DE2.3 Electronics 2 for Design Engineers

Tutorial Sheet 1 – Signals in Time and Frequency Domains
(Lectures 1 & 2)
* indicates level of difficulty

1.* Sketch each of the following continuous-time signals. For each case, specify if the signal is causal/non-causal, periodic/non-periodic, odd/even. If the signal is periodic specify its period.

(i) $x(t) = 2\sin(2\pi t)$

(ii) $x(t) = \begin{cases} 3e^{-2t}, & t \geq 0 \\ 0, & t < 0 \end{cases}$

(iii) $x(t) = 1/|t|$

2.* Sketch the signal

$$x(t) = \begin{cases} 1-t, & 0 \leq t \leq 1 \\ 0, & \text{otherwise} \end{cases}$$

Now sketch each of the following and describe briefly in words how each of the signals can be derived from the original signal $x(t)$.

(i) $x(t+3)$

(ii) $x(t/3)$

(iii) $x(t/3+1)$

(iv) $x(-t+2)$

(v) $x(-2t+1)$

3.** Sketch each of the following signals. For each case, specify if the signal is causal/non-causal, periodic/non-periodic, odd/even. If the signal is periodic specify its period.

(i) $x[n] = \cos(n\pi)$

(ii) $x[n] = \begin{cases} 0.5^{-n}, & n \leq 0 \\ 0, & n > 0 \end{cases}$

4.* Sketch the spectrum of the time domain signal.

(i) $x(t) = \sin(2\pi \times 350t) + 0.35 \times \sin(6283t) + 0.1$

(ii) $y(t) = 1.5 \times \cos(2199t) + \sin(2\pi \times 1000t \div \pi/2)$

5.** (Optional Challenge)

It could be interesting to explore generating the signals in 4) in Matlab using the two functions provided in Lab 1 (i.e. sine_gen and plot_spec) to find out in practice the spectrum of the x(t) and y(t).