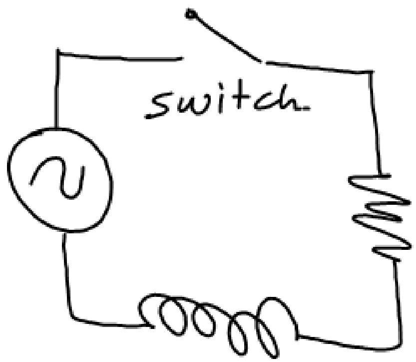
Step function

$$u(t-a) = \begin{cases} 0 \;;\; t \le a \\ 1 \;;\; t > a \end{cases}$$

$u(t-3)$



RL circuit

$R = 2$ ohm

$V = 120 \sin(60(2\pi t))$

$L = 10$ Henry.

$$L\frac{di(t)}{dt} + Ri(t) = u(t-3)\,120\sin(120\pi t)$$

ODE(1) LccNH $i(0) = 0$ initial condition.

$$10\,\frac{di(t)}{dt} + 2\,i(t) = u(t-3)\,120\,\sin(120\pi t)$$

$$\mathcal{L}^{-1}\left\{\frac{e^{-2s}\,s}{(s^2+2s+2)^2}\right\}$$

$$\mathcal{L}^{-1}\left\{e^{-as}F(s)\right\} = u(t-a)\,f(t-a)$$

$$\mathcal{L}\left\{e^{at}f(t)\right\} = F(s-a)$$

$$\mathcal{L}^{-1}\left\{F(s)\cdot G(s)\right\} = f(t) * g(t)$$

$$\mathcal{L}^{-1}\left\{\frac{e^{-2s}}{s^2+2s+2}\cdot\frac{s}{s^2+2s+2}\right\}$$

Convolution oper.

$$\mathcal{L}^{-1}\left\{\frac{e^{-2s}}{s^2+2s+2}\right\} * \mathcal{L}^{-1}\left\{\frac{s}{s^2+2s+2}\right\}$$

$$f(t) * g(t) = \int_0^t f(t-\tau)\cdot g(\tau)\,d\tau.$$

$$g(t) * f(t) = \int_0^t g(t-\tau)\cdot f(\tau)\,d\tau.$$

Linear Ordinary Differential Equations
with initial conditions

with Sectional continuous functions

Heaviside(t-a) $\Rightarrow u(t-a)$

(t-a)Heaviside(t-a) $r(t-a)$

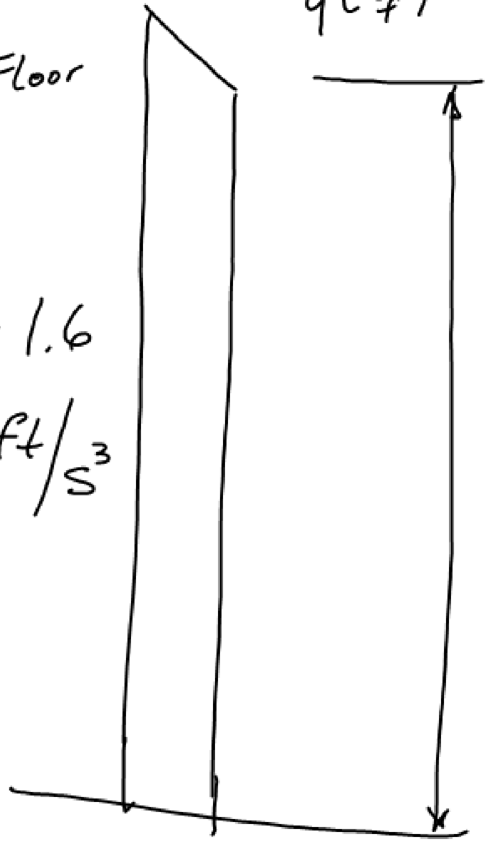
Dirac(t-a). $= \delta(t-a)$

$$\frac{d^3y(t)}{dt^3} - 4\frac{d^2y(t)}{dt^2} - 6y(t) = t^2 e^{3t}\cos(4t)$$

$$y(0) = 2 \quad y'(0) = -6 \quad y''(0) = 8$$

$y(t_f) = h \quad y'(t_f) = 0 \quad y''(t_f) = 0$

55° Floor

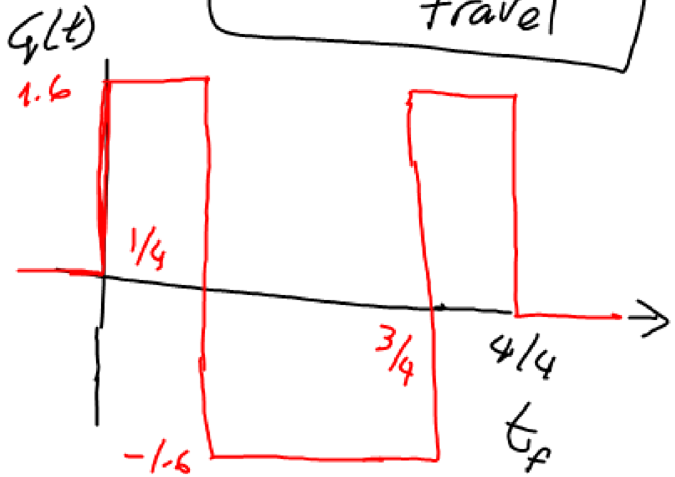


$$\frac{d^3 y(t)}{dt^3} = G(t)$$

$$\frac{d\,a(t)}{dt} \leq 1.6 \ ft/s^3$$

$h = ?$

$$\boxed{time_{travel} = ?}$$



$y(0) = 0$

$y'(0) = 0$

$y''(0) = 0$

$$\mathcal{L}^{-1}\left\{\frac{e^{-2s}}{s^2+2s+2}\right\} = \mathcal{L}^{-1}\left\{\frac{e^{-2s}}{(s^2+2s+1)+(1)}\right\}$$

$$= \mathcal{L}^{-1}\left\{\frac{e^{-2s}}{(s+1)^2+(1)^2}\right\}$$

$$\mathcal{L}^{-1}\left\{\frac{1}{(s+1)^2+(1)^2}\right\} = e^{-t}\sin(t)$$

$$= u(t-2)e^{-(t-2)}\sin(t-2)$$

$$\mathcal{L}^{-1}\left\{\frac{s}{s^2+2s+2}\right\} = \mathcal{L}^{-1}\left\{\frac{s}{(s+1)^2+(1)^2}\right\}$$

$$= \mathcal{L}^{-1}\left\{\frac{(s+1)-1}{(s+1)^2+(1)^2}\right\}$$

$$= \mathcal{L}^{-1}\left\{\frac{s+1}{(s+1)^2+(1)^2}\right\} - \mathcal{L}^{-1}\left\{\frac{1}{(s+1)^2+(1)^2}\right\}$$

$$= e^{-t}\cos(t) - e^{-t}\sin(t)$$

$$\left[u(t-2)e^{-(t-2)}\sin(t-2)\right] * \left[e^{-t}\cos(t)-e^{-t}\sin(t)\right]$$