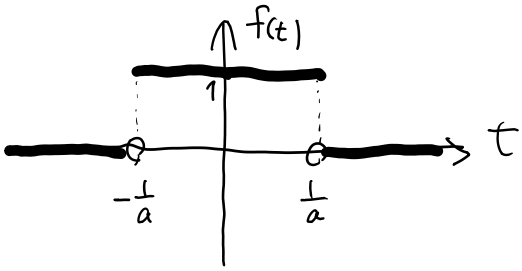
1. $\omega \neq 0$ のとき　$F(\omega) = \int_{-\frac{1}{a}}^{\frac{1}{a}} 1 \cdot e^{-i\omega t}\, dt \ = \left[-\frac{1}{i\omega} e^{-i\omega t}\right]_{-\frac{1}{a}}^{\frac{1}{a}} = -\frac{1}{i\omega}\left(e^{-\frac{i\omega}{a}} - e^{\frac{i\omega}{a}}\right) = \frac{e^{\frac{iw}{a}} - e^{-\frac{i\omega}{a}}}{i} \cdot$

$\frac{1}{\omega} = 2\sin\left(\frac{\omega}{a}\right) \cdot \frac{1}{\omega}$

$\omega = 0$ のとき　$F(\omega) = \int_{-\frac{1}{a}}^{\frac{1}{a}} dt = \frac{2}{a}$

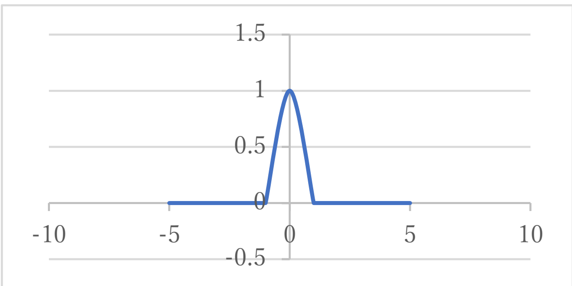


2. $\omega \neq 0$ のとき　$F(\omega) = \int_{-1}^{1} (1-t^2) \cdot e^{-i\omega t}\, dt = 2\int_0^1 (1-t^2)\cos(\omega t)\, dt = 2\Big[(1-$

$t^2)\left(\frac{1}{\omega}\sin(\omega t)\right) - 2t \cdot \frac{1}{\omega^2}\cos(\omega t) + \left(-\frac{1}{w^3}\sin(\omega t)\right)\Big]_0^1 = -2\left(-2\frac{1}{\omega^2}\cos\omega - 2\frac{1}{\omega^3}\sin\omega\right) =$

$-4 \cdot \frac{\omega\cos\omega - \sin\omega}{\omega^3} = 4\frac{\sin\omega - \omega\cos\omega}{\omega^3}$

$\omega = 0$ のとき $\mathrm{F}(\omega) = \int_{-1}^{1} (1-\mathrm{t}^2)\, \mathrm{dt} = \left[\mathrm{t} - \frac{1}{3}\mathrm{t}^3\right]_{-1}^{1} = \frac{2}{3} - \left(-\frac{2}{3}\right) = \frac{4}{3}$



3. $F(\omega) = \int_{-\infty}^{\infty} e^{-\beta|t|} \cdot e^{-i\omega t}\, dt = \int_0^{\infty} \quad e^{-\beta t} \cdot e^{-i\omega t}\, dt + \int_{-\infty}^{0} e^{\beta t} \cdot e^{-i\omega t}\, dt =$

$\int_0^{\infty} e^{-(i\omega+\beta)t}\, dt + \int_{-\infty}^{0} e^{-(i\omega-\beta)t}\, dt = -\frac{1}{i\omega+\beta}\left[e^{-(i\omega+\beta)t}\right]_0^{\infty} - \frac{1}{i\omega-\beta}\left[e^{-(i\omega-\beta)t}\right]_{-\infty}^{0} = \frac{1}{i\omega+\beta} -$

$\frac{1}{i\omega-\beta} = \frac{-2\beta}{(i\omega+\beta)(i\omega-\beta)} = \frac{2\beta}{\omega^2+\beta^2}$