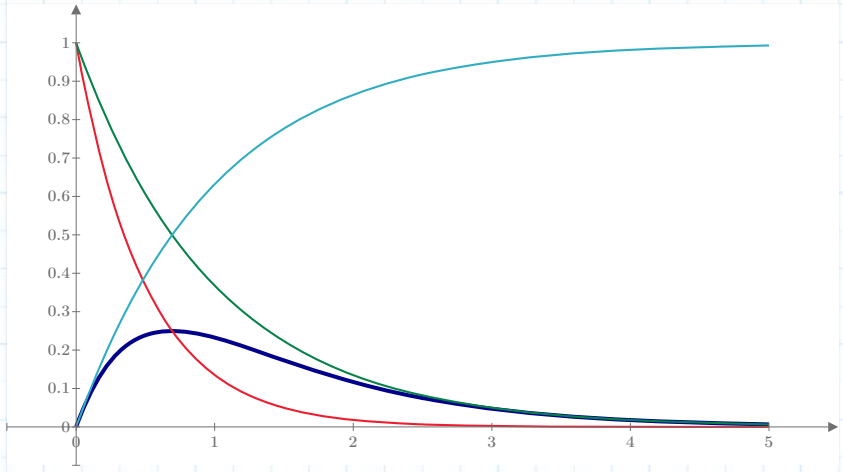
Ex.3 Convolution (Response of electric circuits)
R=1Ω,L=1 H (Series connection)

$R := 1$ $L := 1$ $Z(s) := R + s \cdot L$ $h(t) := e^{-t}$ impulse response

$e(t) := e^{-2 \cdot t} \xrightarrow{laplace} \frac{1}{s+2}$ $E(s) := \frac{1}{s+2}$ $e(t) := e^{-2 \cdot t}$ *input*

$I(s) := \frac{E(s)}{Z(s)} \rightarrow \frac{1}{(s+1) \cdot (s+2)} \xrightarrow{invlaplace} e^{-t} - e^{-(2 \cdot t)}$ *output*

$i(t) := e^{-t} - e^{-(2 \cdot t)}$ *output*



$i(t)$

$e(t)$

$h(t)$

$1 - e^{-t}$

t

$h(t) := e^{-t}$ impulse response

$h_i(t) := \int_0^t h(t)\,dt \rightarrow 1 - e^{-t}$ indicial response (unit step response)

$\mathbf{clear}(t, i)$

ソルバー制約条件 推定値

$R := 1$ $L := 1$

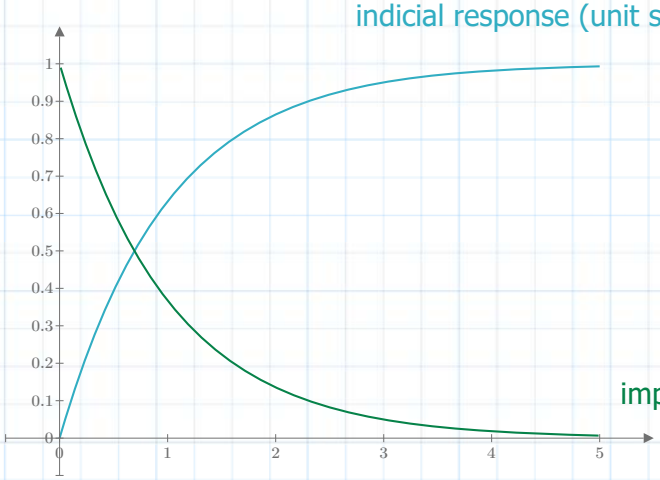
$L \cdot \frac{d}{dt} i(t) + R \cdot i(t) = \Phi(t)$ $i(0) = 0$

$i := \mathbf{odesolve}(i(t), 5)$

RL Circuit (series connection)

$$Y(s) := \frac{1}{1+s}$$

indicial response (unit step response)



$i(t)$

$\frac{d}{dt} i(t)$

impulse response

t

input *output*

impulse response

$$\frac{d}{dt}\Phi(t) \xrightarrow{laplace} 1 \qquad e^{-t} \qquad \frac{1}{1+s} \xrightarrow{invlaplace} e^{-t}$$

indicial response
(unit step response)

$$\Phi(t) \xrightarrow{laplace} \frac{1}{s} \qquad 1-e^{-t} \qquad \frac{\frac{1}{s}}{1+s} \xrightarrow{invlaplace} 1-e^{-t}$$

ramp response

$$\int_0^t \Phi(t)\,dt \xrightarrow{laplace} \frac{1}{s^2} \qquad t+e^{-t}-1 \qquad \frac{\frac{1}{s^2}}{1+s} \xrightarrow{invlaplace} t+e^{-t}-1$$

exponential response

$$e^{-2\cdot t} \xrightarrow{laplace} \frac{1}{s+2} \qquad e^{-t}-e^{-(2\cdot t)} \qquad \frac{\frac{1}{s+2}}{1+s} \xrightarrow{invlaplace} e^{-t}-e^{-(2\cdot t)}$$