1-2-25 $f(t) = 1 + \cdots = \sum a_k e^{jk\pi t}$

$\xRightarrow{FS}$ 其中 $a_k = (\frac{1}{2})^n$.

1次谐波 $e^{j\pi t}$. $T = \frac{2\pi}{w} = 2$

(2) $f(-t) = f(t)$ 偶函. (全是 $\cos(t)$)

(3) 变换域.

$$(jw)^2 \cdot X(jw) + w_0^2 X(jw) = f(t)$$

π^2

$$f(t) \xrightarrow{FS} \sum_{k=-\infty}^{\infty} (\frac{1}{2})^{|k|} 2\pi \delta(w - k\pi)$$

须收敛 $(\frac{1}{2})^{|k|}$ 无误!

$$X(jw) = \frac{\sum (\frac{1}{2})^k 2\pi \delta(w - k\pi)}{(\pi)^2 + (jw)^2}$$

其实快做出了

$$X(jw) = \sum (\frac{1}{2})^n \frac{2\pi}{\pi^2 - (k\pi)^2}.$$

w_0 不能动它

$$= \sum (\frac{1}{2})^n \frac{2\pi}{}$$

$$X(jw) = 2\pi \sum^{+\infty} (\frac{1}{2})^{|k|} \cdot \frac{1}{(jw)^2 + w_0^2} \cdot \delta(w - k\pi)$$

$$\xrightarrow{\mathcal{F}^{-1}} \sum \frac{(\frac{1}{2})^k}{(jk\pi)^2 + w_0^2} e^{jk\pi t}$$

1-2-2. $\int_{-\infty}^{+\infty} \sin(\pi t)\,\delta(2t-1)\,dt$

令 $t'=2t$ $\int_{-\infty}^{+\infty} \sin(\pi \frac{t'}{2})\,\delta(t'-1)\,d\frac{t'}{2}$ 的

$$= \frac{1}{2}\int_{-\infty}^{+\infty} \sin(\pi \frac{t'}{2})\,\delta(t'-1)\,dt'$$

$$= \frac{1}{2} \sin \pi \frac{1}{2} = \frac{1}{2}.$$

1-2-5 $t'=3t$

$$= \int_{-\infty}^{+\infty} \cos(\pi t')\,\delta(t'-1)\,d\frac{t'}{3}$$

$$= \frac{1}{3}\int_{-\infty}^{+\infty} \cos \pi t'\,\delta(t'-1)\,dt'$$

$$= \frac{1}{3}\cdot \cos \pi = -\frac{1}{3}$$

1-2-6 $t'=2t$

$$\int_{-\infty}^{+\infty} 2((\frac{t'}{2})^2-2)\,\delta(t'-4)\,d\frac{t'}{2}$$

$$= \int_{-\infty}^{+\infty} (\frac{t'^2}{4}-2)\,\delta(t'-4)\,dt'$$

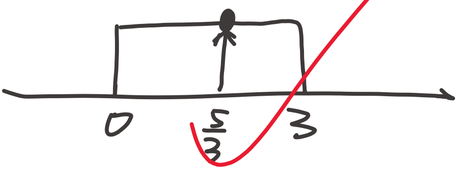
$$= 4. -2. = 2$$

1-2-7 $\quad t' = 3t$

$$\therefore = \frac{1}{3}\int_0^9 \left[u\left(\frac{t'}{3}\right) - u\left(\frac{t'}{3}-3\right)\right] \delta(t'-5)\,dt'$$

$$= \frac{1}{3}$$

$u(t) - u(t-3) \quad \cdot \quad \delta(3t-5)$



1-2-8.

