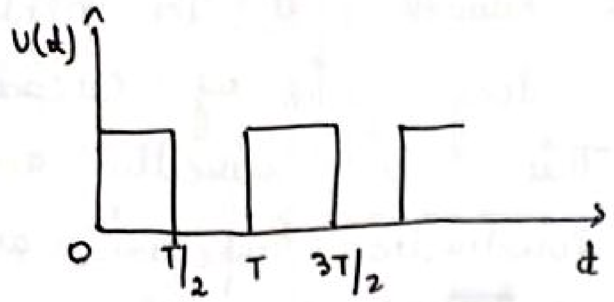
Q5

a) 

$v(t) = V$, for $0 < t < T/2$

$= 0$, for $T/2 < t < T$

$$a_0 = \frac{1}{T}\int_0^T v(t)\,dt = \frac{1}{T}\int_0^{T/2} V\,dt = V/2$$

$$a_n = \frac{2}{T}\int_0^T v(t)\cos n\omega t\,dt = \frac{2}{T}\int_0^{T/2} V\cos\left(n\frac{2\pi}{T}\right)dt = 0$$

$$b_n = \frac{2}{T}\int_0^T v(t)\sin n\omega t\,dt = \frac{2}{T}\int_0^{T/2} V\sin\left(n\frac{2\pi}{T}\right)dt$$

$$= \frac{V}{n\pi}(1-\cos n\pi) : \quad n = \pm 1, \pm 2, \pm 3$$

$= \frac{2V}{n\pi} \rightarrow$ for even n

$= \frac{V}{n\pi} \rightarrow$ for add n.

Fourier series of square wave is

$$v(t) = V\left[\frac{1}{2} + \frac{2}{\pi}\sin\omega t + \frac{2}{3\pi}\sin\omega t + \frac{2}{5\pi}\sin\omega t + \cdots\right]$$

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(b) Given,

$$A(s) = 4s^6 + 3s^5 + 2s^4 + 5s^3 + 2s^2 + 3s + 4$$
$$= M(s) + N(s)$$

$$M(s) = 4s^6 + 2s^4 + 3s^2 + 4$$
$$N(s) = 3s^5 + 5s^3 + 3s$$

Using continued fraction method

$$3s^5 + 5s^3 + 3s \; \big) \; 4s^6 + 2s^4 + 2s^2 + 4 \; \big(\; \frac{4}{3}s$$
$$4s^6 + \frac{20}{3}s^4 + 4s^2$$
$$(-) \quad (-) \quad (-)$$

$$\cancel{\frac{-14}{3}} \quad \frac{-14}{3}s^4 - 2s^2 + 4 \; \big) \; 3s^5 + 5s^3 + 3s \; \big(\; \frac{9s^2}{14}$$
$$3s^5 + \frac{9}{7}s^3 - \frac{18s}{7}$$
$$(-) \quad (-) \quad (+)$$

$$\frac{26}{7}s^3 + \frac{3s}{7}$$

$$\frac{26}{7}s^3 + \frac{3s}{7} \; \big) \; -\frac{14}{3}s^4 - 2s^2 + 4 \; \big(\; \frac{-14 \times 7}{3 \times 26}s$$

As we see negative quotients here this mean that A(s) is not Hurwitz., as there is root at origin, Thus A(s) is not hurwitz.

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