- Representation of Aperiodic Signals:
  the Discrete-Time Fourier Transform
- The Fourier Transform for Periodic Signals
- Properties of Discrete-Time Fourier Transform
- The Convolution Property
- The Multiplication Property
- Duality
- Systems Characterized by
  Linear Constant-Coefficient Difference Equations

Problem 5.1-5.2 (p.400) – FT of Aperiodic Signals [SS5:5]

5.1. Use the Fourier transform analysis equation (5.9) to calculate the Fourier transforms of:

(a) $(\frac{1}{2})^{n-1}u[n-1]$ **(b)** $(\frac{1}{2})^{|n-1|}$

Sketch and label one period of the magnitude of each Fourier transform.

Problem 5.1-5.2 (p.400) – FT of Aperiodic Signals [SS5:5]

5.2. Use the Fourier transform analysis equation (5.9) to calculate the Fourier transforms of:

(a) $\delta[n-1]+\delta[n+1]$ **(b)** $\delta[n+2]-\delta[n-2]$

Sketch and label one period of the magnitude of each Fourier transform.

Problem 5.4-5.5 (p.400) – IFT [SS5:5]

5.4. Use the Fourier transform synthesis equation (5.8) to determine the inverse Fourier transforms of:

(a) $X_1(e^{j\omega}) = \sum_{k=-\infty}^{\infty}\{2\pi\delta(\omega - 2\pi k) + \pi\delta(\omega - \frac{\pi}{2} - 2\pi k) + \pi\delta(\omega + \frac{\pi}{2} - 2\pi k)\}$

(b) $X_2(e^{j\omega}) = \begin{cases} 2j, & 0 < \omega \leq \pi \\ -2j, & -\pi < \omega \leq 0 \end{cases}$

Problem 5.4-5.5 (p.400) – IFT [SS5:5]

5.5. Use the Fourier transform synthesis equation (5.8) to determine the inverse Fourier transform of $X(e^{j\omega}) = |X(e^{j\omega})|e^{j\sphericalangle X(e^{j\omega})}$, where

$$|X(e^{j\omega})| = \begin{cases} 1, & 0 \le |\omega| < \frac{\pi}{4} \\ 0, & \frac{\pi}{4} \le |\omega| \le \pi \end{cases} \quad \text{and } \sphericalangle X(e^{j\omega}) = -\frac{3\omega}{2}.$$

Use your answer to determine the values of n for which $x[n] = 0$.

Problem 5.3 (p.400) – FT of Periodic Signals [SS5:18]

5.3. Determine the Fourier transform for $-\pi \leq \omega < \pi$ in the case of each of the following periodic signals:

(a) $\sin(\frac{\pi}{3}n + \frac{\pi}{4})$ **(b)** $2 + \cos(\frac{\pi}{6}n + \frac{\pi}{8})$