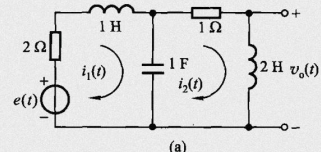
HW1: 2-1(a), 2-4(1), 2-7

HW2: 卷积 2-13(2)(3) , 2-14,
2-15(1)(3), 2-18(a)(c) , 2-20

信号作业2

2－1 对题图2－1所示电路图分别列写求电压 $v_o(t)$ 的微分方程表示。



$i_L(t) = \frac{1}{L_2}\int_{-\infty}^{t} v_0(\tau)\,d\tau$ $\quad i_C(t) = i_1(t) - i_2(t)$.

$u_C(t) = v_0(t) + i_2(t)$.

$L_1 \frac{d}{dt} i_1(t) = e(t) - 2i_1(t) - v_0(t) - i_L(t)$.

2－4 已知系统相应的齐次方程及其对应的0₊状态条件，求系统的零输入响应。

(1) $\frac{d^2}{dt^2}r(t) + 2\frac{d}{dt}r(t) + 2r(t) = 0$ 给定：$r(0_+) = 1, r'(0_+) = 2$

$r^2 + 2r + 2 = 0$.

$r_1 = -1 - i, \quad r_2 = -1 + i$

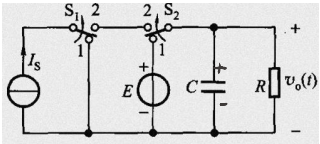
$\therefore r(t) = e^{-t}(C_1 \cos t + C_2 \sin t) \quad r(0) = C_1 = 1.$

$r'(t) = e^{-t}(-\sin t + C_2 \cos t - \cos t - C_2 \sin t)$

$r'(0) = C_2 - 1 = 2. \quad C_2 = 3.$

$\therefore r(t) = e^{-t}(\cos t + 3\sin t)$

2-7



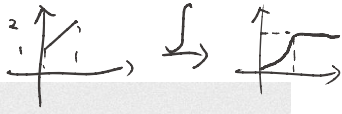
题图 2-7

零输入：$U_o(t) = RC\frac{dU_c}{dt}$

$U_c(0) = E$

零状态：$V_o(t) = I_S R$

$\frac{1}{2}t^2+t$



2-1 (2) $f_1(t) = \delta(t), f_2(t) = \cos(\omega t + 45°)$

(3) $f_1(t) = (1+t)[u(t) - u(t-1)], f_2(t) = u(t-1) - u(t-2)$

(2) $f_1 * f_2 = f_2 = \cos(\omega t + 45°)$ （性质）.

(3) $f_1 * f_2 = f_1 * u(t-1) - f_1 * u(t-2)$

$= \int_{-\infty}^{t-1} f_1(\tau)d\tau - \int_{-\infty}^{t-2} f_1(\tau)d\tau$

$= \int_{t-2}^{t-1} f_1(\tau)d\tau$

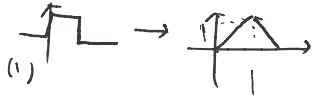
$= \int_{t-2}^{t-1} (1+\tau)u(\tau)d\tau - \int_{t-2}^{t-1} (1+\tau)u(t-1)d\tau$

$= \left(\frac{1}{2}\tau^2+\tau\right)u(\tau)\Big|_{t-2}^{t-1} - \left(\frac{1}{2}\tau^2+\tau-\frac{3}{2}\right)u(\tau-1)\Big|_{t-2}^{t-1}$

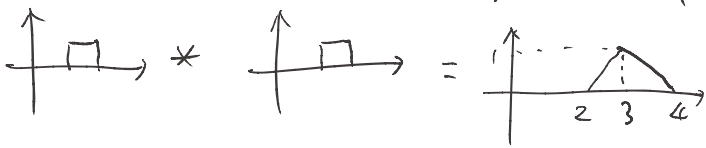
2-14 (1) $f(t)=u(t)-u(t-1)$，求 $s(t)=f(t)*f(t)$；

(2) $f(t)=u(t-1)-u(t-2)$，求 $s(t)=f(t)*f(t)$。

(1)



(2)



2-15 已知 $f_1(t)=u(t+1)-u(t-1)$，$f_2(t)=\delta(t+5)+\delta(t-5)$，$f_3(t)=\delta\left(t+\frac{1}{2}\right)+\delta\left(t-\frac{1}{2}\right)$，画出下列各卷积波形。

(1) $s_1(t)=f_1(t)*f_2(t)$

~~(2) $s_2(t)=f_1(t)*f_2(t)*f_2(t)$~~

(3) $s_3(t)=\{[f_1(t)*f_2(t)][u(t+5)-u(t-5)]\}*f_2(t)$

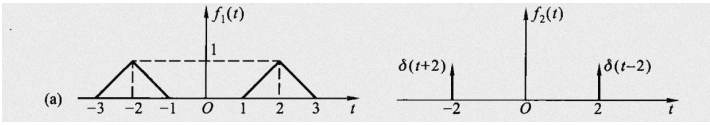
(1) $S_1(t)=u(t+6)-u(t+4)+u(t-4)-u(t-6)$

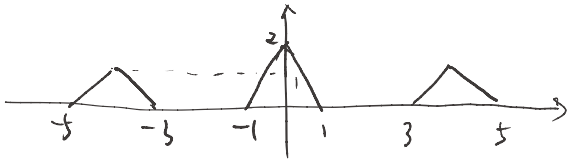
(2) $S_3(t)=$

$*f_2(t)$

$=$

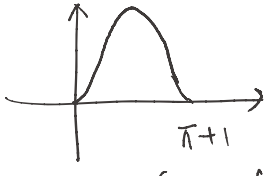
2-19

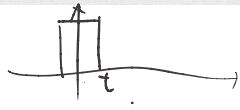




$$f_1(t) * f_2(t) = f_1(t) * \delta(t+2) + f_1(t) * \delta(t-2)$$

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





对 $t\in(0,1)$ $f_1(t) * f_2(t) = \int_0^t 2\sin\tau\, d\tau = 2-2\cos t$

对 $t\in(1,\pi)$ $f_1(t) * f_2(t) = \int_{t-1}^t 2\sin\tau\, d\tau = -2(\cos t - \cos(t-1))$

对 $t\in(\pi,\pi+1)$ $f_1(t) * f_2(t) = \int_{t-1}^{\pi} 2\sin\tau\, d\tau = 2+2\cos(t-1)$

2-20

每个子系统都是 LTI.

$h(t) = h_1(t) + h_2(t) * h_1(t) * h_3(t)$

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

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

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