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Ex.S7 Response of electric circuit when impulse response and input signal are shown as follows. Sinusoidal waves input. R=1Ω,L=1 H (Series connection)

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

$h(t):=e^{-t}$ $\quad H(s):=\dfrac{1}{s+1}$ $\quad R:=1$ $\quad \omega:=1$ $\quad L:=1$

$m:=m$

$$x_m(t):=\sin(m\cdot\omega\cdot t)\xrightarrow{laplace}\frac{m}{m^2+s^2} \qquad X_m(s):=\frac{m}{m^2+s^2}$$

$$Y_m(s):=X_m(s)\cdot H(s)\rightarrow\frac{m}{(s+1)\cdot(m^2+s^2)}\xrightarrow{invlaplace}\frac{m\cdot\sin\left(t\cdot\sqrt{m^2}\right)+m\cdot e^{-t}\cdot\sqrt{m^2}-m\cdot co\ldots}{\sqrt{m^2}\cdot(m^2+1)}$$

$$y_m(t):=\frac{m\cdot\sin\left(t\cdot\sqrt{m^2}\right)+m\cdot e^{-t}\cdot\sqrt{m^2}-m\cdot\cos\left(t\cdot\sqrt{m^2}\right)\cdot\sqrt{m^2}}{\sqrt{m^2}\cdot(m^2+1)}$$

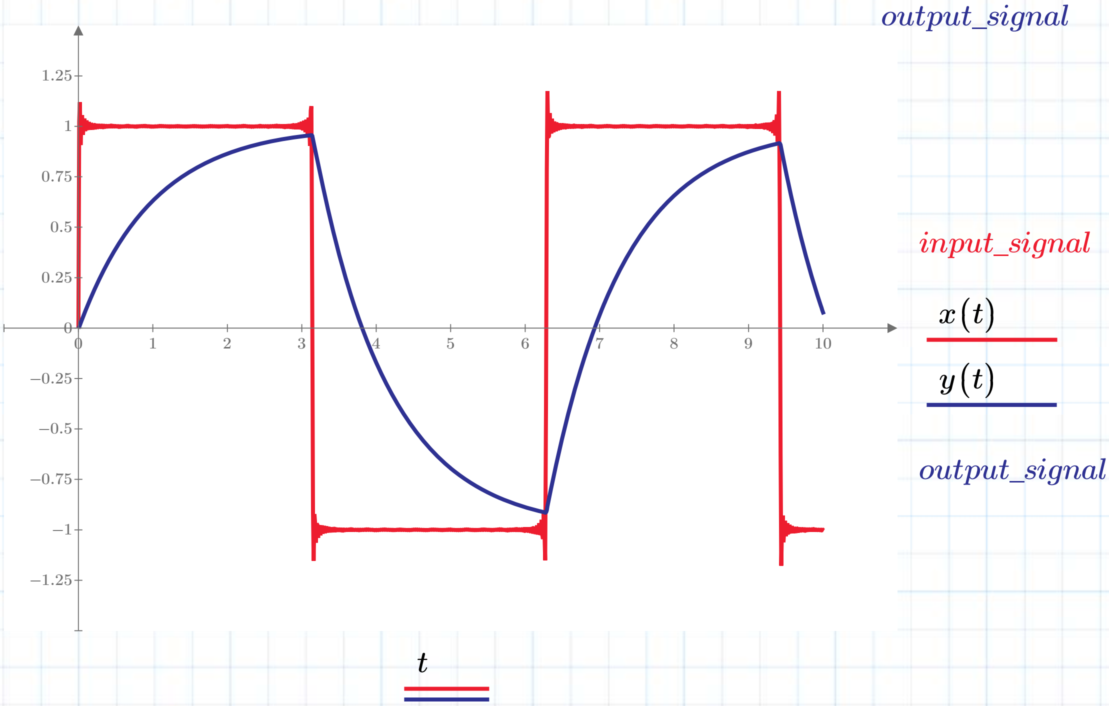
$m:=100$

$t:=0,0.01..10.1$

$$x(t):=\sum_{n=1}^{m}\left(\frac{4}{\pi}\frac{1}{(2\cdot n-1)}\cdot\sin((2\ n-1)\cdot t)\right) \qquad input\_signal$$

$$y(t):=\sum_{n=1}^{m}\left(\frac{4}{\pi}\cdot\frac{1}{(2\cdot n-1)}\cdot\left(\frac{(2\cdot n-1)\cdot\sin(t\cdot(2\cdot n-1))+(2\cdot n-1)\cdot e^{-t}\cdot(2\cdot n-1)-(2\cdot n-1)\cdot\cos(t\cdot(2\cdot n-1))\cdot(2\cdot n-1)}{(2\cdot n-1)\cdot\left((2\cdot n-1)^2+1\right)}\right)\right)$$

output_signal



$y(0)=0$ $\quad y(\pi)=0.953$ $\quad y(2\cdot\pi)=-0.912$ $\quad y(10\cdot\pi)=-0.914$