1-2-12 $f(5t-3)=2\delta(3-t)$

$f(t-3)=2\delta(3-\frac{1}{5}t)$

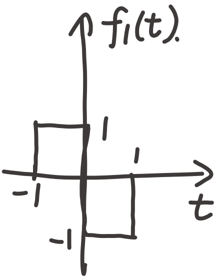
$f(t)=2\delta(3-\frac{t+3}{5})$

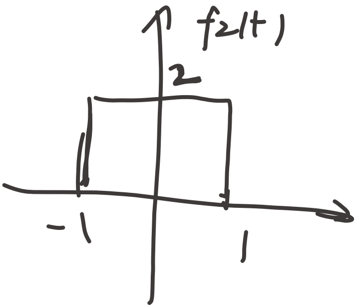
$=2\delta(\frac{12}{5}-\frac{1}{5}t)$

$\int_0^{+\infty} f(t)dt=\int_0^{+\infty}2\delta(\frac{12}{5}-\frac{1}{5}t)=10$

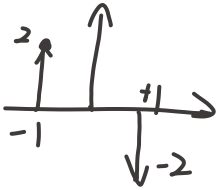
1-2-13

1-2-35





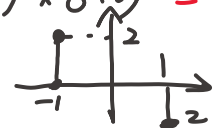
$f_2(t)*\delta'(t)=$



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

$f_1(t)*f_2(t)*\delta'(t)=\underline{2f_1(t+1)-2f_1(t-1)}$

$=$



不要混淆卷积与相乘!!

1 15 重做 $\int_{-\infty}^{+\infty}(t^2+2)[\delta'(t-1)+\delta(t-1)]dt$

$[(t^2+2)\delta(t-1)]' = \underline{(t^2+2)\delta'(t-1)} + 2t\delta(t-1)$

$(t^2+2)\delta'(t-1) = 3\delta'(t-1) - 2\delta(t-1)$.

且 $(t^2+2)\delta(t-1) = 3\delta(t-1)$

$\therefore = \int_{-\infty}^{+\infty} 3\delta'(t-1) + \delta(t-1)dt$

$= 3\delta(\cancel{t}) + 5 = \boxed{0+1}$.

1 14 重做

$e^{-2\tau}\delta'(\tau) = [e^{-2\tau}\delta(t)]' - (e^{-2\tau})'\delta(t)$

$= \delta'(t) - (-2)e^{-2\tau}d(\tau)$

$= \delta'(t) + 2e^{-2\tau}d(\tau) = \delta'(t) + 2\delta(\tau)$.

$\therefore e^{-2\tau}\delta(\tau) = +1\delta(t)$

$\therefore$ 原 $= \int_{-\infty}^{t} \delta'(t) + 2\delta(\tau) - \delta(\tau)\, d\tau$

$= \delta(t) + u(t)$ (定上限积分)

1 13 $\delta'(\frac{1}{6}-t) = -\delta'(t-\frac{1}{6})$ 冲激偶为奇

$$\int_{-5}^{5} -\delta'(t-\tfrac{1}{6})\cos(2\pi t)\,dt$$

$$= -\int_{-5}^{5} \left[\cos 2\pi t\,\delta(t-\tfrac{1}{6})\right]' - \delta(t-\tfrac{1}{6})(-\sin 2\pi t)\,2\pi\,dt$$

$$= -\int_{-5}^{5} \left(\tfrac{\sqrt{3}}{2}\delta'(t-\tfrac{1}{6})\,dt + \tfrac{\sqrt{3}}{2}2\pi\right.$$

$$= \cancel{-\int_{-5}^{5} \pi\,dt}\ 0 - \sqrt{3}\pi$$

1-2-36 $f_2(t) = \delta(t+2) - \delta(t-2)$

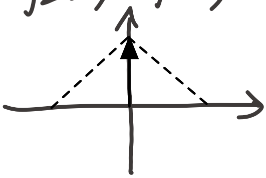
$f_2(t) * f_2(t) = [\delta(t+2) - \delta(t-2)] * [\delta(t+2) - \delta(t-2)]$

$= \delta(t+4) - \delta(t) - \delta(t) + \delta(t-4)$

$= \underline{\delta(t+4) - 2\delta(t) + \delta(t-4)}$ ✓

你又不对了

$\therefore f_1(t) * f_2(t) * f_2(t) = -2\delta(t) * f_1(t)$ (其他无)

$=$  $= -2 f_1(t)$ 同下反.

