2-1-1 $y(t) \xlongequal{\tau'=\tau-1} \int_{t-3}^{+\infty} e^{t-\tau'-1} x(\tau')\,d\tau'$

$d\tau' = d\tau$ $=$

其实这种给积分凑卷积的题 注意形式即可

$y(t) = \int_{t-2}^{+\infty} e^{t-\tau} x(\tau-1)\,d\tau = \int_{-\infty}^{+\infty} e^{t-\tau} x(\tau-1)\, u(\tau-(t-2))\,d\tau$

$= \int_{-\infty}^{+\infty} e^{t-\tau} x(\tau-1)\, u(-(t-\tau)+2)\,d\tau \xlongequal{\tau'=\tau-1} \int_{-\infty}^{+\infty} e^{\boxed{t-\tau'}-1} x(\tau')\, u(-\boxed{(t-\tau')}+3)\,d\tau'$

注意2个 $t-\tau'$ 形式即可 $\Rightarrow$ $x(t) * \underbrace{e^{t-1} \cdot u(3-t)}_{h(t)}$.

法2 就事论事，单位冲激 $x(t)$ 换 $\delta(t)$

$y(t) = h(t) = \int_{t-2}^{+\infty} e^{t-\tau} \delta(\tau-1)\,d\tau = e^{t} \int_{t-2}^{+\infty} e^{-\tau} \delta(\tau-1)\,d\tau = e^{t} \int_{t-2}^{+\infty} e^{-1} \delta(\tau-1)\,d\tau \overset{\text{ksm 性质}}{=} e^{t-1} \int_{t-2}^{+\infty} \delta(\tau-1)\,d\tau = e^{t-1}\, u(3-t)$

2-1-2 $x_1(t) * \delta(t+3) * x_2(t) * \delta(t-1)$

$x_1(t) * x_2(t) * \delta(t+2)$.

2-1-3 $f(t-\tau) * \delta(t) = A$. ?

2-1-5 $u(t)$ 与 $u(t)$ 的卷积一直是重点.

$u(t+\frac{\tau}{2}) = u(t) * \delta(t+\frac{\tau}{2})$

$f(t) = \underline{u(t) * u(t)} * \delta(t+\tau) - 2\,u(t)*u(t) + u(t)*u(t) * \delta(t-\tau)$

把这种阶跃看成. 矩形卷积

理解成 上升沿, 下降沿. 上升沿相卷 → 斜上. 下降沿 → 斜下.

上升沿 无法同下降沿相卷, 是个 ∞ . 因为一反方向就 ∞.

$u(t) * u(-t)$??? X

$u(t) * u(t-1)$? $\Rightarrow$ $u(t) * u(t) * \delta(t-1)$

这与 $e^{-at}u(t) * e^{-bt}u(t)$ 又不同

频域 证明.

$e^{-at}u(t) \xrightarrow{\mathcal{F}} \frac{1}{jw+a}$ $\quad e^{-bt}u(t) \xrightarrow{\mathcal{F}} \frac{1}{jw+b}$

∴ 频域 $e^{-at}u(t) * e^{-bt}u(t) \xrightarrow{\mathcal{F}} \frac{1}{(jw+a)(jw+b)}$

① $\alpha=\beta$ ∴ $F(jw) = \frac{1}{(jw+\alpha)^2} = t \cdot e^{-at}u(t)$

$$\left[\frac{d\left(\frac{1}{jw+a}\right)}{dw} = \frac{-j}{(jw+a)^2} = \frac{1}{j}\frac{1}{(jw+a)^2} = \left(\frac{1}{j} t f(t)\right) \right]$$ —

② $\alpha \neq \beta$ $\quad F(jw) = \frac{1}{b-a}\left(\frac{1}{jw+a} - \frac{1}{jw+b}\right) \xrightarrow{\mathcal{F}^{-1}} \frac{e^{-at}-e^{-bt}}{b-a}u(t)$

∴ $f(t) = tu(t) * \delta(t+\tau) - 2tu(t) + tu(t) * \delta(t-\tau)$

看 τ 为常数即可

2-1-6

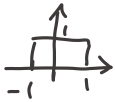
虽然 $t * u(t)$ 结果是算不了的. 但 $u(t) - u(t-1)$ 是会卡住积分区间的.

