The supply current was sampled 1024 times over a very short time interval. The data so obtained is given in column B of the accompanying *Excel* worksheet[1]. This worksheet has been set up to give a graph showing the spectral components of the data.

Question 3

i) Obtain the Fourier Transform for the data using the Fourier Analysis tool of *Excel*. The transformed data should commence in cell D2.

ii) Identify the principal frequencies in the current waveform.

iii) *Estimate* the total harmonic distortion [*THD*] present in the current waveform using the formula:

$$THD(I) = \frac{1}{I_1}\sqrt{\sum_{n=2}^{\max}\left(I_n\right)^2} \times 100\%$$

where I_1 is the r.m.s. value of the fundamental current, I_n the r.m.s value of the nth harmonic and n(max) is the number of the highest measurable or significant harmonic.

[Note the vertical axis of the spectrum graph is scaled in (current)^2.]

iv) Attempt to synthesise the shape of the original waveform from its principal harmonics [e.g. sketch the waveforms of the harmonics on the same time axis and add them together].

Q4. *Sketch*, on a set of common axes, waveforms to represent the transient response of circuits having transfer functions with the following parameters:

a) $\zeta = 0.5$, $\omega_o = 1\times10^3$ rad s^{-1}

b) $\zeta = 0.2$, $\omega_o = 2\times10^3$ rad s^{-1}

c) $\zeta = 2$, $\omega_o = 1\times10^3$ rad s^{-1}

[1] The spreadsheet can be found with the assessment material on Blackboard .