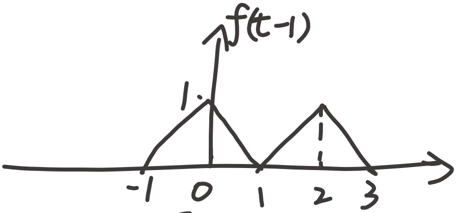
卷积而不是筛选.

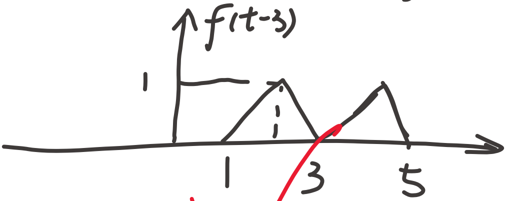
$= f_1(t+4) - 2f_1(t) + f_1(t-4)$

1-2-37

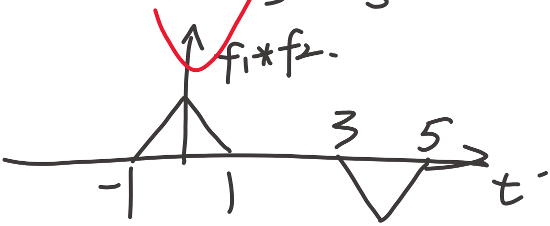
$f_2(t) = \delta(t-1) - \delta(t-3)$

$f_1 * f_2 =$





$f_1 * f_2 =$



1-3-1 $\lim\limits_{T\to\infty}\int_{-T}^{T}\frac{1}{w_1}d\sin w_1 t$

$= \lim\limits_{T\to\infty}\frac{1}{w_1}\sin w_1 t\Big|_{-T}^{T}$ ✗

$\cos w_1 t = \frac{1}{2}(e^{jw_1 t}+e^{-jw_1 t})$

$\because\ a_0 = \lim\limits_{T\to\infty}\frac{1}{2T}\int_{-\frac{T}{2}}^{\frac{T}{2}}(e^{jw_1 t}+e^{-jw_1 t})dt$

$= \lim\limits_{T\to\infty}\frac{1}{T}\int_{-T}^{T}\cos w_1 t\,dt$

$= 0$

1-~~3~~-2 $\cancel{a_0} = 0$

其实对直流分量，有2种理解，

① 函数在整个时间轴的积分

② 周期复指数信号0次谐波之系数。

1-3.2. 分量 $\int_{-\infty}^{+\infty}x(t)dt = \int_{0}^{+\infty}\sin t\,dt$ ✗，

$\lim\limits_{T\to\infty}\frac{1}{2T}\int_{-T}^{T}f(t)\,dt$ 是对一个非周期信号的直流分量

$= \lim\limits_{T\to\infty}\frac{1}{2T}\int_{0}^{T}\sin t\,dt = 0$

$$\underline{\lim_{T\to\infty}\frac{1}{2T}\int_{-T}^{T}\sin^2 t\,dt} = \lim_{T\to\infty}\frac{1}{2T}\int_{0}^{T}\frac{1-\cos 2t}{2}\,dt$$

$$= \lim_{T\to\infty}\frac{1}{2T}\cdot\frac{T}{2} = \frac{1}{4}.$$

1-3-3 $f(t) = |\sin(\Omega t)|$

分量 $\lim_{T\to\infty}\frac{1}{2T}\int_{-T}^{T}|\sin(\Omega t)|\,dt.$

$$= \lim_{T\to\infty}\frac{1}{T}\int_{0}^{T}|\sin\Omega t|\,dt$$

又 $\because T = \frac{1}{2}\cdot\frac{2\pi}{\Omega} = \frac{\pi}{\Omega}.$

对一个周期信号

$$a_0 = \frac{\Omega}{\pi}\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}}|\sin(\Omega t)|\,dt$$

$$= \frac{\Omega}{\pi}\int_{0}^{\frac{\pi}{\Omega}}|\sin\Omega t|\,dt$$

$$= \frac{\Omega}{\pi}\int_{0}^{\frac{\pi}{\Omega}}\sin\Omega t\,dt = -\cancel{}\cdot\cos\Omega t\Big|_{0}^{\frac{\pi}{\Omega}}.$$

$$= \frac{2\Omega}{\pi\Omega} + \cancel{} = \frac{2}{\pi}$$

1-3-4 $x(t) = |\cos 2t|$

$$T = \frac{1}{2}\cdot\frac{2\pi}{2} = \frac{\pi}{2}$$

$$\frac{2}{\pi}\int_{-\frac{T}{2}}^{\frac{T}{2}} |\cos 2t|\,dt = \frac{2}{\pi}\int_{0}^{\frac{\pi}{2}} |\cos 2t|\,dt$$