换 τ 即可.

$$Conv = \int_{-\infty}^{+\infty} (3\tau+2)\left(u(t-\tau) - u(\boxed{t-\tau}-1)\right)d\tau$$

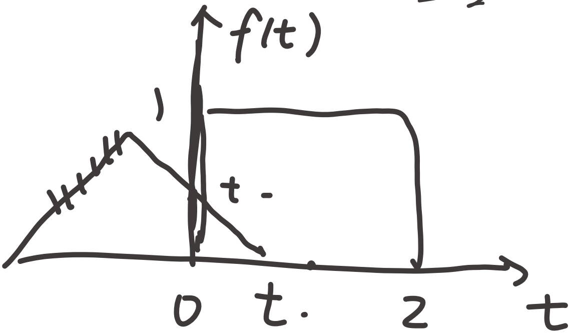
$$= \int_{t-1}^{t} (3\tau+2)d\tau = 3t + \frac{1}{2}.$$

2-1-7 $f(t)=\int_{-\infty}^{+\infty} f_1(-\tau)\, f_2(\tau)\, d\tau$

$= 2\int_{-\infty}^{+\infty}$  $\cdot\ f_2(t)\, d\tau.$

$=3$

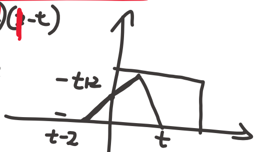
2-1-8.



① $t\in(0,1)$, $y(t)=\frac{1}{2}t^2$

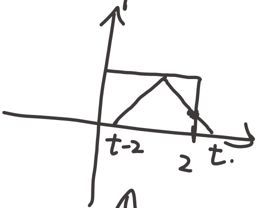
② $t\in(1,2)$ $y(t)=1-\frac{1}{2}(-t+1)(1-t)$

③ $t\in(2,3)$ $y(t)=1-\frac{1}{2}(t-1)^2$ 一样



④ $t\in(3,4)$ $y(t)=\frac{1}{2}(4-t)^2$

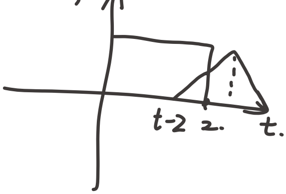
⑤ $t\geq 4$. $y(t)=0$



实际上 $y(t)$是组合

$\frac{t^2}{2}u(t)-(t-1)^2u(t-1)$ ...

去累计



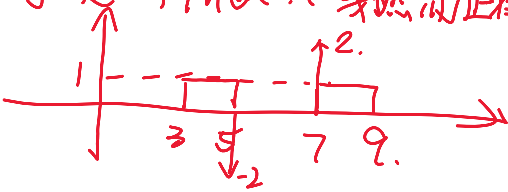
2.1.9 $y(t) = t[u(t)-u(t-2)] * \delta(t-3) + (-t)[u(-t)-u(-t-2)] * \delta(t+9)$

X 看不懂

$f(t) = [u(t+1)-u(t-1)] * \delta(t+3)$

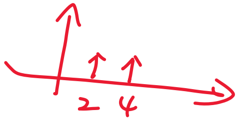
把 △ 求导 是一个阶跃.（嘎然而止有冲激）

$y'(t)' =$



同理，给 $x(t) * h(t)$ 一个微分器.

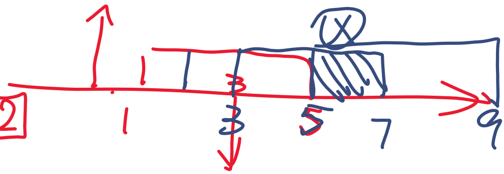
$f'(t) = \delta(t-2) - \delta(t-4)$.



$\therefore f'(t) * h(t) = y'(t)$

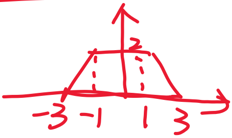
h(t) 显而易见

有一个3处的冲激 $\boxed{-2}$

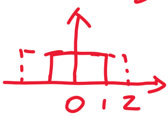


3-5 门函数
7-9 门函数 } 一个大门中间互抵

法二：



⇒ 小门 [-1, 1]
大门：[-2, 2] }（高均为1）



$y(t) = g_1(t) * g_2(t) * \delta(t+6) - [u(t-5)-u(t-7)]$

写成 $y(t) = x(t) * h(t)$

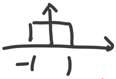
$y(t)=f(t)*\delta(t+3)\qquad *\delta(t-6)\ -\boxed{2f(t)*\delta(t-3)}.$

