- Let $X(n)$ be a signal produced by sampling an oscilator with foundementa frequency f_o.

(5.13a)

- Let P_X be the power of $X(n)$.
- Let $X_i(n)$ be an ideal sinusoid of frequency f_o with Power P_{Xi}

- The spurious harmonic power will be given by.

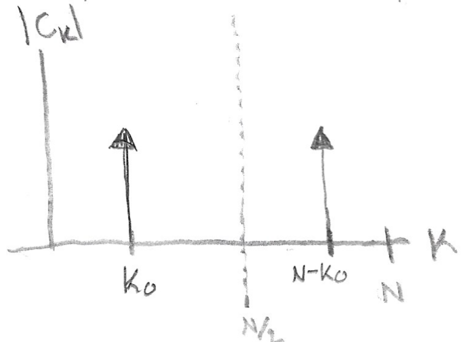
$$P_X - P_{Xi}$$

- Since P_i is the power of X_i, and X_i is a pure sinusoid of freq f_o

$$P_{Xi} = \frac{1}{N} \sum_{n=0}^{N-1} |X(n)|^2$$

$$P_{Xi} = \sum_{n=0}^{N-1} |C_K|^2 \quad \left\{ \text{eq } 4.2.11 \right.$$

- From the question we know the graph of the frequency components of a pure sinusoid has matching lines at. K_o and $N-K_o$



- From this graph we can see

$$P_{Xi} = \sum_{n=0}^{N-1} |C_K|^2 = |C_{K_0}|^2 + |C_{N-K_0}|^2$$

$$= 2|C_{K_o}|^2$$

- Using the above result we can calculate the sporious harmonic power by subtracting it from the sampled sinusoid power, P_X.

$$\text{Spurious Harmonic Power} = P_X - P_{Xi} = \underline{P_X - 2|C_{K_o}|^2}$$

$$\text{since } THD = \frac{\text{spurious Harmonic Power}}{\text{total power}}$$

it follows that:

$$\boxed{THD = \frac{P_X - P_{Xi}}{P_X} = \frac{P_X - 2|C_{K_o}|^2}{P_X} = 1 - \frac{2|C_{K_o}|^2}{P_X}}$$