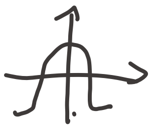
$$= \frac{2}{\pi}\int_0^{\frac{\pi}{4}} \cos 2t\,dt - \frac{2}{\pi}\int_{\frac{\pi}{4}}^{\frac{\pi}{2}} \cos 2t\,dt$$

$$= \frac{1}{\pi}\sin 2t\Big|_0^{\frac{\pi}{4}} - \frac{2}{\pi}\cdot\frac{1}{2}\sin 2t\Big|_{\frac{\pi}{4}}^{\frac{\pi}{2}}$$

$$= \frac{1}{\pi} - \frac{1}{\pi}(0-1) = \frac{2}{\pi}$$

1-3-5 $f(t) = \frac{1-\cos 2\omega_0 t}{2}$ 周期 $T = \frac{2\pi}{2\omega_0} = \frac{\pi}{\omega_0}$

$$a_0 = \frac{\omega_0}{\pi}\int_{-\frac{T}{2}}^{\frac{T}{2}} \frac{1-\cos 2\omega_0 t}{2}\,dt$$



$$= \frac{\omega_0}{\pi}\cdot\frac{1}{2}\cdot\frac{\pi}{\omega_0} - \frac{\omega_0}{\pi}\int_0^{\frac{T}{2}} \cos(2\omega_0 t)\,dt$$

$$= \frac{1}{2}\ \cancel{1} - \frac{\omega_0}{\pi}\cdot\frac{1}{2}\sin 2\omega_0 t\Big|_0^{\frac{\pi}{2}}$$

$$= \frac{1}{2}\ \cancel{1} - \frac{\omega_0}{\pi}\cdot\frac{1}{2}\left(\sin 2\omega_0\cdot\frac{\pi}{2\omega_0} - 0\right)$$

$$= \cancel{1}\ \frac{1}{2} - \frac{\omega_0}{2\pi}\cdot 0 = 1$$

你很努力，也很幼稚

直流分量即 $\boxed{\frac{1}{2}}$.

1-3-8,

$$u_c(t) = e(t) - r(t)$$

$$i_c(t) = \frac{d[e(t)-r(t)]}{dt}$$

$$i_c(t) = e'(t) - r'(t)$$

$$\frac{r(t)}{2} = e'(t) - r'(t)$$

同样.电路微分方程来解是正确的
但计算是没必要的.

$$\therefore r'(t) + \frac{r(t)}{2} = e'(t)$$

$$SR(s) + \frac{1}{2}R(s) = SE(s)$$

$$H(s) = \frac{2S}{2S+1}$$

$$R_{zs}(S) = \frac{2j\omega}{2j\omega+1} \cdot \left\{ 2\pi\delta(\omega) + \pi[\delta(\omega+2) + \delta(\omega-2)] \right\}$$