$*[f(t)*\delta(t+4)+f(t)*\delta(t+2)],$

从这看出

$h(t)$ 显然有个 $-2\delta(t-3)$

已判断出

$=\{f(t)*$ 

$+f(t)*$ 

$\}*\delta(t-6)]$

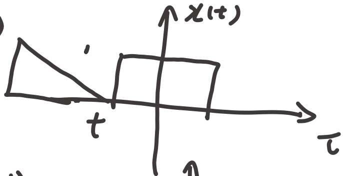
$h(t)$的部分.可合并

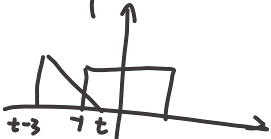
2 1.10 ① $t<-1$. $x_1(t)*x_2(t)=0$

② $-1<t<1$ $x(t)=\frac{1}{4}(t+1)^2$

③ $1<t<2$ $x(t)=1-\frac{1}{2}\cdot(t-1)\frac{1}{3}(t-1)$

④ $2<t<3$





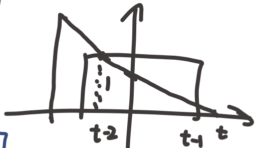
2.110与218一样

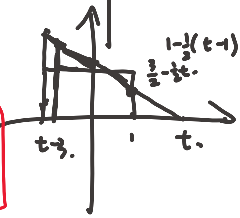
有人写成 $u(t-t_0)$ 形式做讨论

有人写成 { t_1 t_2 ... 都可 → 一般是分段出现

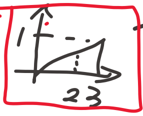
但 { 这种再转成 "$u(t-t_0)-u(t-t_1)$" → 一般为变换域出现

就没必要了





第2点是 最好归1.★ $x_1(t)*x_2(t)$

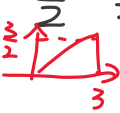
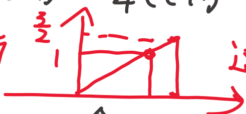
=  $*\ \frac{3}{2}$ 

① $t<-1$ $x_1(t)*x_2(t)=0$.

② $-1<t<1$, 面积是个三角形

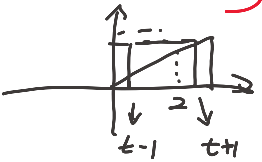
长 $t+1$ 高 $\frac{1}{3}(t+1)$

$\therefore x_1(t)*x_2(t)=\frac{3}{2}\ \frac{1}{2}\ \frac{1}{3}(t+1)^2=\frac{1}{4}(t+1)^2$

不至于错 如果是  会有  这种状况

很恶心

③ $1<t<2$ 是个梯形

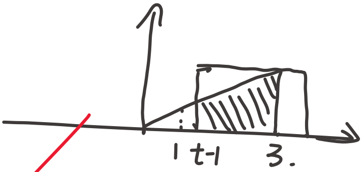


下底 $\frac{1}{3}(t-1)$ 高 2

上底 $\frac{1}{3}(t+1)$

$\therefore\ x_1(t) * x_2(t) = \frac{3}{2}\ \ \frac{1}{3}[(t-1)+(t+1)]\ 2\ \frac{1}{2}$

$= t.$



④ $2 < t < 4$

下底 $\frac{1}{3}(t-1)$ 上底 1

高: $3-t+1 = 4-t$

$\therefore\ x_1(t) * x_2(t) = \frac{1}{2}(4-t)[\frac{1}{3}(t-1)+1]\ \frac{3}{2}.$

$= \frac{3}{4}(4-t)(\frac{1}{3}t+\frac{2}{3}) = \frac{1}{4}(4-t)(t+2).$

⑤ $t > 4$ 0、综即可.

法2. 变换域 $x_1(t) \xleftrightarrow{F} \frac{2\sin\omega}{\omega}$

$x_2(t) = \frac{3}{2}\ \frac{1}{3}t(u(t) - u(t-3)) = \frac{1}{2}t(u(t) - u(t-3)) \xrightarrow{F} \frac{1}{2}$

$(-jt)u(t) \to j\frac{dX(j\omega)}{d\omega} = \frac{d(\frac{1}{j\omega}+\pi\delta(\omega))}{d\omega}$

$tu(t) \xrightarrow{F} \int_0^{+\infty} te^{-j\omega t}dt = \frac{te^{-j\omega t}}{-j\omega}\Big|_0^{+\infty} - \frac{e^{-j\omega t}}{(-j\omega)^2}\Big|_0^{+\infty}$ 对的.

$= 0-(0-\frac{1}{(-j\omega)^2}) = \frac{1}{-\omega^2}$ 所以只要拼jω $\frac{1}{(j\omega)^2}$是

$\frac{1}{2}tu(t) - \frac{1}{2}tu(t-3) = \frac{1}{2}tu(t) - \frac{1}{2}(t-3)u(t-3) - \frac{3}{2}u(t-3)$

$= \frac{1}{2}\cdot\frac{1}{-\omega^2} - \frac{1}{2}\cdot e^{-3j\omega}\frac{1}{-\omega^2} - \frac{3}{2}e^{-3j\omega}(\frac{1}{j\omega}+\pi\delta(\omega))$

