$$f(t) = e^{-\frac{t}{\tau}} \cos(\omega_s t)\ \Theta(t)$$

$$\mathcal{F}[f](\omega) = \frac{1}{\sqrt{2\pi}} \cdot \int_{-\infty}^{\infty} f(t) \cdot e^{-\omega i t}\, dt$$

$$= \frac{1}{\sqrt{2\pi}} \cdot \int_{-\infty}^{\infty} e^{-\frac{t}{\tau}} \cos(\omega_s t) \cdot \Theta(t) \cdot e^{-i\omega t}\, dt$$

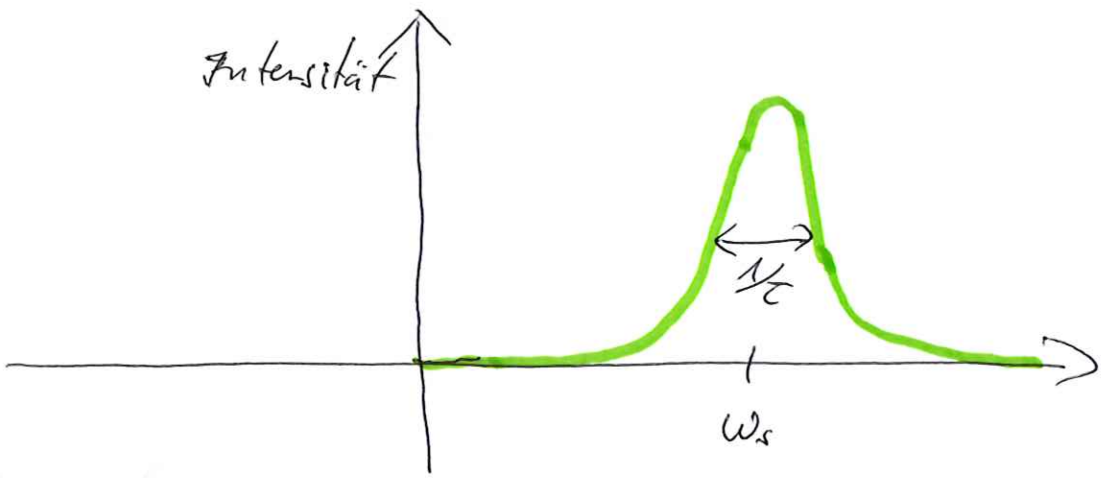
$$= \frac{1}{\sqrt{2\pi}} \int_0^{\infty} e^{-\frac{t}{\tau}} \cdot \frac{1}{2}\left(e^{i\omega_s t} + e^{-i\omega_s t}\right) e^{-i\omega t}\, dt$$

$$= \frac{1}{2\sqrt{2\pi}} \int_0^{\infty} \left(e^{-t\cdot\left(\frac{1}{\tau} - i(\omega_s - \omega)\right)} + e^{-t\left(\frac{1}{\tau} + i(\omega_s + \omega)\right)}\right) dt$$

$$= \frac{1}{2\sqrt{2\pi}} \left[-\frac{1}{\frac{1}{\tau} - i(\omega_s - \omega)} e^{-t\left(\frac{1}{\tau} - i(\omega_s - \omega)\right)} - \frac{1}{\frac{1}{\tau} + i(\omega_s + \omega)} e^{-t\left(\frac{1}{\tau} + i(\omega_s + \omega)\right)} \right]_0^{\infty}$$

$$= \frac{1}{2\sqrt{2\pi}} \left(\frac{1}{\frac{1}{\tau} - i(\omega_s - \omega)} + \frac{1}{\frac{1}{\tau} + i(\omega_s + \omega)} \right) = \frac{1}{\sqrt{2\pi}} \cdot \left(\frac{\frac{1}{\tau} + i\omega}{\left(\frac{1}{\tau} + i\omega\right)^2 + \omega_s^2} \right)$$

Realteil von $\mathcal{F}[f](\omega)$



$$f(t) = e^{-\frac{t}{\tau}} \cos c$$