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3.5

解：$x_2(t)=x_1(t-1)+x_1(-(t-1))$ 显然 $x_2(t)$ 为 $x_1(t)$ 的翻转、移位线性组合，而周期性不改变．故 $w_2=w_1$

$x_1(t)=\sum_{k=-\infty}^{+\infty} a_k e^{jkw_1t}$ 即 $x_1(t)\rightarrow a_k$

$x_1(t-1)\rightarrow e^{-jkw_1}a_k$

$x_1(1-t)=x_1(-(t-1))\rightarrow e^{-jkw_1}a_{-k}$

由线性性质 $x_2(t)\rightarrow e^{-jkw_1}(a_k+a_{-k})$

3.8

解：$\because x(t)$ 为实奇函数 $\therefore a_k^*=a_{-k}=-a_k$

$\therefore a_k$ 为纯虚数 $w_0=\frac{2\pi}{T}=\pi$

$\because T=2$ $|k|>1$ $a_k=0$ $\therefore a_0=0$ 只有 a_{-1} 和 a_1 不为 0

由 Parseval 定理 $\frac{1}{T}\int_T |x(t)|^2dt=\sum_{k=-\infty}^{+\infty}|a_k|^2$

即 $|a_1|^2+|a_{-1}|^2=1$ $\Rightarrow 2|a_1|^2=1$ $a_1=\frac{1}{\sqrt2}j$ 或 $a_1=-\frac{1}{\sqrt2}j$

若 $a_1=\frac{1}{\sqrt2}j$ $a_{-1}=-\frac{1}{\sqrt2}j$ $x(t)=\frac{1}{\sqrt2}j\cdot e^{j\pi t}-\frac{1}{\sqrt2}je^{-j\pi t}$

$=\sqrt2\sin\pi t$

若 $a_1=-\frac{1}{\sqrt2}j$ $a_{-1}=\frac{1}{\sqrt2}j$ $x(t)=-\frac{1}{\sqrt2}je^{j\pi t}+\frac{1}{\sqrt2}je^{j\pi t}$

$=-\sqrt2\sin\pi t$

即 $x(t)=\sqrt2\sin\pi t$ 或 $-\sqrt2\sin\pi t$

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3.22

(a) 观察知 $T=2 \quad w_0=\frac{2\pi}{T}=\pi \qquad x(-t)=-x(t)$. a_k为奇对称. 则$a_0=0$

$x(t)=\sum_{k=-\infty}^{+\infty} a_k e^{-jk\pi t}$

$a_k=\frac{1}{2}\int_{-1}^{1} t e^{-jk\pi t}dt \quad =\frac{1}{2}\left(-\frac{1}{jk\pi} t e^{-jk\pi t}+\frac{1}{k^2\pi^2} e^{-jk\pi t}\right)\Big|_{-1}^{1}$

$=\frac{1}{2}\left(-\frac{1}{jk\pi}e^{-jk\pi}+\frac{1}{k^2\pi^2}e^{-jk\pi}-(-1)\frac{1}{jk\pi}(-1)e^{jk\pi}-\frac{1}{k^2\pi^2}e^{jk\pi}\right)$

$=\frac{1}{2}\left[-\frac{1}{jk\pi}(e^{jk\pi}+e^{-jk\pi})-\frac{1}{k^2\pi^2}(e^{jk\pi}-e^{-jk\pi})\right]$

$=-\frac{1}{jk\pi}\cos k\pi-\frac{j}{k^2\pi^2}\sin k\pi$

$=\frac{j}{k\pi}(-1)^k \qquad$ 即 $x(t)=\sum_{k=-\infty}^{+\infty}\left(\frac{j}{k\pi}\right)(-1)^k e^{-jk\pi t}$

(b) $T=6 \quad w_0=\frac{2\pi}{6}=\frac{\pi}{3} \qquad x(t)=x(-t)$ a_k偶对称

$$x(t)=\begin{cases} t+2 & -2<t<-1 \\ 1 & -1<t<1 \\ -t+2 & 1<t<2 \\ 0 & 2<t<4 \end{cases}$$