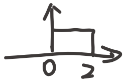
$=$ $-jt\,u(t) \to j\frac{dX}{d\omega}$

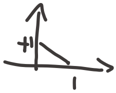
事实上.有个问题. $te^{-j\omega t}\big|_0^{+\infty}$ 也是振荡的

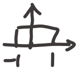
因为从未注意过. $e^{-j\omega t}$ 这个东西并非 e^{-t}, 它是三角函数 而三角在$+\infty$

是振荡的 这一步其实是不可以直接计算的

所以老老实实用 $(-jt)^n x(t) \to \frac{d^nX(j\omega)}{d\omega^n}$

2.11 $h(t)=$ 

$x(t)=$ 

① 时域 $h(t)=$ 

$*\,\delta(t-1)$

$H(j\omega)=\frac{2\sin\omega}{\omega}e^{-j\omega}$

$x(t)=u(t)-tu(t)\overset{+(t-1)u(t-1)}{\underline{-u(t-1)+tu(t-1)}}=$

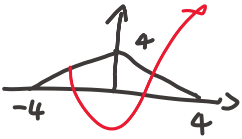
$X(j\omega)=\frac{1}{j\omega}+\pi\delta(\omega)-\frac{1}{(j\omega)^2}+\frac{1}{(j\omega)^2}e^{-j\omega}$

$Y(j\omega)=X(j\omega)H(j\omega)=\frac{2\sin\omega}{j\omega^2}e^{-j\omega}+2\pi-\frac{2\sin\omega e^{-j\omega}}{(j\omega)^2\omega}+\frac{2\sin\omega e^{-2j\omega}}{\omega(j\omega)^2}$

目前来看 咱没学Laplace $u(t)\xrightarrow{\mathcal{F}}\int_0^{+\infty}e^{-st}dt=\frac{1}{s}$ 是方便 但Fourier不方便是真的

再注意: $(-jt)^n x(t)\xrightarrow{\mathcal{F}}\frac{d^nX(j\omega)}{d\omega^n}$ (含j必信)

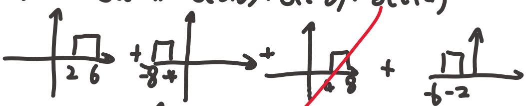
2-1-12.

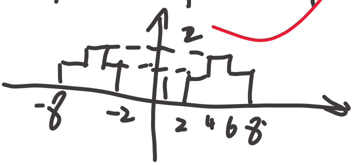
(1) $f_1(t)*f_1(t)=$ 

(2) $f_2(t)=\delta(t-5)+\delta(t+5)$

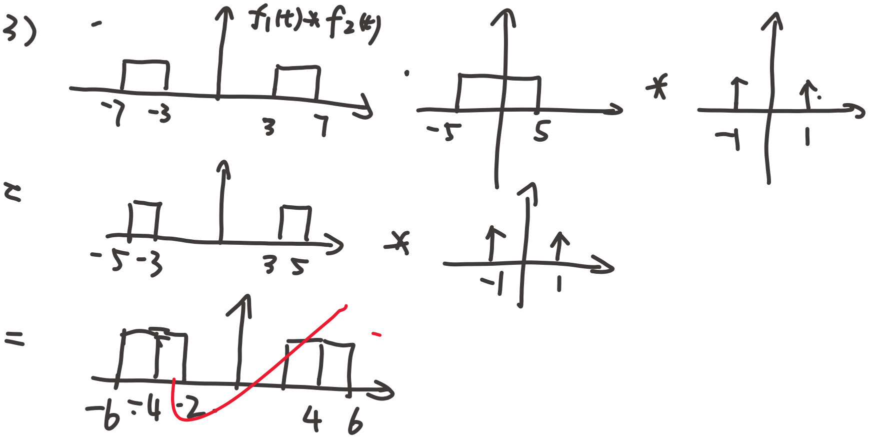
$f_3(t)=\delta(t-1)+\delta(t+1)$

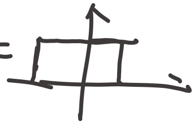
$f_2(t)*f_3(t)=\delta(t-4)+\delta(t+6)+\delta(t-6)+\delta(t+4)$

∴ 原式= 

= 

(3)

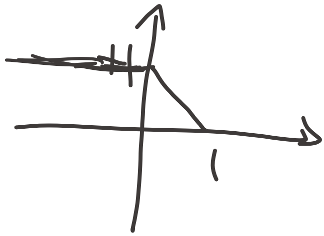


2-1-13. $f_1(t)=u(-t)$ $f_2(t)=$ 

① 当 $0<t<1$ $f_1(t)*f_2(t)=1-t$

② $t>1$. $f(t)=0$

③ $t<0$ Conv $=1$.



