EE-3032, HW-1

Signal properties

1. Consider a triangular pulse, defined as

$$\Delta(t) \triangleq \begin{cases} 1-2|t| & |t| < \frac{1}{2} \\ 0 & |t| \geq \frac{1}{2} \end{cases}$$

   Plot the following signals:
   a. $x_1(t) = 6\Delta(t-3)$
   b. $x_2(t) = -3\Delta(2t)$
   c. $x_3(t) = \Delta\big(2(t-3)\big)$
   d. $x_4(t) = \Delta(-3t+2)$

2. State whether each of the following signals is even, odd, or neither. Justify your answer.
   a. $x_1(t) = rect\left(\frac{t}{T}\right)$
   b. $x_2(t) = A\cos(\omega_0 t)$
   c. $x_3(t) = A\sin(\omega_0 t)$
   d. $x_4(t) = x_1(t)x_2(t)$
   e. $x_5(t) = x_1(t)x_3(t)$
   f. $x_6(t) = x_2(t)x_3(t)$
   g. $x_7(t) = x_1(t) + x_2(t)$
   h. $x_8(t) = x_2(t) + x_3(t)$

3. Determine whether each of the following signals is periodic and state the period, if one exists.
   a. $x_1(t) = e^{(-2+j5)t}$
   b. $x_2(t) = e^{j(100\pi t + \pi/6)}$
   c. $x_3(t) = \sum_{n=-\infty}^{\infty} \Delta\left(\frac{t-nT_0}{T_1}\right)$
   d. $x_4(t) = 5\cos(400\pi t) + 3\sin(500\pi t) + \cos(300\pi t)$

4. [Learning objective: power/energy] Calculate the energy or power (as applicable) of the following signals:
   a. $x_1(t) = \Delta\left(\frac{t}{T}\right)$
   b. $x_2(t) = e^{j2\pi t}$
   c. $x_3(t) = A\cos(\omega_0 t) + B\sin(\omega_0 t)$
   d. $x_4(t) = A\, rect\left(\frac{t}{T}\right)\cos(\omega_0 t)$

Additional problems from the Chaparro text: 1.3, 1.4