EE3210 Signals and Systems

Tutorial 8

Problem 1: Consider the following three discrete-time periodic signals:

$$x[n] = 1 + \cos\left(\frac{2\pi}{6}n\right), \quad y[n] = \sin\left(\frac{2\pi}{6}n + \frac{\pi}{4}\right), \quad z[n] = x[n]y[n].$$

(a) Determine the Fourier series coefficients of $x[n]$.

(b) Determine the Fourier series coefficients of $y[n]$.

(c) Use the results of parts (a) and (b), along with the multiplication property of the discrete-time Fourier series, to determine the Fourier series coefficients of $z[n]$.

(d) Determine the Fourier series coefficients of $z[n]$ through direct evaluation, and compare your result with that of part (c).

Problem 2: Compute the Fourier transform of the following continuous-time signal:

$$x(t) = \sum_{k=0}^{+\infty} \alpha^k \delta(t - kT), \ |\alpha| < 1.$$

Problem 3: Determine the continuous-time signal corresponding to each of the following Fourier transforms:

(a) $X(\omega) = 2\pi\delta(\omega - \omega_0)$, where ω_0 is a real number.

(b) $X(\omega) = 2[\delta(\omega - 1) - \delta(\omega + 1)] + 3[\delta(\omega - 2\pi) + \delta(\omega + 2\pi)]$