2-2-1 $y[n]=f[n]+\frac{1}{2}f[n-1]$.

问 $f[n]=2\delta[n]+4\delta[n-1]-2\delta[n-2]$

解 $Y(e^{j\omega})=F(e^{j\omega})+\frac{1}{2}e^{-j\omega}F(e^{j\omega})$

$$F(e^{j\omega})=2+4e^{-j\omega}-2e^{-2j\omega}.$$

$$\therefore Y(e^{j\omega})=2+4e^{-j\omega}-2e^{-2j\omega}+\frac{1}{2}e^{-j\omega}(2+4e^{-j\omega}-2e^{-2j\omega})$$

$= 2+4e^{-jw}-2e^{-2jw}+e^{-jw}+2e^{-2jw}-e^{-3jw}$

$= 2+5e^{-jw}-e^{-3jw}$

$y_{zs}[n] = 2\delta[n]+5\delta[n-1]-\delta[n-3]$

2-2-2 $f(t)= \cos 2t \xrightarrow{h(t)} \cos 3t$ 送

2-2-3. $x(t)=e^{j3t} \xrightarrow{S} y(t)=e^{j2t}$

$x(t)=e^{-j3t} \xrightarrow{S} y(t)=e^{-2jt}$,

$x(t)=\cos 3t \xrightarrow{S} y(t)=\cos 2t$.

即 $y(t)=x(\frac{2}{3}t)$. 不是个 LTI

$\cos(3t-3) \xrightarrow{S} y(t)=\cos(2t-3)$. A

2-2-4 可知 $f(t)$ 输入时 $y_{zs}(t)=(2e^{-t}+e^{-2t})u(t)$

由 $y(t)=y_{zi}(t)+y_{zs}(t)$

$= y_{zi}(t)+f(t)*h(t)$

$\therefore y_{zi}(t)=(e^{-t}+e^{-2t})u(t)$

即 $Y(jw)=\frac{1}{1+jw}+\frac{1}{2+jw}=\frac{3+2jw}{(1+jw)(2+jw)}$

不用算了. $y_{zi}(t)$ 别动. $y_{zs}(t)$ 该导导

$y_{zs}(t) = \boxed{2y'_{zs}(t) + 3y_{zs}(t)}$ 存在冲激 $(2e^{-t}-e^{-2t})u(t)+6\delta(t)$.

2-2-5

微分器是 LTI

全响应: $y(t) = y_{zs1}(t) + \boxed{y_{zi}(t)}$ 不动 系统原本

$$e_1(t) \xrightarrow{S} (e^{-t} + \cos\pi t)u(t) = y_{zs}(t) + y_{zi1}(t)$$

$$3e_1(t) \xrightarrow{S} (-2e^{-t} + 3\cos\pi t)u(t) = 3y_{zs}(t) + y_{zi2}(t)$$

2-2-5 出存点 SB.

2-2-6. D $(j\omega)^2 Y(j\omega) + 2Y(j\omega) = j\omega X(j\omega)$

$\lambda^2 + 2 = 0 \qquad \lambda^2 = -2 \qquad \lambda = \pm\sqrt{-2}$

$\lambda = \pm\sqrt{2}\, i$

2-3-1 $h[n]=\delta[n]+\delta[n-1]+\delta[n-2]$.

$f[n]=(\frac{1}{4})^{n}u[n]$

$y_{zs}[n]=f[n]*h[n]=(\frac{1}{4})^{n}u[n]+(\frac{1}{4})^{n-1}u[n-1]+(\frac{1}{4})^{n-2}u[n-2]$

2-3-2 $f(t)\xrightarrow{\mathcal{F}}\frac{1}{j\omega}+\pi\delta(\omega)+3e^{-3j\omega}$

$y(t)\xrightarrow{\mathcal{F}}3e^{-6j\omega}[\frac{1}{j\omega}+\pi\delta(\omega)]+9e^{-9j\omega}$.

$h(t)=3\delta(t-6)$

2.3.3 (1) $y_1(t)=\int_{-\infty}^{t}e^{-(t-\tau)}x_1(\tau-2)d\tau$.

令 $t'=\tau-2$. $\tau'+2=\tau$.