$a_k=\frac{1}{6}\int_{-2}^{4} x(t)e^{-jkw_0t}dt$

$=\frac{1}{6}\left(\int_{-2}^{-1}(t+2)e^{-jkw_0t}dt+\int_{-1}^{1}e^{-jkw_0t}dt+\int_{1}^{2}(-t+2)e^{-jkw_0t}dt+0\right)$

$=\frac{1}{6}\Big[\frac{1}{jkw_0}(e^{jkw_0}-2e^{2jkw_0})+\frac{1}{k^2w_0^2}(e^{jkw_0}-e^{2jkw_0})+\frac{2}{jkw_0}(e^{2jkw_0}-e^{jkw_0})+\frac{1}{jkw_0}(e^{jkw_0}-e^{-jkw_0})+\frac{1}{jkw_0}(2e^{-2jkw_0}-e^{-jkw_0})+\frac{1}{k^2w_0^2}(e^{-jkw_0}-e^{-2jkw_0})+\frac{2}{jkw_0}(e^{-jkw_0}-e^{-2jkw_0})\Big]$

$=\frac{1}{6}\left\{\frac{1}{jkw_0}[0]+\frac{1}{k^2w_0^2}\left[(e^{jkw_0}-e^{-jkw_0})-(e^{2jkw_0}-e^{-2jkw_0})\right]\right\}$

$=\frac{1}{6}\cdot\frac{9}{k^2\pi^2}\cdot\left(2\cos\frac{\pi}{3}k-2\cos\frac{2}{3}\pi\right)=\frac{3}{k^2\pi^2}\left(\cos\frac{\pi}{3}k-\cos\frac{2}{3}k\right)$

$$a_0=\frac{1}{6}\int_{-2}^{2}x(t)dt=\frac{1}{2}$$

$$\therefore x(t)=\sum_{k=-\infty}^{+\infty}\frac{3}{k^2\pi^2}\left(\cos\frac{\pi}{3}k-\cos\frac{2\pi}{3}k\right)e^{j\frac{\pi}{3}kt}=\sum_{k=-\infty}^{-1}+a_0+\sum_{k=1}^{\infty}\quad (由于 a_k=a_{-k})$$

$$=\frac{1}{2}+\sum_{k=1}^{\infty}\frac{12}{k^2\pi^2}\sin\frac{k\pi}{2}\sin\frac{k\pi}{6}\cos\frac{\pi}{3}kt$$

(c). $T=3$ $\quad w_0=\frac{2\pi}{3}$ $\quad a_0=\frac{1}{3}\int_{-2}^{1}x(t)dt=1$

$$x(t)=\begin{cases}t+2 & -2<t<0\\ -2t+2 & 0<t<1\end{cases}$$

$$a_k=\frac{1}{3}\int_{-2}^{1}x(t)dt=\frac{1}{6}\left[\int_{-2}^{0}(t+2)e^{-jkw_0t}dt+\int_{0}^{1}-2(t-1)e^{-jkw_0t}dt\right]$$

$$=\frac{1}{3}\left[\frac{1}{k^2w_0^2}+\frac{-2}{jkw_0}e^{2jkw_0}-\frac{1}{k^2w_0^2}e^{2jkw_0}-\frac{2}{jkw_0}(1-e^{2jkw_0})+\frac{2}{jkw_0}e^{-jkw_0}-\frac{2}{k^2w_0^2}e^{-jkw_0}+\right.$$
$$\left.\frac{2}{k^2w_0^2}-\frac{2}{jkw_0}e^{-jkw_0}+\frac{2}{jkw_0}\right]$$

$$=\frac{1}{3}\left[\frac{1}{jkw_0}\left(0+(-2+2)+(2-2)e^{-jkw_0}\right]+\frac{1}{k^2w_0^2}\left[(1+2)-e^{2jkw_0}-2e^{-jkw_0}\right]\right.$$

$$=\frac{1}{k^2w_0^2}-\frac{1}{3k^2w_0^2}\left[e^{2jkw_0}+e^{-jkw_0}\right]$$

$$=\frac{9}{4k^2\pi^2}-\frac{3}{2k^2\pi^2}\cos k\pi\cdot e^{j\frac{k}{3}\pi}$$

$$\therefore x(t)=\sum_{k=-\infty}^{+\infty}a_ke^{j\frac{2\pi}{3}kt}\qquad a_0=0\qquad a_k=\frac{9}{4k^2\pi^2}-\frac{3}{2k^2\pi^2}\cos k\pi\cdot e^{j\frac{k}{3}\pi}\quad k\neq 0$$

