Fourier Transform for Power Signals

- For energy signals, the Dirichlet conditions should be satisfied.

能量訊號

Eg: $g(t) = A\Pi(\frac{t}{W})$

$\Rightarrow$ energy signal

$$\int_{-\infty}^{\infty} |g(t)|^2 dt < \infty \quad (1)$$

✓ 能量有限大小,

平均功率 = 0

- To expand applicability of the Fourier transform to include power signals — that is, signals for which the condition

Eg: $g(t) = A\cos(2\pi f_0 t)$,

$-\infty < t < \infty$

$\Rightarrow$ power signal

平均功率定義

$$\lim_{T\to\infty} \frac{1}{2T} \int_{-T}^{T} |g(t)|^2 dt < \infty \quad (2)$$

有限

能量訊號 $P = \lim_{T\to\infty} \frac{E}{T} = 0$

$E \to \infty$

功率訊號

- It turns out that both of these objectives are met through the "proper use" of the Dirac delta function or unit impulse $\delta(t)$.

單位脈衝函數 $\delta(t)$ 皆滿足上面兩個條件

$\because \int_{-\infty}^{\infty} |\delta(t)|^2 dt = 1 < \infty \Rightarrow$ energy signal

$\lim_{T\to\infty} \frac{1}{2T} \int_{-T}^{T} |\delta(t)|^2 dt = 0 < \infty \Rightarrow$ power signal