

Example 11-8: Two-Sided Exponential

Consider the two-sided exponential signal $\frac{\text{PSfrag replacements}}{\mathcal{H}_2(\hat{\omega})\mathcal{H}_1(\hat{\omega})e^{j\hat{\omega}n}} \qquad x($

$$t_1(\hat{\omega})e^{j\hat{\omega}n} \qquad \qquad x(t) = e^{-at}u(t) + e^{at}u(-t) = e^{-a|t|}$$

which is the real even time function plotted in Fig. 11-13(a). Using (11.16) and (11.50), it follows that

$$X(j\omega) = \frac{1}{a+j\omega} + \frac{1}{a-j\omega} = \frac{2a}{a^2 + \omega^2}$$

Observe in Fig. 11-13(b) that $X(j\omega)$ is also a real even function of ω .



Figure 11-13: Two-sided exponential signal: (a) Time function $x(t) = e^{-a|t|}$; (b) Corresponding Fourier transform $X(j\omega)$.