電気数学Ⅱおよび演習　小テスト２　解答

2011/04/15　黒川

１．

(1) $\dfrac{4\pi}{3}$　　(2) 2π　　(3) $\sin 2t\cos 2t=\dfrac{1}{2}\sin 4t$　よって$\dfrac{\pi}{2}$

(4) $\sin t\cos 2t=\dfrac{1}{2}\left(\sin 3t-\sin t\right)$　周期$\dfrac{2\pi}{3}$と周期2πとの最小公倍数より、基本周期は2π

２．

(1)

$$f(t)=e^{-|t|}$$
$$f(-t)=f(t)$$

∴偶関数

(2)

$$f(t)=\sin t\cos t$$
$$f(-t)=-\sin t\cos t=-f(t)$$

∴奇関数

(3)

$$f(t)=\sin t+\cos t$$
$$f(-t)=-\sin t+\cos t$$
$$-f(t)=-\sin t-\cos t$$

∴どちらでもない

(4)

$$f(t)=\sin\left(t+\frac{\pi}{4}\right)\cdot\cos\left(t+\frac{\pi}{4}\right)=\frac{1}{2}\cos 2t$$
$$f(-t)=f(t)$$

∴偶関数

３．(1)

$$f(t)=\mathrm{Re}\left[\frac{1}{\sqrt{2}}e^{jt}-\frac{d}{dt}e^{j\left(t-\frac{\pi}{4}\right)}\right]=\mathrm{Re}\left[\left(\frac{1}{\sqrt{2}}-je^{-j\frac{\pi}{4}}\right)e^{jt}\right]=\mathrm{Re}\left[\left(\frac{1}{\sqrt{2}}-j\left(\frac{1}{\sqrt{2}}-j\frac{1}{\sqrt{2}}\right)\right)e^{jt}\right]$$
$$=\mathrm{Re}\left[\left(-j\frac{1}{\sqrt{2}}\right)e^{jt}\right]=\mathrm{Re}\left[\left(\frac{1}{\sqrt{2}}e^{-j\frac{1}{2}\pi}\right)e^{jt}\right]=\frac{1}{\sqrt{2}}\cos\left(t-\frac{\pi}{2}\right)$$

(2)

$$f(t)=\mathrm{Re}\left[100e^{j\left(50t+\frac{\pi}{6}\right)}-j100e^{j(50t)}\right]=100\,\mathrm{Re}\left[e^{j(50t)}\left(e^{j\left(\frac{\pi}{6}\right)}-j1\right)\right]$$
$$=100\,\mathrm{Re}\left[e^{j(50t)}\left(\frac{\sqrt{3}}{2}-j\frac{1}{2}\right)\right]=100\,\mathrm{Re}\left[e^{j\left(50t-\frac{\pi}{6}\right)}\right]=100\cos\left(50t-\frac{\pi}{6}\right)$$

４．

(1)

$f(t)=t\sin\pi t$ は偶関数　$\therefore \displaystyle\int_{-1}^{1}t\sin\pi t\,dt=2\int_{0}^{1}t\sin\pi t\,dt=2\left[-t\frac{\cos\pi t}{\pi}+\frac{\sin\pi t}{\pi^2}\right]_0^1=\frac{2}{\pi}$

(2)

$f(t)=\sin\pi t\cos\pi t$ は奇関数　$\therefore \displaystyle\int_{-1}^{1}\sin\pi t\cos\pi t\,dt=0$