

Let a and k be positive numbers, and let $f(t) = \begin{cases} k, & -a \leq t < a \\ 0, & t < -a, t \geq a \end{cases}$. Find the Fourier transform of $f(t)$.

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$$\begin{aligned} \text{[解]} \int_{-\infty}^{\infty} f(t) e^{-i\omega t} dt &= \int_{-a}^a k e^{-i\omega t} dt = \frac{k}{-i\omega} \cdot e^{-i\omega t} \Big|_{-a}^a = \frac{k}{-i\omega} (e^{-i\omega a} - e^{i\omega a}) \\ &= \frac{k}{-i\omega} (-2i \sin a\omega) = \frac{2k \sin a\omega}{\omega} \end{aligned}$$



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