3.28

解:(b) $N=6$ $\quad w_0=\frac{2\pi}{6}=\frac{\pi}{3}$ $\quad x[n]=\begin{cases}1 & 0\le n\le 3\\ 0 & 4\le n\le 5\end{cases}$

$$a_k=\frac{1}{6}\sum_{k=\langle N\rangle}x[n]e^{-jkw_0n}=\frac{1}{6}\sum_{k=0}^{3}e^{-jkw_0n}=\frac{1}{6}\cdot\frac{1-(e^{-jkw_0n})^4}{1-e^{-jkw_0n}}$$

$$=\frac{1}{6}\cdot\frac{1-e^{-jk\frac{4}{3}\pi}}{1-e^{-jk\frac{\pi}{3}}}=\frac{1}{6}\,\frac{e^{-jk\frac{\pi}{2}}\sin\frac{2}{3}\pi k}{\sin\frac{\pi}{6}k}$$

$$|a_k|=\frac{\sin\frac{2}{3}\pi k}{6\sin\frac{\pi}{6}k}\qquad \measuredangle a_k=-\frac{k}{2}\pi$$

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(c) $N=6 \quad w_0 = \frac{2\pi}{N} = \frac{\pi}{3}$ 且 $x[n]=x[-n]$. 则 $a_k = a_{-k}$

$$a_k = \frac{1}{6}\sum_{n=<6>} x[n]e^{-jkw_0 n} = \frac{1}{6}[1+2(e^{-jkw_0}+e^{-j5kw_0}) - (e^{-2jkw_0}+e^{-4jkw_0})]$$

$$= \frac{1}{6}[1+2(e^{-jk\frac{\pi}{3}}+e^{jk\frac{\pi}{3}}) - 1(e^{-jk\frac{2}{3}\pi}+e^{jk\frac{2}{3}\pi})]$$

$$= \frac{1}{6}[1+4\cos\frac{k}{3}\pi - 4\cos\frac{2}{3}k\pi]$$

$$|a_k| = \frac{1}{6}\left|1+4\cos\frac{k\pi}{3} - 4\cos\frac{2k}{3}\pi\right| \qquad \measuredangle a_k = 0$$

3.11

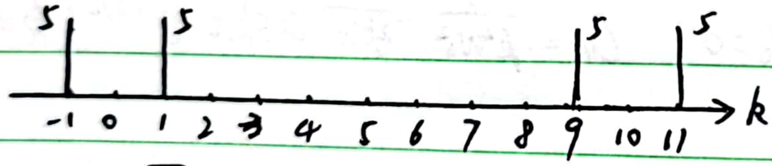
证明: ∵ $x[n]$是实偶信号. ∴ $a_k = a_{-k}$ 且 a_k为实数

$a_k = a_{k+10}$ $\qquad a_{11} = 5 \Rightarrow a_1 = a_{-1} = a_9 = 5$

由Parseval定理 $\quad \frac{1}{10}\sum_{n=0}^{9}|x[n]|^2 = \sum_{n=0}^{9} a_n^2$

而 $a_1 = a_9 = 5$ $\quad$ ∴ a_0、a_2、a_3 …… $a_8 = 0$

即$x[n]$的频谱为



$$\therefore x[n] = \sum_{k=<N>} a_k e^{jkw_0 n} \qquad w_0 = \frac{2\pi}{10}$$

$$\therefore x[n] = 5(e^{j\cdot\frac{2\pi}{10}n} + e^{j\frac{2\pi}{10}\cdot 9n})$$

$$= 5(e^{-j\frac{2\pi}{10}n} + e^{j\frac{2\pi}{10}n})$$

$$= 5\cos(\frac{\pi}{5}n) = A\cos(Bn+C)$$

$$\therefore A=5 \quad B=\frac{\pi}{5} \quad C=0$$

3.30

(a) $x[n]=1+\frac{1}{2}(e^{j\frac{2\pi}{6}\cdot n}+e^{-j\frac{2\pi}{6}\cdot n})$ $\therefore a_0=1\quad a_1=\frac{1}{2}\quad a_{-1}=\frac{1}{2}=a_5$

