DE2.3 Electronics 2 for Design Engineers

Tutorial 4

Selected Questions from Problem sheets 1 & 2

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Sheet 1 Q1

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

(ii) \( x(t) = \begin{cases} 3e^{-2t} & t \geq 0 \\ 0 & t < 0 \end{cases} \)
**Sheet 1 Q4 (i)**

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

\[ x(t) = \sin(2\pi \times 350t) + 0.35 \times \sin(6283t) + 0.1 \]

(i) We will only consider the magnitude of spectra.

Let \( x(t) = \sin(2\pi \times 350t) + 0.35 \sin(2\pi \times 1000t) + 0.1 \)

\[ \sin(\omega t) = \frac{e^{j\omega t} - e^{-j\omega t}}{2j} \]

\[ \therefore |\sin(\omega t)| = \frac{1}{2} |e^{j\omega t}| + \frac{1}{2} |e^{-j\omega t}| \]

**Sheet 2 Q1 a)**

1.* Derive from first principle the Fourier transform of the signals \( f(t) \) shown in Fig. Q1 (a)

\[ f(t) = e^{-at} u(t) \]

\[ F(\omega) = \int_0^T e^{-at} e^{-j\omega t} \, dt \]

\[ = \int_0^T e^{-(a+j\omega t)} \, dt \]

\[ = \left[ -\frac{e^{-(a+j\omega t)}}{a+j\omega} \right]_0^T \]

\[ = 1 - \frac{e^{-(a+j\omega T)}}{a+j\omega} \]