EE-3032, HW-5

F'17

CTFS including infinite series

Problems from the Chaparro text:

- 4.5, part (iii) only (p. 320)
- 4.7, part (a) only
- 4.9, find Y_k only

(4.5) (iii) $x_3(t) = \cos(3t) + \cos(5t)$. Find FS, plot mag & ϕ spectra for $k \geq 0$.

$= \frac{1}{2}\left(e^{j\Omega_0 3t} + e^{-j\Omega_0 3t} + e^{j\Omega_0 5t} + e^{-j\Omega_0 5t}\right)$

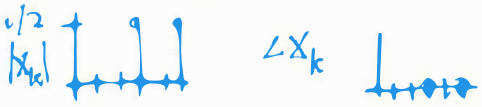
$X_3 = X_{-3} = \frac{1}{2} \qquad X_5 = X_{-5} = \frac{1}{2}$

$X = \{\frac{1}{2}, 0, \frac{1}{2}, 0, 0, \underline{0}, 0, 0, \frac{1}{2}, 0, \frac{1}{2}\}$

$\Omega_0 = 1$ rad/s

$F_0 = \frac{1}{2\pi}$ Hz

$T_0 = 2\pi$ s



(4.7a) $x(t) = \sum_{k=-\infty}^{\infty} \frac{3}{4 + (k\pi)^2} e^{jk\pi t}$

(i) T_0? Form gives $\Omega_0 = \pi \rightarrow f_0 = \frac{1}{2} \rightarrow T_0 = 2$s

(ii) $DC(x(t)) = X_0 = \frac{3}{4 + (0\pi)^2} = 3/4$

(iii) Is $x(t) \in a.\,0$? $X_k \in \mathbb{R}$ c.c. $\therefore x(t) = c_0 + 2\sum_{k=1}^{\infty} c_k \cos(k\pi t)$ ↓ even

(iv) One freq. comp of $x(t)$ is $A\cos(3\pi t)$. $A = ?$

$k = 3 \quad X_3 = \frac{3}{4 + (3\pi)^2} = \frac{3}{4 + 9\pi^2} = c_3 - jd_3$. $A = 2c_3 = \frac{6}{4 + 9\pi^2} \doteq 0.064\,636\ldots$

(4.9) $x(t) \leftrightarrow X_k$, $\Omega_0 = 2\pi/T_0$

$y(t) = 2x(t) - 3$. Note, this doesn't change Ω_0 of signal

$Y_k = 2X_k - \mathcal{F}\{3\}$ Fourier transform is linear → superposition applies.

$Y_k = 2X_k - 3\delta(k)$ ← DC signal, FS = {3} ← $k = 0$

↑ Kronecker δ understood when $k \in \mathbb{Z}$.

$= \begin{cases} 2X_0 - 3, & \text{when } k = 0 \\ 2X_k, & \text{otherwise} \end{cases}$