$\therefore$ 周期内的傅里叶系数为 $a_0=1\quad a_1=\frac{1}{2}\quad a_5=\frac{1}{2}$

(b) $y[n]=\sin(\frac{2\pi}{6}n+\frac{\pi}{4})=\frac{1}{2j}(e^{j(\frac{2\pi}{6}n+\frac{\pi}{4})}-e^{-j(\frac{2\pi}{6}n+\frac{\pi}{4})})$

$=\frac{1}{2j}\cdot(e^{\frac{\pi}{4}j}\cdot e^{j\frac{2\pi}{6}n}-e^{-\frac{\pi}{4}j}\cdot e^{-j\frac{2\pi}{6}n})$

$=\frac{\sqrt{2}}{4}(1-j)e^{j\frac{2\pi}{6}n}+\frac{\sqrt{2}}{4}(1+j)e^{-j\frac{2\pi}{6}n}$

$\therefore$ 周期内的傅里叶系数 $b_1=\frac{\sqrt{2}}{4}(1-j)\qquad b_{-1}=b_5=\frac{\sqrt{2}}{4}(1+j)$

(c) $z[n]=x[n]\cdot y[n]$ 则 $c_k=a_k * b_k$

即 $c_k=\sum_{l=\langle N\rangle}a_l b_{k-l}=\sum_{l=0}^{5}a_l b_{k-l}$.

$\therefore c_0=\sum_{l=0}^{5}a_l b_{-l}=\frac{\sqrt{2}}{4}\qquad c_1=\sum_{l=0}^{5}a_l b_{1-l}=\frac{\sqrt{2}}{4}(1-j)$

$c_2=\sum_{l=0}^{5}a_l b_{2-l}=\frac{\sqrt{2}}{8}(1-j)\qquad c_3=\sum_{l=0}^{5}a_l b_{3-l}=0$

$c_4=\sum_{l=0}^{5}a_l b_{4-l}=\frac{\sqrt{2}}{8}(1+j)\qquad c_5=\sum_{l=0}^{5}a_l b_{5-l}=\frac{\sqrt{2}}{4}(1+j)$

(d) $z[n]=(1+\cos\frac{2\pi}{6}n)\cdot\sin(\frac{2\pi}{6}n+\frac{\pi}{4})$

$=\sin(\frac{2\pi n}{6}+\frac{\pi}{4})+\sin(\frac{2\pi n}{6}+\frac{\pi}{4})\cdot\cos\frac{2\pi}{6}n$

$=\sin(\frac{2\pi}{6}n+\frac{\pi}{4})+\frac{1}{2}[\sin(\frac{4\pi}{6}n+\frac{\pi}{4})+\sin\frac{\pi}{4}]$

$=\frac{\sqrt{2}}{4}+\sin(\frac{2\pi}{6}n+\frac{\pi}{4})+\frac{1}{2}\sin(\frac{4\pi}{6}n+\frac{\pi}{4})$

$=\frac{\sqrt{2}}{4}+\frac{1}{2j}(e^{j(\frac{2\pi}{6}n+\frac{\pi}{4})}-e^{-j(\frac{2\pi}{6}n+\frac{\pi}{4})})+\frac{1}{4j}(e^{j(\frac{4\pi}{6}n+\frac{\pi}{4})}-e^{-j(\frac{4\pi}{6}n+\frac{\pi}{4})})$

$=\frac{\sqrt{2}}{4}+\frac{\sqrt{2}}{4}(1-j)e^{j\frac{2\pi}{6}n}+\frac{\sqrt{2}}{4}(1+j)e^{-j\frac{2\pi}{6}n}+\frac{\sqrt{2}}{8}(1-j)e^{j\frac{4\pi}{6}n}+\frac{\sqrt{2}}{8}(1+j)e^{-j\frac{4\pi}{6}n}$

$\therefore c_0=\frac{\sqrt{2}}{4}\quad c_1=\frac{\sqrt{2}}{4}(1-j)\quad c_{-1}=c_5=\frac{\sqrt{2}}{4}(1+j)\quad c_2=\frac{\sqrt{2}}{8}(1-j)\quad c_4=\frac{\sqrt{2}}{8}(1+j)$

和(3)相符. $c_3=0$

Date:

3.34.

