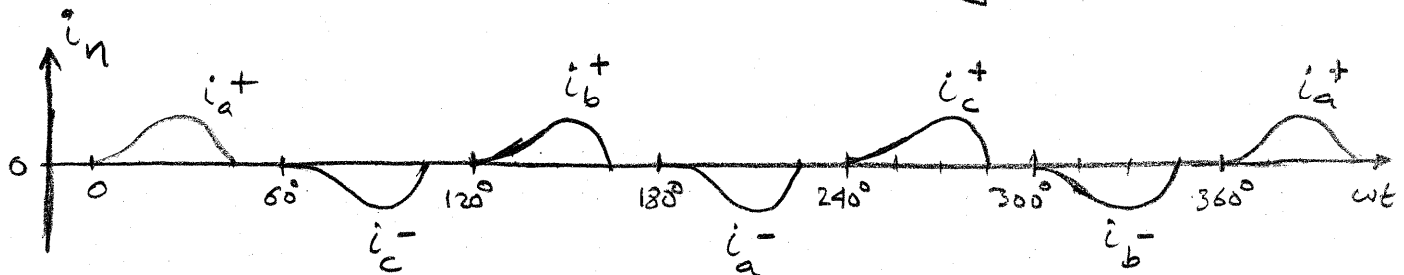



Problem 5-21

If the load currents flow for less than 60 degrees per half-cycle of the line-to-neutral voltages, then the neutral-current will have the following waveform.



where the superscripts + and - refer to the phase current waveforms in the positive and the negative half-cycles, respectively.

Considering only i_a , let's say that its rms value is I_{line} . If the area under the square of each pulse  is A , then the rms value

$$I_{line} = \sqrt{\frac{2A}{2\pi}} \quad \text{for phase A.}$$

In the i_n waveform, the rms value will be

$$I_n = \sqrt{\frac{6A}{2\pi}} \quad \text{because it has 6 pulses in } 2\pi \text{ radians.}$$

$$\therefore I_n = \sqrt{3} I_{line}$$