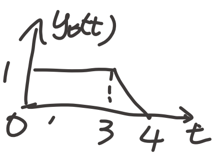
$$y_1(t)=\int_{-\infty}^{t-2}e^{-(t-2-t')}x_1(\tau')d\tau'$$

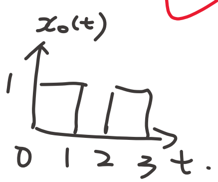
$$=\int_{-\infty}^{+\infty}e^{-(t-2-\tau')}u(\tau'-(t-2))x_1(\tau')d\tau'$$

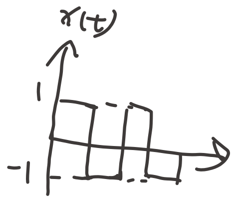
$$=x_1(t)*e^{-t}u(t)*\delta(t-2)$$

$\therefore h_1(t)=e^{-t}u(t)*\delta(t-2)$

(2)







$y_0(t)=(1-t)u(t)*\delta(t-3)+u(t)-u(t-3)$

$= [u(t) - tu(t)] * \delta(t-3) + u(t) - u(t-3)$

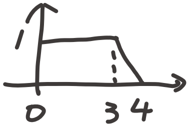
$x_0(t) = [u(t)-u(t-1)] * [\delta(t)+\delta(t-2)]$

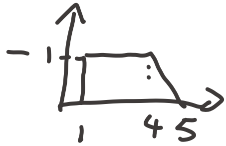
既然无法从 $x_0(t)$ $y_0(t)$ 硬求，则间接整体分析

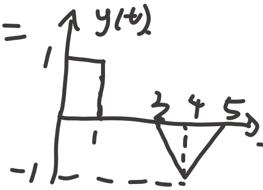
$x(t) = x_0(t) - x_0(t-1)$

$= x_0(t) \ (\delta(t)-\delta(t-1))$

$y(t) = y_0(t)\,[\delta(t)-\delta(t-1)]$ → 写出表达式再作图

= 

− 

= 

$h_3(t) = \delta(-\frac{1}{2}t-1)$

$h_3(-t) = \delta(\frac{1}{2}t-1)$.

$h_3(4-t) = \delta(\frac{1}{2}t-3)$.

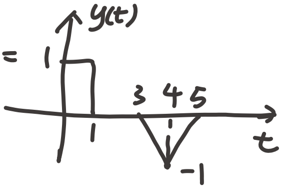
(3) $h_3(4-2t) = \delta(t-3)$ $\quad h_3(-2t) = \delta(t+1)$

$h_3(2t) = \delta(-t+1)$ $\quad h_3(t) = \delta(-\frac{t}{2}+1)$.

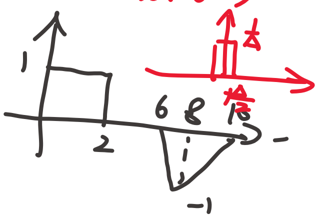
$= \delta(-\frac{1}{2}(t+2))$

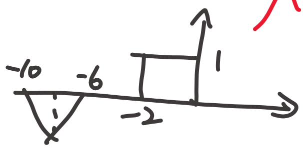
$= 2\delta(t+2)$

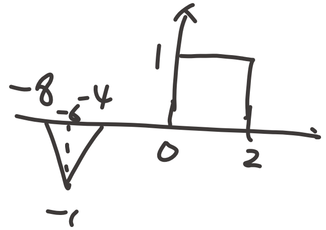
类于 $\delta(t)$

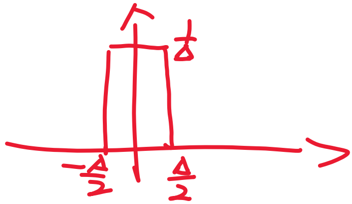
$y(t) =$ 

$\therefore y_3(t) = y(t) * \cancel{\delta(-\frac{t}{2}+1)}$.

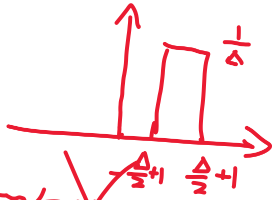


→ 



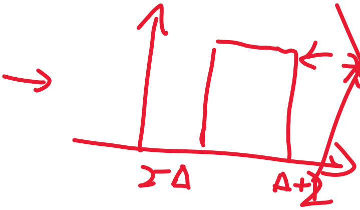


$\delta(-\frac{1}{2}t-1)$



平移一致+

$\delta(at)=\frac{1}{|a|}\delta(t)$



~~积分为1，变成 $\frac{1}{2\Delta}$~~

$\int_{-\infty}^{+\infty}\delta(at)\,dt$

$= \frac{1}{|a|}\boxed{\int_{-\infty}^{+\infty}\delta(at)\,d\,at} = \int_{-\infty}^{+\infty}\delta(t)\,dt$

