周期信号的频谱分析

傅立叶级数.

$$\begin{cases} a_0 = \frac{1}{T}\int_{-\frac{T}{2}}^{\frac{T}{2}} x(t)\,dt. \\ a_n = \frac{2}{T}\int_{-\frac{T}{2}}^{\frac{T}{2}} x(t)\cos \omega_0 nt\,dt \\ b_n = \frac{2}{T}\int_{-\frac{T}{2}}^{\frac{T}{2}} x(t)\sin \omega_0 nt\,dt. \end{cases}$$

$$f = a_0 + \sum_{1}^{\infty} a_n \cos n\omega t + \sum_{1}^{\infty} b_n \sin n\omega t.$$

指数形式的傅立叶级数.

$$a_n = \frac{1}{T}\int_{-\frac{T}{2}}^{\frac{T}{2}} x(t)\, e^{-jn\omega_0 t}\,dt.$$

$$f(t) = \sum_{-\infty}^{+\infty} a_n e^{jn\omega_0 t}.$$

$$= \sum_{-\infty}^{+\infty} \underbrace{|a_n|}_{a_n 模} \cdot \underbrace{e^{i\phi_n}}_{a_n 相位.} e^{jn\omega_0 t}$$

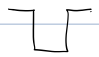
$a_n > 0$, $\phi_n = 0$.

$a_n < 0$ $\phi_n = \mp\pi$ $n<0$, 取 π, $n>0$ 取 $-\pi$.

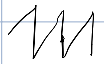
频带宽度 $B_\omega = \frac{2\pi}{\tau}$, 或 $B_f = \frac{1}{\tau}$

信号可测性.

测不准原理. τ 越短, 分辨能力越强.

矩形波. $10\omega_0$. 

三角波. $3\omega_0$ 

锯齿波. $10\omega_0$ 

半三角波 $3\omega_0$