



## 第2次作业

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ICE2301 Homework (Ch2) 2022.3.6 (due date)

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1. 解: (a)  $y_{zi}(t) = e^{-t} - e^{-3t}$ .

(b)  $y_{zi}(t) = 2te^{-t}$ .

2. 解:  $y_h = A_1 e^{-t} + A_2 e^{-5t}$ ,  $y_p = -6e^{-2t}$

$\Rightarrow y = y_h + y_p \xrightarrow{\text{I.C.}} y = e^{-t} + e^{-5t} - 6e^{-2t}$ ,  $t > 0$ .

3. 解: (a)  $u(t) * u(t) = \int_{-\infty}^t u(\tau) d\tau = \int_{-\infty}^t u(\tau) d\tau = tu(t)$ .

(b) 同解  $\Rightarrow f_1(t) * f_2(t) = \begin{cases} 0, & t \leq -2\tau \text{ or } t > 2\tau, \\ 2\tau + t, & -2\tau \leq t \leq 0, \\ 2\tau - t, & 0 \leq t \leq 2\tau. \end{cases}$

(c) 同解  $\Rightarrow f_1(t) * f_2(t) = \begin{cases} 0, & t \leq 0 \text{ or } t > 2\tau, \\ t, & 0 \leq t \leq \tau, \\ 2\tau - t, & \tau \leq t \leq 2\tau. \end{cases}$

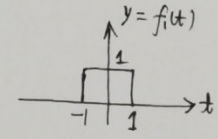
(d) 同解  $\Rightarrow f_1(t) * f_2(t) = \begin{cases} 0, & t \leq -3\tau \text{ or } t > 3\tau, \\ 3\tau + t, & -3\tau \leq t \leq -\tau, \\ 2\tau, & -\tau \leq t \leq \tau, \\ 3\tau - t, & \tau \leq t \leq 3\tau. \end{cases}$

(g) 同解  $\Rightarrow f_1(t) * f_2(t) = \begin{cases} \int_0^t \sin(\lambda\tau) d\tau = \frac{1 - \cos(\lambda t)}{\lambda}, & 0 \leq t < 4, \\ 0, & \text{otherwise.} \end{cases}$

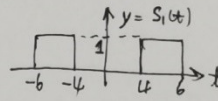
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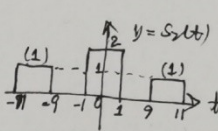
4. 解: (a)  $S_1 = f_1(t) * [\delta(t+5) + \delta(t-5)] = f_1(t+5) + f_1(t-5)$



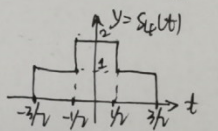
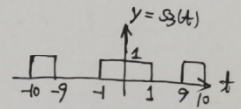
(b)  $S_2 = S_1(t+5) + S_1(t-5)$   
 $= f_1(t) * [\delta(t+10) + 2\delta(t) + \delta(t-10)]$   
 $= f_1(t+10) + 2f_1(t) + f_1(t-10)$



(c)  $\tilde{S}_1(t) := S_1(t) [u(t+5) - u(t-5)]$ ,  
 $\Rightarrow S_3(t) = \tilde{S}_1(t+5) + \tilde{S}_1(t-5)$



(d)  $S_4(t) = f_1(t+1/2) + f_1(t-1/2)$



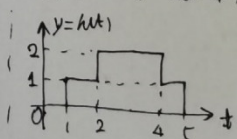
5. 解: (a)  $h_1(t) = \int_{-1}^t e^{-(t-\tau)} \delta(\tau-2) d\tau = e^{-(t-2)} u(t-2)$

(b)  $x(t) = \int_{\mathbb{R}} x(\tau) \delta(t-\tau) d\tau$

$\stackrel{LTI}{\Rightarrow} y(t) = \int_{\mathbb{R}} x(\tau) h_1(t-\tau) d\tau = \begin{cases} 0, & t \leq -1, \\ e^2 - e^{1-t}, & -1 \leq t \leq 2, \\ e^{2-t} - e^{1-t}, & t > 2. \end{cases}$

6. 解:  $h_2(t) = [(h_1(t) * h_1(t)) + h_1(t)] * h_2(t)$   
 $= [\delta(t-2) + \delta(t-1)] * [u(t) - u(t-3)] = u(t-2) - u(t-5) + u(t-1) - u(t-4)$

7. 解:  $y_1(t) := \sin t u(t) \rightarrow t[u(t) - u(t-1)] + (2-t)[u(t-1) - u(t-2)]$



$\stackrel{LTI}{\Rightarrow} \cos t u(t) + \sin t \delta(t) \rightarrow y_1'(t) = u(t) - 2u(t-1) + u(t-2)$   
 $\Rightarrow -\sin t u(t) + \delta(t) \rightarrow y_1''(t) = \delta(t-1) - 2\delta(t-1) + \delta(t-2)$

$\Rightarrow \delta(t) \rightarrow h_2(t) = y_1(t) + y_1''(t)$