$$= 0 + \frac{-4j\pi}{-4j+1} + \frac{4j\pi}{4j+1}$$

$$r_{zs}(t) = x(t) * h(t)$$

$$= H(0) \cdot a_0 + H(j2) \cdot e^{j2t} + H(j-2)\, e^{j-2t}$$

$\boxed{\text{咱只要 } H(0) = 0.}$

1-3-9 基波分量的概念．±1次谐波．

$x(t)=\sum a_k e^{jkt}$ $w_0=1$

书P117有提到．不可以脱离概念

$\frac{1}{T}\int_{-\infty}^{+\infty}|x(t)|^2dt$

回顾一下PSWE（周期FS）

$\lim_{T\to\infty}\frac{1}{2T}\int_{-T}^{T}|x(t)|^2dt=\sum|a_k|^2.$

$=4+4+1+1+1=11$

2次分量 $\bar{P}=$ $a_{(-2)}^2+|a_2|^2=2.$

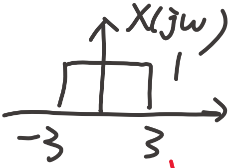
1-3-10 $f=5KHz$ $w=2\pi f=10k\pi\ Hz$

$T=\frac{1}{5k}s.$

$x(t)=\sum a_n e^{jn(10k\pi)t}$

1-4-1.

1-4-2 $x(t) \xrightarrow{\mathcal{F}}$



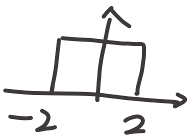
$$E = \int_{-\infty}^{+\infty} |X(t)|^2 dt = \frac{1}{2\pi}\int_{-3}^{3} 1 \, d\omega$$

$$= \frac{3}{\pi}$$

1-4-3. 这就是调制

$$f(t) = \boxed{2\pi} \frac{\sin 2t}{\pi t} \cdot \cos 10^3 t$$

$\xrightarrow{\mathcal{F}}$



$$* \, \pi[\delta(\omega-10^3)+\delta(\omega+10^3)]$$

=

$$E = \frac{1}{2\pi}\int_{-\infty}^{+\infty} |X(j\omega)|^2 d\omega$$

$$= \frac{1}{2\pi}\int_{-1002}^{-998} \pi^2 d\omega + \frac{1}{2\pi}\int_{998}^{1002} \pi^2 d\omega.$$

$$= \frac{\pi}{2} \cdot 4 + \frac{\pi}{2} 4 = 4\pi \ (J)$$

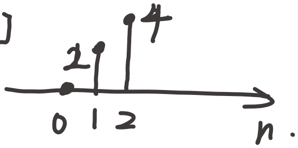
1-4-5 (1)

$x_1[n]$

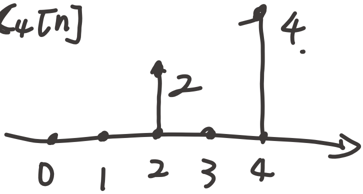
不会有5?

$x_2[n]$

$x_3[n]$



$x_4[n]$



$x_2[n]$: $E = \cancel{\frac{1}{2\pi}\left(1^2+2^2+3^2+4^2+5^2\right)}$

$= \frac{1}{2\pi} \cancel{30}$ 3

没必要用频域，但得记频域

$$\sum |x[n]|^2 = \frac{1}{2\pi}\int_{2\pi} |X(e^{j\omega})|^2 d\omega$$

因为 $\sum_{-\infty}^{+\infty} |x[n]|^2 = \sum x[n]\, x^*[n]$

$$= \sum x[n] \cdot \frac{1}{2\pi}\int_{2\pi} X^*(e^{j\omega}) e^{-j\omega n} d\omega$$

$$= \frac{1}{2\pi}\int_{2\pi} \sum x[n]\, e^{-j\omega n}\, X^*(e^{j\omega})\, d\omega$$

$$= \frac{1}{2\pi}\int_{2\pi} |X(e^{j\omega})|^2 d\omega$$

1-4-6

E. $\boxed{\int_{0}^{+\infty}(e^{-2t}+1)dt}$ 不是.

1-4-8 $e^{j\frac{\pi}{2}}=j=\cos\frac{\pi}{2}+j\sin\frac{\pi}{2}$

$\therefore P=\lim_{T\to\infty}\frac{1}{2T}\int_{-\infty}^{T}|e^{j\frac{t}{2}}|^2dt$

$=\lim_{T\to\infty}\frac{1}{2T}\int_{-T}^{T}1dt=1$

$x[n]=e^{j\frac{2\pi}{3}n}+e^{j\frac{5}{6}\pi n}$

周期 $N_1=\frac{2\pi}{\frac{2\pi}{3}}=3$ $N_2=\frac{2\pi}{\frac{5}{6}\pi}=\frac{12}{5}$.

