
Aufgabe I.3.4

$$\text{a) } E = \int_{-\infty}^{\infty} |u(t)|^2 dt = \int_0^{\infty} 4V^2 e^{-2\sigma t} dt = \left[-\frac{4V^2}{2\sigma} e^{-2\sigma t} \right]_0^{\infty} = \frac{4V^2}{2\sigma} < \infty$$

$$\begin{aligned} \text{b) } U(f) &= \int_{-\infty}^{\infty} u(t) e^{-j2\pi f t} dt = \int_0^{\infty} 2V e^{-\sigma t} e^{-j2\pi f t} dt = 2V \int_0^{\infty} e^{-(\sigma + j2\pi f)t} dt = 2V \left[\frac{1}{-(\sigma + j2\pi f)} e^{-(\sigma + j2\pi f)t} \right]_0^{\infty} \\ &= \frac{2V}{\sigma + j2\pi f} \end{aligned}$$