$\therefore\ \delta$

$\therefore\ \delta(at)=\delta(t)\cdot\frac{1}{|a|}$

2-3-4. $y_{zi}(t)=Ae^{-2t}+Be^{-5t}$，

松弛 不存在 $y(0_-)$ $y'(0_-)$

$f'(t)=-e^{-t}u(t)+e^{-t}\delta(t)=-e^{-t}u(t)+\delta(t)$

① 变域 $(s^2+7s+10)Y(s)=2sF(s)-F(s)$

$F(s)=\frac{1}{s+1}$，$Y(s)=\frac{2s-1}{s+1}\Big/(s+2)(s+5)$

$=\frac{2s+2-3}{s+1}\Big/(s+2)(s+5)=\cancel{2-\frac{3}{s+1}\Big/(s+2)(s+5)}$

$=\cancel{\frac{2}{3}\left(\frac{1}{s+2}-\frac{1}{s+5}\right)-3\left(\frac{\frac{1}{4}}{s+1}+\frac{-\frac{1}{3}}{s+2}+\frac{\frac{1}{12}}{s+5}\right)}$ 不会就别用

$Y(s)=-\frac{3}{4}\frac{1}{s+1}+\frac{5}{3}\frac{1}{s+2}-\frac{7}{12}\frac{1}{s+5}$

$y(t) = \left(-\frac{3}{4}e^{-t} + \frac{5}{3}e^{-2t} - \frac{7}{12}e^{-5t}\right)u(t)$

$y(0_+) = -\frac{3}{4} + \frac{5}{3} - \frac{7}{12} = -\frac{16}{12} + \frac{5}{3} = \frac{1}{3}$.

$y'(t) =$

$y''(t) = A\delta(t) + Bu(t)$

$y'(t) = \cancel{Au(t)} \Rightarrow A\delta(t) + \boxed{Bu(t)\ (Au(t)} + 10\cancel{Atu(t)}) = 2e^{-t}u(t) + 2\delta(t) - e^{-t}u(t)$

有跳

$y(t) = Atu(t)$ 无跳

$A = 2$

2-3-5 $g(t) = u(t) * h(t) = u(t) - u(t-2)$

(1) $h(t) = \delta(t) + (-\delta(t-2))$

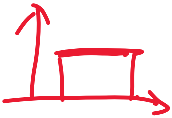
(2) $f(t) = \int_{-\infty}^{+\infty} f(\tau)\, u(\cancel{(t-1)-\tau})\, u(\cancel{(t-5)-\tau})\, d\tau$ $(\tau-(t-5))$ $(t-\tau-1)$ 不可能同号!!!

$= \int_{-\infty}^{+\infty} f(\tau)\, u(t-\tau-1)\, u(t-\tau-5)\, d\tau$.

$= f(t) * u(\cancel{t-1})\cancel{u(t-5)}$ $1-t$

搞错

$u(t-1)u(5-t)$



$= u(t-1) - u(t-5)$

时刻的阶跃

2-3-6 (1) $y(t)=\int_{-\infty}^{t} e^{-2(t-\tau)}x(\tau-3)\,d\tau.$

$$=\int_{-\infty}^{+\infty} e^{-2(t-\tau)}u(t-\tau)\,x(\tau-3)\,d\tau.$$

$\tau'=\tau-3.\Rightarrow \int_{-\infty}^{+\infty} e^{-2(t-3-\tau')}u(t-3-\tau')\,x(\tau')\,d\tau'$

$\therefore\ y(t)=x(t)*e^{-2t}u(t)*\delta(t-3)$

$\therefore\ h(t)=e^{-2t}u(t)*\delta(t-3)$

(2) $x(t)=u(t)$

$y(t)=e^{-0t}u(t)*e^{-2t}u(t)*\delta(t-3)$

$$\Rightarrow\left[\frac{1}{j\omega}+\pi\delta(\omega)\right]\frac{1}{j\omega+2}$$

$$\rightarrow \frac{1}{2}\left(\frac{1}{j\omega}-\frac{1}{j\omega+2}\right)+\frac{\pi}{2}\delta(\omega)$$

$$\xrightarrow{\mathcal{F}^{-1}} \frac{1-e^{-2t}}{2}u(t)*\delta(t-3)$$

$$=\frac{1-e^{-2(t-3)}}{2}u(t-3)$$

2-3-7

$$g(t)=h(t)*u(t)=\delta(t)-\delta(t-3)$$

$$x(t)=\frac{1}{\pi t}$$

$$y(t)=\frac{1}{\pi t}[\delta(t)-\delta(t-3)]$$

$$=\frac{1}{\pi t}-\frac{1}{\pi(t-3)}$$

-1分

2-3-8.