$\therefore$ 为 $N=12$. 1次谐波频率 $w_0=\frac{\pi}{6}$.

$\therefore P_\infty=\frac{1}{24}\sum_{-\infty}^{\infty}|x[n]|^2=\frac{1}{24}\frac{1}{2\pi}\int_{2\pi}|X(e^{jw})|^2dw$

$\frac{1}{2N+1}$

$=\frac{1}{48\pi}\left(\frac{4}{9}\pi^2+\frac{25}{36}\pi^2\right)$.

$\frac{1}{2N+1}\sum_{-\infty}^{+\infty}[x[n]]^2=\frac{1}{25}\sum_{-\infty}^{+\infty}\underbrace{\left(e^{j\frac{4}{3}\pi n}+2e^{j\frac{3}{2}\pi n}+e^{j\frac{5}{3}\pi n}\right)}_{dt}$

X

这题2个解法:

① 只有 +4次与 +5次谐波分量. 系数为1

$$\therefore \sum |a_k|^2 = \frac{1}{2N+1}\sum_{-N}^{N} |x[n]|^2 = 2 = P_\infty$$

② 从直接计算.

$$\frac{1}{2N+1}\sum_{-N}^{N} |x[n]|^2 = \frac{1}{25}\sum_{-N}^{N} \left|e^{j\frac{2}{3}t} + e^{j\frac{5}{6}t}\right|^2$$

$$\because |a+b|^2 = (a+b)(a+b)^* = |a|^2 + |b|^2 + ab^* + a^*b$$

$$= 1 + 1 + ab^* + a^*b$$

$$= 2 + ab^* + (ab^*)^* = 2 + 2\mathrm{Re}(ab^*)$$

$$= 2 + 2\mathrm{Re}\left(e^{-j\frac{1}{6}\pi n}\right)$$

$$= \underbrace{2 + 2\cos\frac{1}{6}\pi n}$$

→ 无功率

↓

功率2 最后: $\frac{1}{25} \cdot 2 \times 25 = 2$

1-5-1 时变.

① 先时变 后系统.

$x_2(t) = x_1(t-t_0)$ $\quad y_2(t) = x_1(4t-t_0)$.

② 先系统后时变

$y_2(t-t_0) = x_1(4t-4t_0) \neq x_1(4t-t_0)$

∴ 时变的.

1-5-2. 记忆 因果.

$y(-2) = -2x(-1)$. 取决于未来.

无记忆性: 需要只取决当前.

$\underline{y(t) = x(t)}$ $\quad y(1)=x(1)$ $\quad y(2)=x(2)$.

而因果可取决于以前 $\quad y(1)=x(0)$ ..

① 时变性:

$x_1 = x(t-t_0) \xrightarrow{S} y_1(t) = t\,x(\frac{t}{2}-t_0)$.

$y_1(t-t_0) = (t-t_0)\,x(\frac{t-t_0}{2}) \neq t\,x(\frac{t}{2}-t_0)$ 时变

② 线性.

① 1) $x_3(t) = a x_2(t) + b x_1(t)$.

$y_3(t) = at x_2(\frac{t}{2}) + bt x_1(\frac{t}{2})$

$a y_2(t) + b y_1(t) = at x_2(\frac{t}{2}) + bt x_1(\frac{t}{2})$. 线的

③ 稳定 $x(t)=1 \Rightarrow y(t)=t$.

稳定：$|x(t)| \le M \rightarrow |y(t)| \le M$?

$y(t)$ 能否为有限

注 若 LTI. 可分析 $h(t)$ 的稳定性

$$\int_{-\infty}^{+\infty} |h(\tau)| d\tau$$

1-5-3

① $f_1(t-t_0) \xrightarrow{\delta} y_1(t) = e^{-4t} f_1(t-t_0)$

② $y(t-t_0) = e^{-4(t-t_0)} f(t-t_0)$

1-5-4 非因果

① 先线性后系统 $x_3(t)=a x_2(t)+b x_1(t)$

1) $y_3(t) = a x_2(1-t) + b x_1(1-t)$

② 先系统后线性

a $y_1(t) + a y_2(t) = b x_1(1-t) + a x_2(1-t) = y_3(t)$.

