期中测试（2022-05-04）

危国锐　516021910080
（上海交通大学电子信息与电气工程学院，上海 200240）

摘　要： 摘要。
关键词： 词 1，词 2

Mid-term Exam (2022-05-04)

Guorui Wei　516021910080
(*School of Electronic Information and Electrical Engineering*,
Shanghai Jiao Tong University, *Shanghai* 200240, *China*)

Abstract: Abstract.
Keywords: keyword 1, keyword

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1 Midterm-Exam (2022-05-04)

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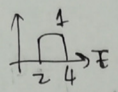
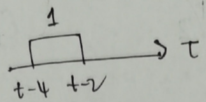
一、1.(1) $x(\tau) =$  ,

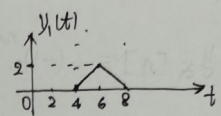
$h_1(t-\tau) =$ 

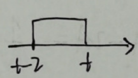
$t-2 \le 2$ 或 $t-4 \ge 4$: $y_1(t) = 0$.

$2 \le t-2 \le 4$: $y_1(t) = t-4$.

$2 \le t-4 \le 4$: $y_1(t) = 8-t$.

$$\Rightarrow y_1(t) = \begin{cases} t-4, & 4 \le t \le 6, \\ 8-t, & 6 \le t \le 8, \\ 0, & \text{其他} \end{cases} =$$



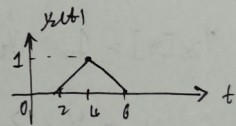
1.(2) $h_2(t-\tau) =$  .

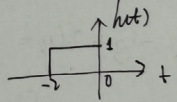
$t \le 2$ 或 $t-2 \ge 4$: $y_2(t) = 0$.

$2 \le t \le 4$: $y_2(t) = t-2$,

$2 \le t-2 \le 4$: $y_2(t) = 6-t$.

$$\Rightarrow y_2(t) = \begin{cases} t-2, & 2 \le t \le 4, \\ 6-t, & 4 \le t \le 6, \\ 0, & \text{其他} \end{cases} =$$



一、2.(1) $x(t)$ 的 MF : $h(t) = x^*(2-t) =$  $\ne h_1(t), h_2(t)$,

$\Rightarrow h_1(t), h_2(t)$ 不是 $x(t)$ 的 MF.

(2) 证: $y(t) = x(t) * h(t) = \int_{\mathbb{R}} x(\tau) x^*(T+\tau-t) d\tau$

$$\Rightarrow |y(t)| \le \cancel{\int_{\mathbb{R}} |x(\tau)| d\tau \int_{\mathbb{R}}} \int_{\mathbb{R}} |x(\tau) x^*(T+\tau-t)| d\tau$$

$$\le \dots$$

$$\le \int_{\mathbb{R}} |x(\tau)|^2 d\tau = y(0).$$

$\therefore y(0)$ 取到 $y(t)$ 的最大值.

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二. 1. $\alpha^2 - \alpha - 2 = 0 \Rightarrow (\alpha-2)(\alpha+1) = 0 \Rightarrow \alpha_1 = -1,\ \alpha_2 = 2.$

$$\Rightarrow \begin{cases} y_{zi}[n] = C_1(-1)^n + C_2 \cdot 2^n \\ y_{zi}[-1] = 2,\ y_{zi}[-2] = -1/2 \end{cases} \Rightarrow \begin{cases} -C_1 + \frac{1}{2}C_2 = 2, \\ C_1 + \frac{1}{4}C_2 = -1/2 \end{cases}$$

$$\Rightarrow \frac{3}{4}C_2 = \frac{3}{2} \Rightarrow C_2 = 2 \Rightarrow C_1 = -1$$

$$\Rightarrow y_{zi}[n] = (-1)^{n+1} + 2^{n+1}.$$

$$y_{zs}[0] = 1, \Rightarrow y_{zs}[1] = y_{zs}[0] + u[1] = 2.$$

设 $y_p[n] = A\cancel{u[n]}$, $n \geq 0$, $\Rightarrow A - A - 2A = 1 \Rightarrow A = -1/2$