解. (b) $H(jk\omega_0)=\int_{-\infty}^{+\infty} h(t)e^{-jk\omega_0 t}dt \qquad T=2 \quad \omega_0=\frac{2\pi}{T}=\pi$

$\therefore H(jk\omega_0)=\int_{-\infty}^{0} e^{4t}\cdot e^{-jk\omega_0 t}dt+\int_{0}^{+\infty} e^{-4t}e^{-jk\omega_0 t}dt$

$=\int_{-\infty}^{0} e^{-(jk\omega_0-4)t}dt+\int_{0}^{+\infty} e^{-(jk\omega_0+4)t}dt$

$=\frac{1}{4-jk\omega_0}+\frac{1}{4+jk\omega_0}=\frac{1}{4-jk\pi}+\frac{1}{4+jk\pi} = \frac{8}{16+k^2\pi^2}$

$a_k=\frac{1}{T}\int_T x(t)e^{-jk\omega_0 t}dt$

$=\frac{1}{2}\int_0^2 (\delta(t)-\delta(t-1))e^{-jk\omega_0 t}dt$

$=\frac{1}{2}\left(\int_0^2 \delta(t)e^{-jk\pi t}dt-\int_0^2 \delta(t-1)e^{-jk\pi t}dt\right)$

$=\frac{1}{2}(1-e^{-jk\pi}) = \frac{1}{2}(1-\cos k\pi) = \begin{cases} 0 & k为偶 \\ 1 & k为奇 \end{cases}$

$\therefore y(t)=\sum_{k=-\infty}^{+\infty} a_k H(jk\omega_0)e^{jk\omega_0 t}=\begin{cases} 0 & k为偶 \\ \frac{8}{16+\pi^2k^2}e^{jk\pi t} & k为奇 \end{cases}$

(c) $x(t)=\begin{cases} 1 & -\frac{1}{4}<x<\frac{1}{4} \\ 0 & \frac{1}{4}<x<\frac{3}{4} \end{cases} \qquad T=1 \quad \omega_0=\frac{2\pi}{T}=2\pi$

$a_k=\frac{1}{T}\int_T x(t)e^{-jk\omega_0 t}dt$

$=\int_{-\frac{1}{4}}^{\frac{3}{4}} x(t)e^{-jk\omega_0 t}dt$

$=\int_{-\frac{1}{4}}^{\frac{1}{4}} e^{-jk\omega_0 t}+\int_{\frac{1}{4}}^{\frac{3}{4}} 0\,dt = \frac{\sin(\frac{1}{2}k\pi)}{k\pi}$

$\therefore y(t)=\sum_{k=-\infty}^{+\infty} a_k H(jk\omega_0)e^{jk\omega_0 t}$

$=\frac{8}{16+4k^2\pi^2}\cdot\frac{\sin(\frac{1}{2}k\pi)}{k\pi}\cdot e^{jk2\pi t}$

3.35

解：$T=\frac{\pi}{7}$　$w_0=\frac{2\pi}{T}=14$.

由于 $y(t)=x(t)$ $\Rightarrow b_k=a_k$.

而 $b_k=H(jw)\cdot a_k$.　　∴当 $|H(jw)|=1$ 时 才有 $y(t)=x(t)$

即. $|14k|\le 250$　　∴ $|k|\le 7$ 时　$a_k=0$

3.36

解：由差分方程改写 $h[n]-\frac{1}{4}h[n-1]=\delta[n]$

∴ $h[n]=(\frac{1}{4})^n u[n]$.

