期中考试

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摘 要：2022-05-04.

关键词：词 1，词 2

Mid-term Exam

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Keywords: key1, key2

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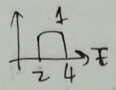
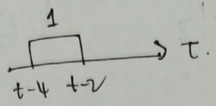
ICE2301 期中测试 2022.05.04

一、1.(1) $x(\tau) =$  ，

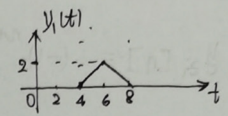
$h_1(t-\tau) =$ 

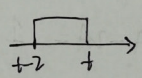
$t-2 \le 2$ 或 $t-4 \geq 4$：$y_1(t) = 0$.

$2 \le t-2 \le 4$：$y_1(t) = t-4$.

$2 \le t-4 \le 4$：$y_1(t) = 8-t$.

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



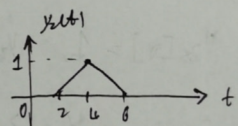
1.(2) $h_2(t-\tau) =$ 

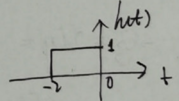
$t \le 2$ 或 $t-2 \geq 4$：$y_2(t) = 0$.

$2 \le t \le 4$：$y_2(t) = t-2$,

$2 \le t-2 \le 4$：$y_2(t) = 6-t$.

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



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

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

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

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

$$\le \cdots$$

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

$\therefore y(0)$ 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 $y_p[n] = A,\ n\geq 0,\ \Rightarrow A-A-2A=1 \Rightarrow A=-1/2$

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

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

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

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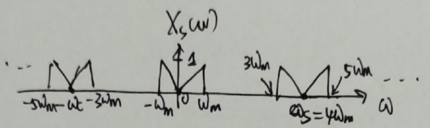
三. 1. $s(t) = T_s\sum_n \delta(t-nT_s) = \sum_k S_k e^{jk\omega_s t}$, $S_k = \frac{1}{T_s}\int_{T_s} T_s\delta(t)e^{-jk\omega_s t}dt = 1$

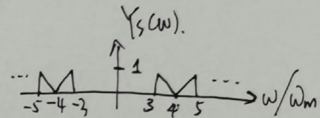
$\Rightarrow s(t)=\sum_k e^{jk\omega_s t} \leftrightarrow \sum_k 2\pi\delta(\omega-k\omega_s). =: S(\omega).$

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

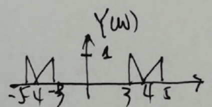
$\Rightarrow X_s(\omega) =$



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



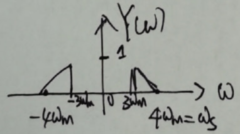
2. $Y_2(\omega) =$



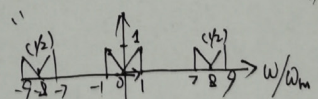
$= X(\omega-4\omega_m) + X(\omega+4\omega_m)$

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

3. $Y_3(\omega) =$

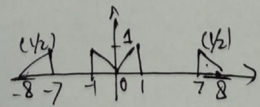


4. (1) 题2: $Y_2(\omega) \to \otimes$ ($\cos\omega_s t$) $=$



$\to \boxed{H_2(\omega)} \to x_{r_2}(t)$

题3: $Y_3(\omega) \to \otimes$ ($\cos\omega_s t$) $=$



$\to \boxed{H_2(\omega)} \to x_{r_3}(t).$

∴ 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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4 Cheat-sheet

References