$$H\left[\frac{de(t)}{dt}\right]=\underbrace{e(t)*h(t)}_{r(t)}*\delta'(t)$$

$$r'(t)+3r(t)=e^{-t}u(t)$$

$$\because\quad (j\omega+3)R(j\omega)=\frac{1}{j\omega+1}$$

$$R(j\omega)=\frac{1}{j\omega+3\quad j\omega+1}$$

$$=\frac{1}{2}\left(\frac{1}{j\omega+1}-\frac{1}{j\omega+3}\right)$$

$$r(t)=(e^{-t}-e^{-3t})u(t)$$

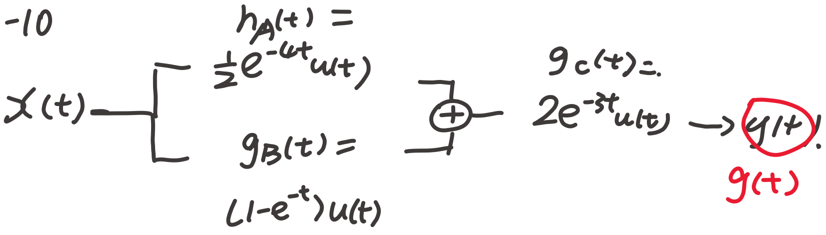
$$R(j\omega)=E(j\omega)\ H(j\omega).$$

$$E(j\omega)=2\cdot\frac{1}{j\omega+3}$$

$$H(j\omega)=\frac{R(j\omega)}{E(j\omega)}=\frac{\frac{1}{(j\omega+3)(j\omega+1)}}{2\frac{1}{j\omega+3}}=\frac{1}{2(j\omega+1)}$$

$$h(t)=\frac{1}{2}\cdot e^{-t}u(t).$$

2-3-10



$$g(t) = u(t) * \left[\tfrac{1}{2}e^{-4t}u(t) + h_B(t)\right] * h_C(t).$$

$$= \frac{1}{2}\left(\left[\frac{1-e^{-4t}}{4}u(t) + (1-e^{-t})u(t)\right] * h_C(t)\right.$$

$$\Rightarrow g_C(t) * \left[\tfrac{1}{2}e^{-4t}u(t) + h_B(t)\right]$$

$$2e^{-3t}u(t) * \left[\tfrac{1}{2}e^{-4t}u(t) + h_B(t)\right]$$

$$(1-e^{-t})u(t) = u(t) * h_B(t)$$

系统可调序

$$h_B(t) = e^{-t}u(t)$$

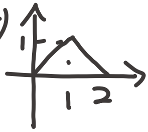
$$2e^{-3t}u(t) * \left(\tfrac{1}{2}e^{-4t}u(t) + e^{-t}u(t)\right)$$

$$\left[e^{-3t} - e^{-4t} + 2\,\frac{e^{-t}-e^{-3t}}{2}\right]u(t)$$

$$(e^{-t} - e^{-4t})\,u(t).$$

提供图像的反卷积问题

$y_{zs}(t)$



$x(t)\cdot \sin t\, u(t)$

求 $h(t)$

吸收本题可采用的时域方法

补基础·

$$y''(t)+5y'(t)+4y(t)=x(t).$$

$x(t)=5e^{-3t}u(t)$. $y(0_-)=0$ $y'(0_-)=1$

用时域经典法求 $y(t)$

$$y(t)=\underbrace{y_h(t)}_{\text{齐次}}+\underbrace{y_p(t)}_{\text{特}}$$

① 特解·与输入形式联系. $y_p(t)=Ce^{-3t}$

$\therefore 9Ce^{-3t}+5\cdot(-3C)e^{-3t}+4Ce^{-3t}=5e^{-3t}u(t)$

$\therefore 9C-15C+4C=5 \quad C=-\frac{5}{2}$

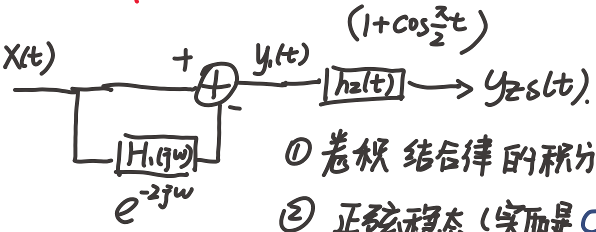
$\therefore y_p(t)=-\frac{5}{2}e^{-3t}$

② 齐次 $y(t)=Ae^{-t}+Be^{-4t}-\frac{5}{2}e^{-3t}$

代入 $y(0_+)=0$ $y'(0_-)=y'(0_+)=0$

$$\begin{cases} A+B-\frac{5}{2}=0 \\ -A-4B+\frac{15}{2}=1 \end{cases} \Rightarrow \begin{cases} B=\frac{4}{3} \\ A=\frac{7}{6} \end{cases}$$

☆ 从现在开始，例题会穿插后续章节（南邮2003）



① 卷积结合律的积分存在

② 正弦稳态（实质是Chapter6 频率响应）