∴ $H(e^{jkw_0})=\sum_{k=-\infty}^{+\infty} h[n]e^{-jkw_0n}=\frac{1}{1-\frac{1}{4}e^{-jw_0k}}$

(a) $x[n]=\sin\frac{3\pi}{4}n$

$=\frac{1}{2j}(e^{j\frac{3\pi}{4}n}-e^{-j\frac{3\pi}{4}n})$　　$\frac{\frac{3\pi}{4}}{2\pi}=\frac{3}{8}$　∴ $N=8$.　$w_0=\frac{2\pi}{N}=\frac{\pi}{4}$

$=\frac{1}{2j}(e^{j\frac{2\pi}{8}\cdot 3n}-e^{-j\frac{2\pi}{8}\cdot 3n})$

∴ $a_3=\frac{1}{2j}$　$a_{-3}=-\frac{1}{2j}$　　　b_k以8为周期

∴ $b_3=a_3\cdot H(e^{j3w_0})=\frac{1}{2j}\cdot\frac{1}{1-\frac{1}{4}e^{-j\frac{3}{4}\pi}}$　　$b_3=a_{-3}\cdot H(e^{j3w_0})=\frac{1}{2j}\cdot\frac{1}{1-\frac{1}{4}e^{j\frac{3}{4}\pi}}$

（其余为0）

(b) $x[n]=\cos\frac{\pi}{4}n+2\cos\frac{\pi}{2}n$

$=\frac{1}{2}(e^{j\frac{\pi}{4}n}+e^{-j\frac{\pi}{4}n})+(e^{j\frac{\pi}{2}n}+e^{-j\frac{\pi}{2}n})$　　$N_1=8$　$N_2=4$　∴ $N=8$

$=\frac{1}{2}(e^{j\frac{2\pi}{8}n}+e^{-j\frac{2\pi}{8}n})+(e^{j\frac{2\pi}{8}\cdot 2n}+e^{-j\frac{2\pi}{8}\cdot 2n})$　　$w_0=\frac{2\pi}{8}$

∴ $a_1=a_{-1}=\frac{1}{2}$　　$a_2=a_{-2}=1$

∴ $b_1=\frac{1}{2}\cdot\frac{1}{1-\frac{1}{4}e^{-j\frac{\pi}{4}}}$　　$b_{-1}=\frac{1}{2}\cdot\frac{1}{1-\frac{1}{4}e^{j\frac{\pi}{4}}}=b_7$　　$b_2=\frac{1}{1-\frac{1}{4}e^{-j\frac{\pi}{2}}}$　　$b_{-2}=\frac{1}{1-\frac{1}{4}e^{j\frac{\pi}{2}}}=b_6$

其余为0

b_k以8为周期

Date:

3.43

解:(a) $x(t)=\sum_{k=-\infty}^{+\infty} a_k e^{jk\frac{2\pi}{T}t}$

$x(t+\frac{T}{2})=\sum_{k=-\infty}^{+\infty} a_k e^{jk\frac{2\pi}{T}t}\cdot e^{jk\pi}$ $\quad e^{jk\pi}=(-1)^k$ 又∵k为奇数才不为0

$\therefore x(t+\frac{T}{2})=-x(t)$

ii $a_k=\frac{1}{T}\int_T x(t)e^{-jk\omega_0 t}dt$

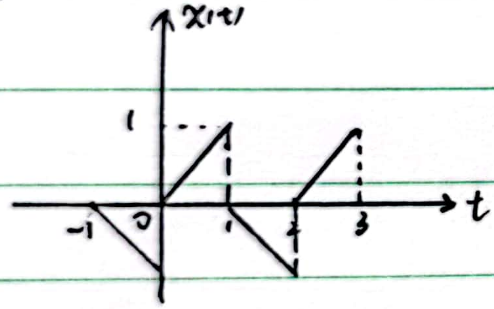
$=\frac{1}{T}\int_0^{\frac{T}{2}} x(t)e^{-jk\omega_0 t}dt+\int_{\frac{T}{2}}^{T} x(t)e^{-jk\omega_0 t}dt$ $\quad$ 令 $t=t-\frac{T}{2}$