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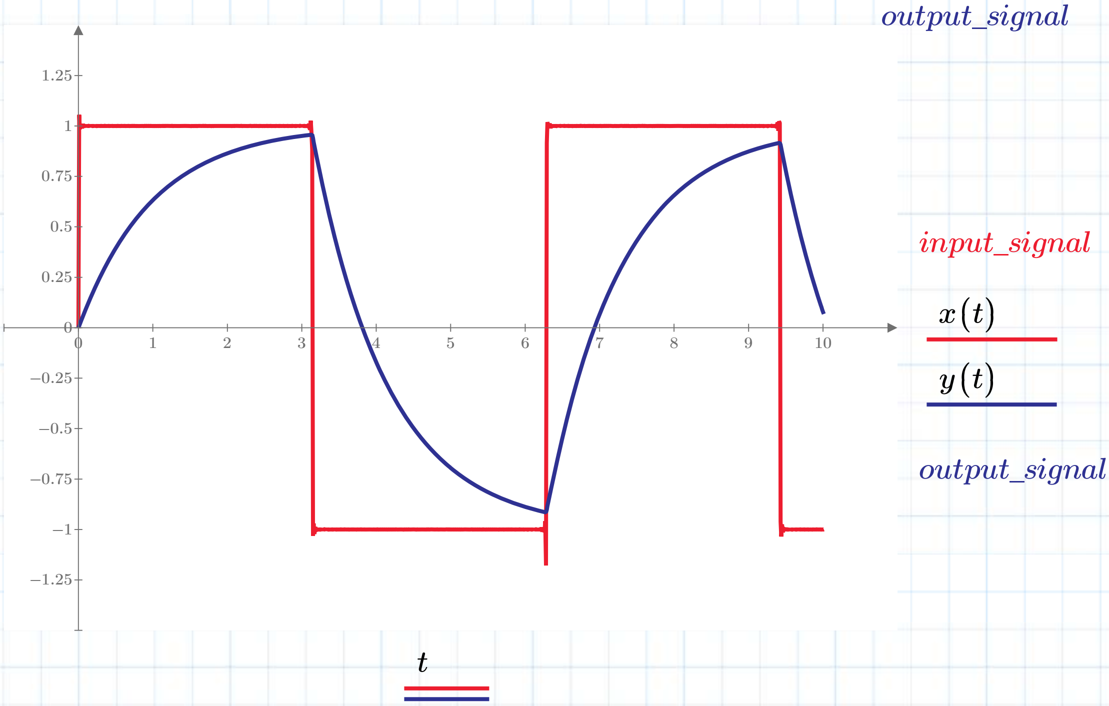
$m := 500$

$t := 0, 0.01 .. 10.1$

$$x(t) := \sum_{n=1}^{m} \left(\frac{4}{\pi} \cdot \frac{1}{(2 \cdot n - 1)} \cdot \sin((2\ n - 1) \cdot t) \right)$$ *input_signal*

$$y(t) := \sum_{n=1}^{m} \left(\frac{4}{\pi} \cdot \frac{1}{(2 \cdot n - 1)} \cdot \left(\frac{(2 \cdot n - 1) \cdot \sin(t \cdot (2 \cdot n - 1)) + (2 \cdot n - 1) \cdot e^{-t} \cdot (2 \cdot n - 1) - (2 \cdot n - 1) \cdot \cos(t \cdot (2 \cdot n - 1)) \cdot (2 \cdot n - 1)}{(2 \cdot n - 1) \cdot \left((2 \cdot n - 1)^2 + 1\right)} \right) \right)$$

output_signal



$y(0) = 0$ $\quad$ $y(\pi) = 0.956$ $\quad$ $y(2 \cdot \pi) = -0.915$ $\quad$ $y(4 \cdot \pi) = -0.917$

$$(1 + A) \cdot e^{-\pi} - 1 = -A \xrightarrow{solve, A} \frac{2}{e^{-\pi} + 1} - 1 = 0.917$$

$$1.917 \cdot e^{-\pi} - 1 = -0.917$$

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