

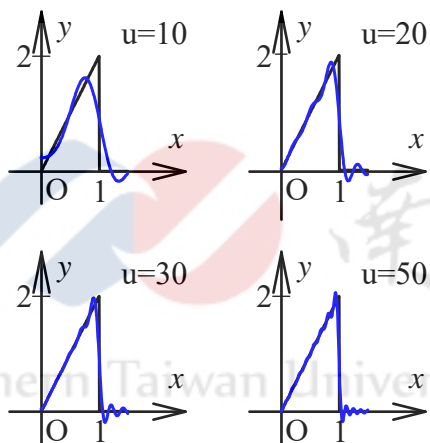
Find the Fourier cosine integral for the function $f(t) = \begin{cases} 2t, & 0 < t < 1 \\ 0, & \text{otherwise} \end{cases}$. [102 虎尾車輛 2]

[解] 設 $f(t) = \int_0^{\infty} a(\omega) \cos \omega t d\omega$

$$\begin{aligned} a(\omega) &= \frac{2}{\pi} \int_0^{\infty} f(t) \cos \omega t dt = \frac{2}{\pi} \int_0^1 2t \cos \omega t dt = \frac{4}{\pi \omega} (t \sin \omega t \Big|_0^1 - \int_0^1 \sin \omega t dt) \\ &= \frac{4}{\pi \omega} \left(\sin \omega + \frac{\cos \omega t}{\omega} \Big|_0^1 \right) = \frac{4}{\pi \omega} \left(\sin \omega + \frac{\cos \omega - 1}{\omega} \right) \end{aligned}$$

$$f(t) = \frac{4}{\pi} \int_0^{\infty} \left(\frac{\sin \omega}{\omega} + \frac{\cos \omega - 1}{\omega^2} \right) \cos \omega t d\omega$$

以 $f(t) = \frac{4}{\pi} \int_0^{\infty} \left(\frac{\sin \omega}{\omega} + \frac{\cos \omega - 1}{\omega^2} \right) \cos \omega t d\omega$ 所繪之圖如下



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