Harmonic distortion is a serious problem for the electrical supply industry and can cause overheating of induction motors and transformers and cause the neutral conductor to carry more than its rated current.

Harmonic distortion is caused by consumer loads requiring non-sinusoidal currents. There are two main types of load that generate harmonic currents:

- Computers and other office equipment. The typical waveform of the current taken by such devices is shown in FIGURE 3(a).

- Variable speed motor drives as used in the manufacturing industry and in lifts. A typical current waveform of such loads is given in FIGURE 3(b).
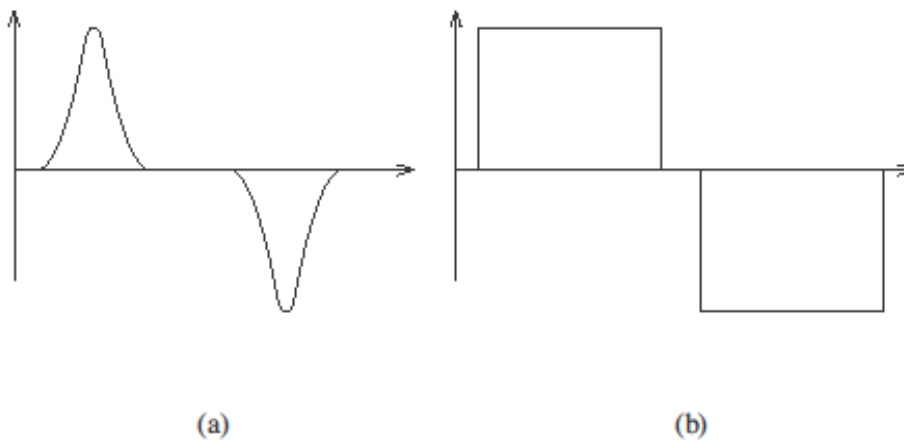

(a)   (b)

FIG. 3

The table below gives the complex Fourier coefficients obtained from a load's current waveform.

(a) Use Excel's Fourier Analysis 'inverse' function to transform the complex coefficients back to the original time domain values.

(b) Use the time domain values to plot a graph of the waveform and hence state if the waveform is from a TYPE A or TYPE B load (as per FIGURE 3).

Z
0
2.59738491749831-26.3716916295659i
–2.78215766452878+13.9868511002062i
–4.16470087261765+13.7291788494004i
6.69411254969542-16.1610173055266i
0.695967816626094-1.30206420374779i
–6.20637559204784+9.28849747632525i
2.44961290075565-2.98486195589656i
2.8-2.8i
–2.46629234795245+2.0240338219476i
-0.349259326562553+0.2333676211103179i
0.944299931009285-0.504738828802029i
–9.411254969543E-002+3.89826944733613E-002i
0.261691425185339-7.93832259584528E-002i
–0.6622074168608+0.13172124498415i
–0.317963770504591+3.1316697973736E-002i
1.2
–0.317963770504578-3.13166979737343E-002i
–0.662207416860802-0.1317212449841511i
0.26169142518533+7.93832259584484E-002i
–9.41125496954309E-002-3.89826944733596E-002i
0.944299931009295+0.504738828802031i
–0.349259326562552-0.2333676211103176i
–2.46629234795247-2.0240338219476i
2.8+2.8i
2.44961290075566+2.98486195589656i
–6.20637559204786-9.28849747632524i
0.695967816626093+1.30206420374778i
6.69411254969544+16.1610173055266i
–4.16470087261769-13.7291788494004i
–2.78215766452882-13.9868511002062i
2.59738491749838+26.3716916295658i