

Problem 2.16

Consider the decaying exponential pulse

$$g(t) = \begin{cases} \exp(-at) & t > 0 \\ 1, & t = 0 \\ 0, & t < 0 \end{cases}$$

Determine the energy spectral density of the pulse $g(t)$.

Solution

The Fourier transform of $g(t)$ is (see Eq. (2.12) in the text

$$G(f) = \frac{1}{a + j2\pi f}$$

The energy spectral density of the pulse is therefore

$$\begin{aligned} E_g(f) &= |G(f)|^2 \\ &= \frac{1}{a^2 + 4\pi^2 f^2}, \quad -\infty < f < \infty \end{aligned}$$