线性

2) ④ $x(t-t_0) \xrightarrow{S} x(1-t-t_0)$

$y(t-t_0) = x(1-t+t_0)$ } 时变.

1-5-6 $y(t) = |x(t)|$.

$ax_1(t)+bx_2(t) \xrightarrow{S} |ax_1(t)+bx_2(t)|$ } 线性

$\cdot \| ?$

$ay_1(t)+by_2(t) = a|x_1(t)|+b|x_2(t)|$.

$y(t) = |x(t)|$

$x(t-t_0) \xrightarrow{S} |x(t-t_0)|$ -

$y(t-t_0) = |x(t-t_0)|$ 时不变的

所以绝对值并不能成为

1-5-8 ① 线性

$x_3[n] = a x_1[n] + b x_2[n]$

$\xrightarrow{S} y_3[n] = a x_1[|n|] + b x_2[|n|]$

$a y_1[n] + b y_2[n] = a x_1[|n|] + b x_2[|n|]$ 线性.

② 时不变.

只对n绝对

$x[|n|-n_0]$

$x[n-n_0] \xrightarrow{S} x[|n\cancel{-}n_0|]$

$y[n-n_0] \xrightarrow{S} x[|n-n_0|]$. } 时变.

绝对值. 一般不可能是LTI 原因

是线 or 时不变 都可以不满足

1-5-9. 积分器显然LTI $u(t) * f(t)$.

1-5-41 $y(t)=\begin{cases}1 & f(t)>0\\ 0 & f(t)\leq 0\end{cases}$

其实写成 $y(t)=u[f(t)]$

① 时变性.

$f(t-t_0) \xrightarrow{S} u[f(t-t_0)]$

$y(t-t_0) = u[f(t-t_0)]$

② 线性

$a_1f_1(t)+b_1f_1(t) \xrightarrow{S} u[af_1(t)+bf_2(t)]$

$ay_1(t)+by_2(t) = a\cdot u[f_1(t)]+bu[f_2(t)]$

1-5-29 可逆是什么?

① $e(t-t_0) \xrightarrow{S} e^2(t-t_0)$

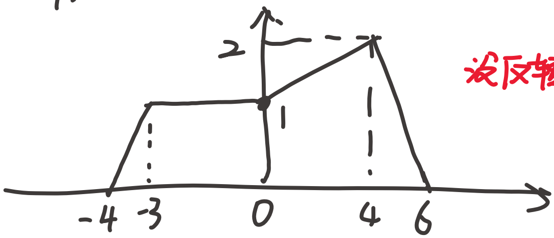
$r(t-t_0) = e^2(t-t_0)$ } 时不变.

②. 可逆: 一输出对一输出.

你说的对的

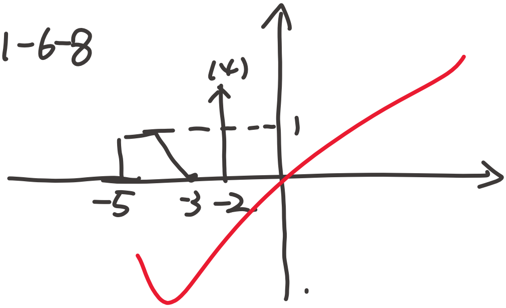
$r(t)=e^2(t)$ 反过来 $\pm\sqrt{r(t)}$

1-6-7.