$=\frac{1}{T}\int_0^{\frac{T}{2}}[x(t)+x(t+\frac{T}{2})e^{-jk\pi}]e^{-jk\omega_0 t}dt$

若 $x(t)=-x(t+\frac{T}{2})$ 则 $a_k=0$ $\quad$ 当k为偶数时 $e^{-jk\pi}=1$ $\quad a_k=0$

$\therefore$ 若$x(t)=-x(t+\frac{T}{2})$ 则 $x(t)$是奇谐的

(b) $T=2$ $\quad \omega_0=\frac{2\pi}{T}=\pi$ $\quad x(t)=-x(t+1)$ 则有$x(t)$为



$x(t)=\begin{cases} t & 0<t<1 \\ -t+1 & 1<t<2 \end{cases}$

$a_k=\frac{1}{2}\int_T x(t)e^{-jk\pi t}dt$

$=\frac{1}{2}\left(\int_0^1 te^{-jk\pi t}dt+\int_1^2(-t+1)e^{-jk\pi t}dt\right)$

$=\begin{cases} 0 & k\text{为偶} \\ \frac{1}{jk\pi}+\frac{2}{k^2\pi^2} & k\text{为奇} \end{cases}$

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3.45

解：(a) 由于 $x(t) = x_e(t) + x_o(t)$　$x_e(t) = \frac{x(t)+x(-t)}{2}$　$x_o(t) = \frac{x(t)-x(-t)}{2}$

$x_e(t) \xrightarrow{F} Re[a_k]$　$x_o(t) \xrightarrow{F} jIm[a_k]$

$x_e(t) = a_0 + 2\sum_{k=1}^{\infty} B_k \cos k w_0 t$　$x_o(t) = 2\sum_{k=1}^{\infty}[-C_k \sin k w_0 t]$

$\therefore \alpha_0 = 0$　$\alpha_k = B_k$

$\beta_0 = 0$　$\beta_k = \begin{cases} jC_k & k>0 \\ -jC_k & k<0 \end{cases}$

(b) ∵ $x_e(t)$ 为偶函数 实函数　$\therefore \alpha_k = \alpha_{-k}$

∵ $x_o(t)$ 为奇函数　$\therefore \beta_k = -\beta_{-k}$

(c) $y_e(t) = 4(a_0 + d_0) + 2\sum_{k=1}^{\infty}(B_k + \frac{1}{2}E_k)\cos\frac{2k\pi}{3}t$

$y_o(t) = 2\sum_{k=1}^{\infty}(F_k \sin\frac{2k\pi}{3}t)$

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3.48

解: $x[n]=\sum_{k=\langle N\rangle} a_k e^{jk\frac{2\pi}{N}n}$ $\qquad \frac{2\pi}{N}=w_0$

(a) $x[n-n_0]=\sum_{k=\langle N\rangle} e^{-jk\frac{2\pi}{N}n_0}\cdot a_k e^{jk\frac{2\pi}{N}n}$

(b) $x[n]-x[n-1]=\sum_{k=\langle N\rangle} a_k e^{jk\frac{2\pi}{N}n}-e^{-jk\frac{2\pi}{N}}\cdot a_k e^{jk\frac{2\pi}{N}n}$

$=\sum_{k=\langle N\rangle}(1-e^{-jk\frac{2\pi}{N}})a_k e^{jk\frac{2\pi}{N}n}$.

(c) $x[n]-x[n-\frac{N}{2}]=\sum_{k=\langle N\rangle} a_k e^{jk\frac{2\pi}{N}n}-e^{jk\frac{2\pi}{N}\frac{N}{2}}a_k e^{jk\frac{2\pi}{N}n}$

$=\sum_{k=\langle N\rangle}[1-(-1)^k]a_k e^{jk\frac{2\pi}{N}\cdot n}$

(d) $x[n]+x[n+\frac{N}{2}]=\sum_{k=\langle N\rangle} a_k e^{jk\frac{2\pi}{N}\cdot n}+e^{jk\pi}a_k e^{jk\frac{2\pi}{N}n}$

$=\sum_{k=\langle N\rangle}[1+(-1)^k]a_k e^{jk\frac{2\pi}{N}\cdot n}$