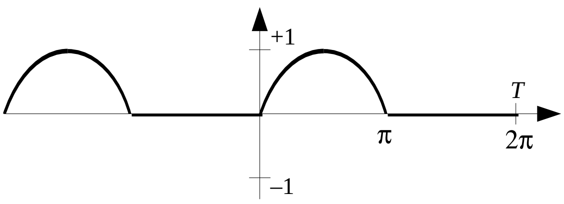


$$v(t)=V_0-\sum_{n=1}^{\infty}V_n\cos 2n\omega_0 t$$

$$V_0=\frac{2}{\pi}\ ;\ V_n=\frac{4}{\pi}\frac{1}{4n^2-1}$$

Monophasé redressé simple alternance :

$T_o = T$

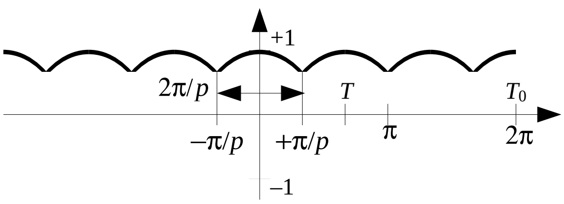


$$v(t)=V_0+\frac{1}{2}\sin\omega_0 t-\sum_{n=1}^{\infty}V_n\cos 2n\omega_0 t$$

$$V_0=\frac{1}{\pi}\ ;\ V_n=\frac{2}{\pi}\frac{1}{4n^2-1}$$

Polyphasé redressé de pulsation p : $v(t)=\cos\omega_0 t=\cos\frac{2\pi}{T_0}t \quad , \quad -\frac{\pi}{p}<\omega_0 t<+\frac{\pi}{p}$

$T_o = pT$



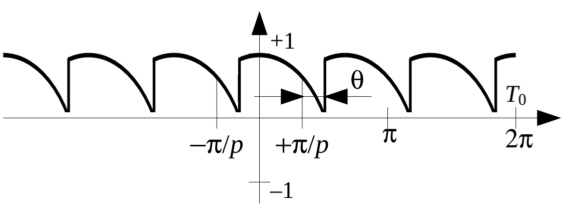
$$v(t)=V_0-\sum_{n=1}^{\infty}(-1)^n V_n\cos pn\omega_0 t$$

$$V_0=\frac{p}{\pi}.\sin\left(\frac{\pi}{p}\right);\ V_n=V_0.\frac{2}{p^2n^2-1}$$

Polyphasé redressé commandé de pulsation p *(pont complet en conduction continue) :*

$T_o = pT$

$$v(t)=V_0-\sum_{n=1}^{\infty}(-1)^n V_n\cos pn\omega_0 t$$



$$V_0=\frac{p}{\pi}\sin\left(\frac{\pi}{p}\right)\cos\theta\ ;\ 0<\theta<\pi$$

$$V_n=\frac{p}{\pi}\sin\left(\frac{\pi}{p}\right)\frac{2}{p^2n^2-1}\sqrt{\cos^2\theta+p^2n^2\sin^2\theta}$$

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