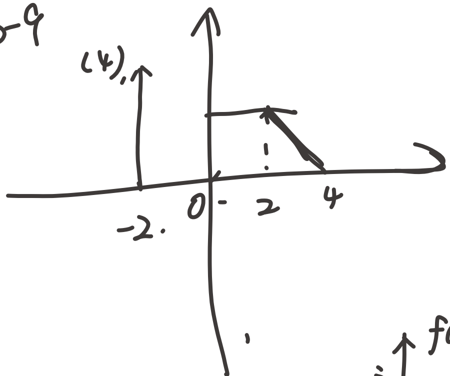


没反转诶

1-6-8

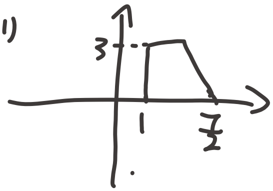


1-6-9

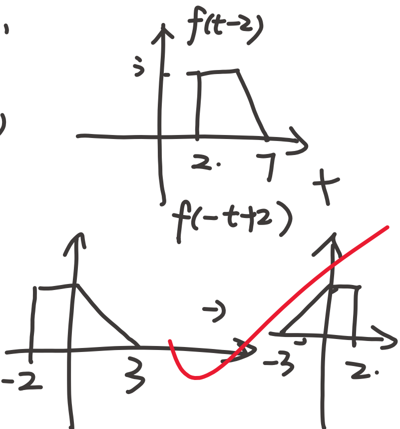


1-6-15

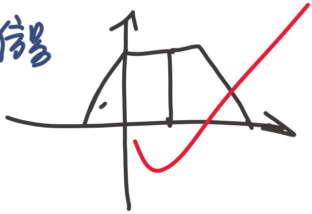
(1)



(2)



说是偶信号



1-6-18 $x(t)=e^{-t}u(t)$.

原 $= \delta'(t) * x(2t) * x(3t)$

$= \delta'(t) * e^{-2t}u(2t) * e^{-3t}u(3t)$

$= [-2e^{-2t}u(2t) + e^{-2t}\delta(2t)] * e^{-3t}u(3t)$

$= \{[-2e^{-2t}u(2t)] + \delta(t)\} * e^{-3t}u(3t)$

$= -2e^{-2t}u(2t) * e^{-3t}u(3t) + e^{-3t}u(3t)$

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

不如直接变换域

$x(t) \xrightarrow{\mathcal{F}} \frac{1}{j\omega+1}$ $\quad x(2t) \xrightarrow{\mathcal{F}} \frac{1}{2}\frac{1}{j\frac{\omega}{2}+1}$

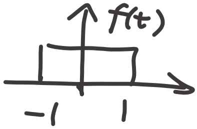
$x(3t) \xrightarrow{\mathcal{F}} \frac{1}{3}\frac{1}{j\frac{\omega}{3}+1}$

1-1-16

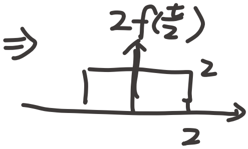
能量、功率的尺度+反转

$f(t)$ $\begin{cases} \text{能量信号 } W & \text{求 } 2f(\frac{t}{2}) \text{ 能量 } W_2 \\ \text{功率信号 } P & \text{求 } 3f(-3t) \text{ 功率 } P_2 \end{cases}$

$W_2 = 8W$ 例如



$\Rightarrow$



$$W_2 = \int_{-2}^{2} |2f(\tfrac{t}{2})|^2 dt$$
$$= 4\int_{-2}^{2} |f(\tfrac{t}{2})|^2 dt$$
$$= 4\int_{-2}^{2} \cdot 2 \cdot |f(\tfrac{t}{2})|^2 d\tfrac{t}{2}$$
换元
$$= 8\int_{-2}^{2} |f(t)|^2 dt$$
$$= 8W$$

$P_2 = 9P$. 例如

对 $\cos t$ 信号

$$P = \frac{1}{2\pi}\int_{-\pi}^{\pi} |\cos t|^2 dt = \frac{1}{2\pi}\int_{-\pi}^{\pi} \frac{1+\cos 2t}{2} dt$$
$$= \frac{1}{2\pi}\left(\pi + \frac{1}{4}\sin 2t \Big|_{-\pi}^{\pi}\right)$$
$$= \frac{1}{2}$$

$\Rightarrow$ 对 $3\cos(-3t) = 3\cos 3t$ 不用管 $\omega_0 = 1$ 或 3.

$$P_2 = \frac{A^2}{2} = \frac{9}{2} = 9P$$

$f(t) \to T$

$f(3t) \to \frac{T}{3}$

因为

$f(3t+T) = f(3t)$

$f(3(t+\frac{1}{3}T)) = f(3t)$