SEÑALES CONTINUAS

Desarrollo en serie de Fourier

$$x(t) = a_0 + \sum_{k=1}^{\infty} a_k \cos(k\omega_0 t) + \sum_{k=1}^{\infty} b_k \operatorname{sen}(k\omega_0 t)$$

$$a_0 = \frac{1}{T_0}\int_{\langle T_0\rangle} x(t)\,dt \qquad a_k = \frac{2}{T_0}\int_{\langle T_0\rangle} x(t)\cos(k\omega_0 t)\,dt \qquad b_k = \frac{2}{T_0}\int_{\langle T_0\rangle} x(t)\operatorname{sen}(k\omega_0 t)\,dt$$

$$x(t) = \sum_{k=-\infty}^{\infty} c_k \cdot e^{jk\omega_0 t} \qquad c_k = \frac{1}{T_0}\int_{T_0} x(t)\cdot e^{-jk\omega_0 t}\,dt \qquad a_k = c_k + c_{-k} \quad b_k = j(c_k - c_{-k})\ (k>0)$$

Transformada de Fourier

$$\mathcal{F}[x(t)] = X(\omega) = \int_{-\infty}^{\infty} x(t)e^{-j\omega t}\,dt$$

$$\mathcal{F}^{-1}[X(\omega)] = X^{-1}(\omega) = x(t) = \frac{1}{2\pi}\int_{-\infty}^{\infty} X(\omega)e^{j\omega t}\,dt$$

Convolución

$$z(t) = x(t) * y(t) = \int_{-\infty}^{\infty} x(\tau)y(t-\tau)\,d\tau$$

Parámetros de interés de una señal

$$\overline{x(t)} = \lim_{T\to\infty}\frac{1}{2T}\int_{-T}^{T} x(t)\,dt \qquad E_\infty = \int_{-\infty}^{\infty}|x(t)|^2\,dt \qquad P_\infty = \lim_{T\to\infty}\frac{1}{2T}\int_{-T}^{T}|x(t)|^2\,dt$$

<u>Caso particular para señales periódicas</u>:

$$\overline{x(t)} = \frac{1}{T_0}\int_{\langle T_0\rangle} x(t)\,dt = c_0 \qquad P_\infty = \frac{1}{T_0}\int_{\langle T_0\rangle}|x(t)|^2\,dt = \sum_{k=-\infty}^{\infty}|c_k|^2$$

SEÑALES DISCRETAS

Desarrollo en serie de Fourier

$$x[n] = \sum_{k=0}^{N_0-1} c_k e^{jk\Omega_0 n} = \sum_{k=<N_0>} c_k e^{jk\Omega_0 n}$$

$$c_k = \frac{1}{N_0} \sum_{n=0}^{N_0-1} x[n] e^{-jk\Omega_0 n} = \frac{1}{N_0} \sum_{n=<N_0>} x[n] e^{-jk\Omega_0 n}$$

Transformada de Fourier de tiempo discreto (DTFT)

$$X(\Omega) = \sum_{n=-\infty}^{\infty} x[n] e^{-j\Omega n}$$

$$x[n] = \frac{1}{2\pi} \int_0^{2\pi} X(\Omega) e^{j\Omega n} d\Omega = \frac{1}{2\pi} \int_{<2\pi>} X(\Omega) e^{j\Omega n} d\Omega$$

Transformada discreta de Fourier (DFT)

$$X[k] = \sum_{n=0}^{N-1} x[n] e^{-j\frac{2\pi}{N}kn} \qquad x[n] = \frac{1}{N} \sum_{k=0}^{N-1} X[k] e^{j\frac{2\pi}{N}kn}$$

Convolución lineal

$$z[n] = x[n] * y[n] = \sum_{k=-\infty}^{\infty} x[k] y[n-k]$$

Convolución circular

$$z[n] = x[n] \, N \, y[n] = \sum_{k=0}^{N-1} x[k] y[(n-k)_{mod\ N}]$$

Parámetros de interés de una señal

$$\overline{x[n]} = \lim_{N\to\infty} \frac{1}{2N+1} \sum_{n=-N}^{N} x[n] \qquad E_\infty = \sum_{n=-\infty}^{\infty} |x[n]|^2 \qquad P_\infty = \lim_{N\to\infty} \frac{1}{2N+1} \sum_{n=-N}^{N} |x[n]|^2$$

Caso particular para señales periódicas:

$$\overline{x[n]} = \frac{1}{N_0} \sum_{n=\langle N_0 \rangle} x[n] = c_0 \qquad P_\infty = \frac{1}{N_0} \sum_{n=\langle N_0 \rangle} |x[n]|^2 = \sum_{k=0}^{N_0-1} |c_k|^2$$