$$\Rightarrow \begin{cases} y_{zs}[n] = C_3(-1)^n + C_4 \cdot 2^n - \frac{1}{2},\ n \geq 0, \\ y_{zs}[0] = 1,\ y_{zs}[1] = 2 \end{cases}$$

$$\Rightarrow \begin{cases} C_3 + C_4 = \cancel{1/2+}\ 3/2, \\ -C_3 + 2C_4 = 5/2 \end{cases} \Rightarrow C_4 = \frac{4}{3},\ C_3 = \frac{3}{2} - \frac{4}{3} = \frac{1}{6}.$$

$$\Rightarrow y_{zs}[n] = \left[\frac{1}{6}(-1)^n + \frac{4}{3} \cdot 2^n - 1/2\right] u[n]. \ \cancel{n \geq 0}$$

2. $\tilde{y}_{zi}[n] = y_{zi}[n] = (-1)^{n+1} + 2^{n+1},$

$$\tilde{y}_{zs}[n] = y_{zs}[n-2] = \left[\frac{1}{6}(-1)^n + \frac{1}{3} \cdot 2^n - 1/2\right] u[n-2],$$

$$\Rightarrow \tilde{y}[n] = \tilde{y}_{zi}[n] + \tilde{y}_{zs}[n] = \sim.$$

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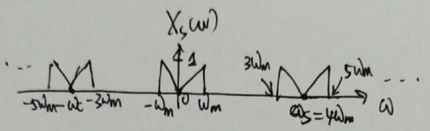
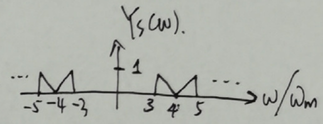
三. 1. $s(t) = T_s \sum_n \delta(t - nT_s) = \sum_k S_k e^{jk\omega_s t}$， $S_k = \frac{1}{T_s}\int_{T_s} T_s \delta(t) e^{-jk\omega_s t} dt$

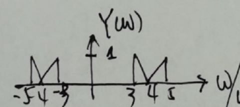
$= 1$

$\Rightarrow s(t) = \sum_k e^{jk\omega_s t} \leftrightarrow \sum_k 2\pi \delta(\omega - k\omega_s). =: S(\omega).$

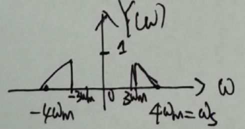
$\Rightarrow x_s(t) = x(t)s(t) \leftrightarrow \frac{1}{2\pi} X(\omega) * S(\omega) = \sum_k X(\omega - k\omega_s) =: X_s(\omega),$

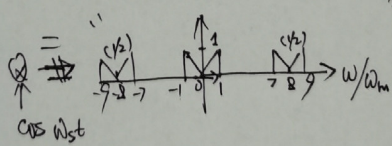
$\Rightarrow X_s(\omega) =$  ,

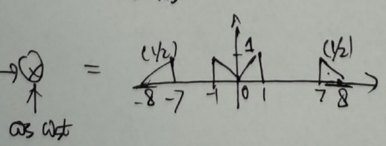
$y_s(t) = x_s(t) - x(t) \leftrightarrow Y_s(\omega) = X_s(\omega) - X(\omega) =$ 

2. $Y_2(\omega) =$  $= X(\omega - 4\omega_m) + X(\omega + 4\omega_m)$

$\leftrightarrow y_2(t) = x(t)\left(e^{j4\omega_m t} - e^{-j4\omega_m t}\right) = 2x(t)\cos(4\omega_m t).$

3. $Y_3(\omega) =$ 

4. (1) 题2： $Y_2(\omega) \to$  $\to \boxed{H_2(\omega)} \to x_{r_2}(t)$

题3： $Y_3(\omega) \to$  $\to \boxed{H_2(\omega)} \to x_{r_3}(t)$.

∴ 只需取 $A = 1$， $\omega_0 = \omega_s = 4\omega_m$， $\omega_m < \omega_c < 7\omega_m$，

就有 $X_{r_2}(\omega) = X_{r_3}(\omega) = X(\omega) \leftrightarrow x(t)$，即可恢复 $x(t)$.

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References