1. Exercise 12.9

2. A certain sound effect can be modeled using the following LTI system with the following frequency response:

\[ H(e^{j\omega}) = \frac{\omega}{\omega^2 - \pi^2} \]  

(a) Let \( x(t) = 1 + \sin^2 \pi t \), determine the appropriate values of \( c_i \) and \( \omega_i \) so that \( x(t) = \sum_i c_i e^{j\omega_i t} \).

(b) Using the result in (a) and the property of an LTI system with an input as a linear combination of complex exponentials, determine the output \( y(t) \).

(c) Describe what happen if we feed \( x(t) = \sin \pi t \) into the system?

3. Determine the DTFS representations of the following signals:

(a) \( x[n] = \cos(\frac{6\pi n}{17} + \frac{\pi}{3}) \)

(b) \( x[n] = 2\sin(\frac{14\pi n}{19}) + \cos(\frac{10\pi n}{19}) + 1 \)

(c) \( x[n] = \sum_{m=-\infty}^{\infty} (-1)^m (\delta[n-2m] + \delta[n+3m]) \)

4. Determine the time-domain signals represented by the following DTFS coefficients

(a) \( X[k] = \cos(\frac{8\pi k}{27}) \)

(b) \( X[k] = \cos(\frac{10\pi k}{19}) + j2\sin(\frac{17\pi k}{19}) \)

(c) \( X[k] = \sum_{m=-\infty}^{\infty} (-1)^m (\delta[k-2m] - 2\delta[k+3m]) \)

5. Determine the FS representations of the following signals:

(a) \( x(t) = \sin(3\pi t) + \cos(4\pi t) \)

(b) \( x(t) = \sum_{m=-\infty}^{\infty} \delta(t - \frac{m}{3}) + \delta(t - \frac{2m}{3}) \)

(c) \( x(t) = \sum_{m=-\infty}^{\infty} e^{j\frac{2\pi}{3}m} \delta(t - 2m) \)

6. Determine the time-domain signals represented by the following FS coefficients:

(a) \( X[k] = j\delta[k-1] - j\delta[k+1] + \delta[k-3] + \delta[k+3], \omega_0 = 2\pi \)

(b) \( X[k] = j\delta[k-1] - j\delta[k+1] + \delta[k-3] + \delta[k+3], \omega_0 = 4\pi \)

(c) \( X[k] = (-\frac{1}{3})^{|k|}, \omega_0 = 1 \)