

Fourierjeva transformacija

$$F[\omega] = \int_{-\infty}^{\infty} f[t] * e^{-i\omega t} dt$$

Naloga 1:

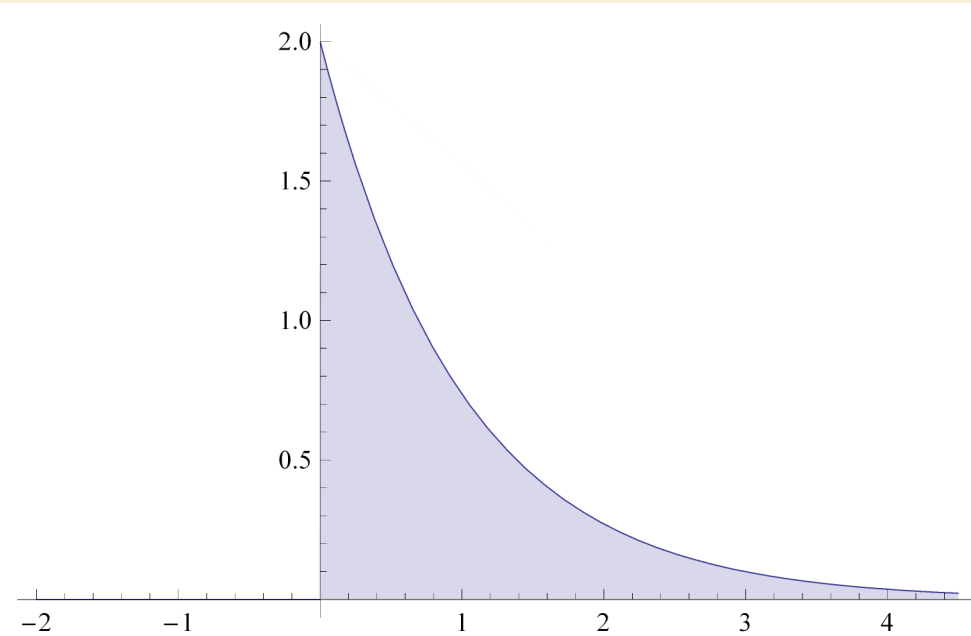
Naloga:

Izračunaj kompleksni spekter ter spekter amplitudne in fazne gostote za signal:

▫ Signal:

$$f[t_] := \begin{cases} B * e^{-a*t} & t \geq 0 \\ 0 & \text{True} \end{cases}$$

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B = 2; a = 1; Plot[f[t], {t, -2.0, 4.5}, PlotRange -> All, Filling -> Axis]
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▫ Fourierjeva transformacija

$$\begin{aligned} F(\omega) &= \int_{-\infty}^{\infty} f(t) * e^{-i\omega t} dt = \int_0^{\infty} B * e^{-a*t} * e^{-i\omega t} dt \\ &= B * \int_0^{\infty} e^{-(i\omega+a)t} dt = B * \left. \frac{e^{-(i\omega+a)t}}{-(i\omega+a)} \right|_0^{\infty} = \\ &= \frac{B}{i\omega+a} = \frac{B(a-i\omega)}{a^2+\omega^2} \end{aligned}$$

▫ Spekter amplitudne gostote

$$\begin{aligned} |F(\omega)| &= \sqrt{\left(\frac{Ba}{a^2+\omega^2}\right)^2 + \left(\frac{B\omega}{a^2+\omega^2}\right)^2} = \\ &= \sqrt{\frac{B^2(a^2+\omega^2)}{(a^2+\omega^2)^2}} = \frac{B}{\sqrt{a^2+\omega^2}} \end{aligned}$$

▫ Spekter fazne gostote

$$\Theta(\omega) = \text{ATan} \left[\frac{\frac{-B\omega}{a^2 + \omega^2}}{\frac{Ba}{a^2 + \omega^2}} \right] = -\text{ATan} \left[\frac{\omega}{a} \right]$$