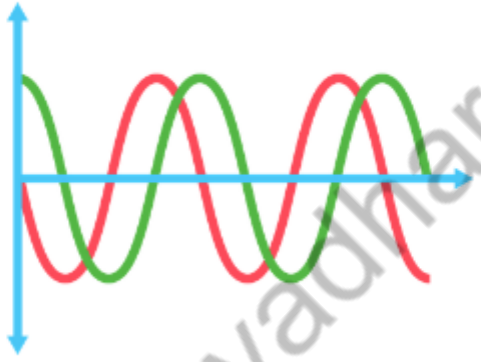
Course: Advanced Analog IC Design



Lecture 4: Total Harmonic Distortion

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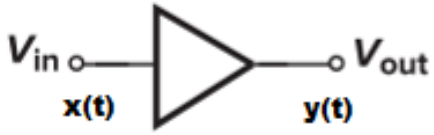
Total Harmonic Distortion

The network is linear and memoryless if out put is defined as :

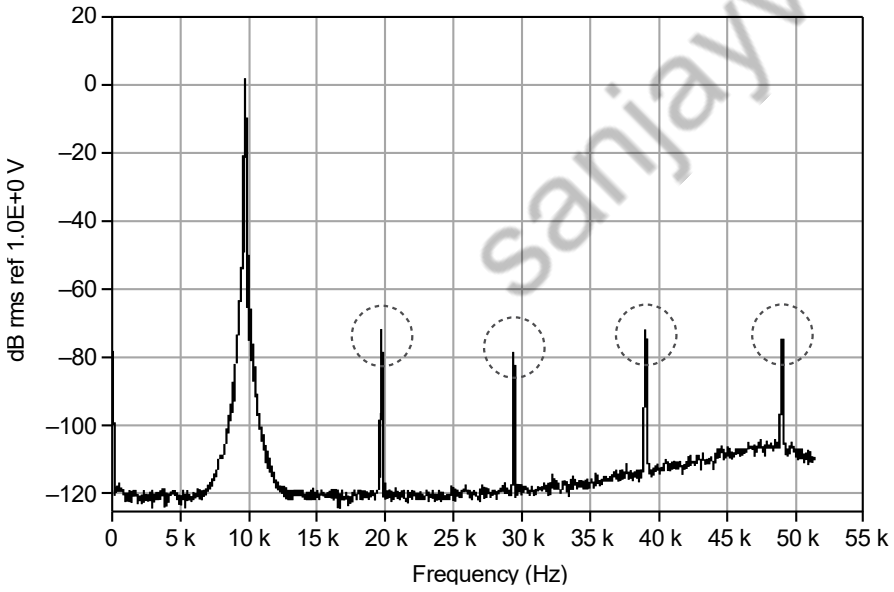


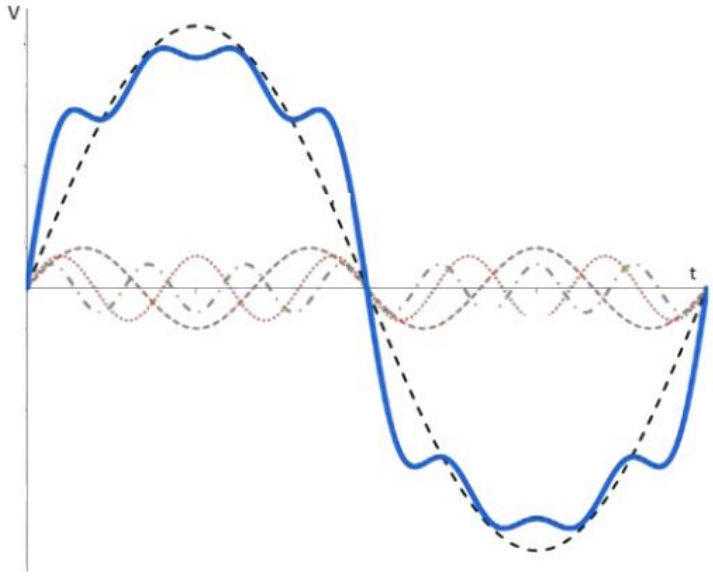
$$y(t) = \alpha_1 x(t)$$

and Non-Linear if out put is defined as :

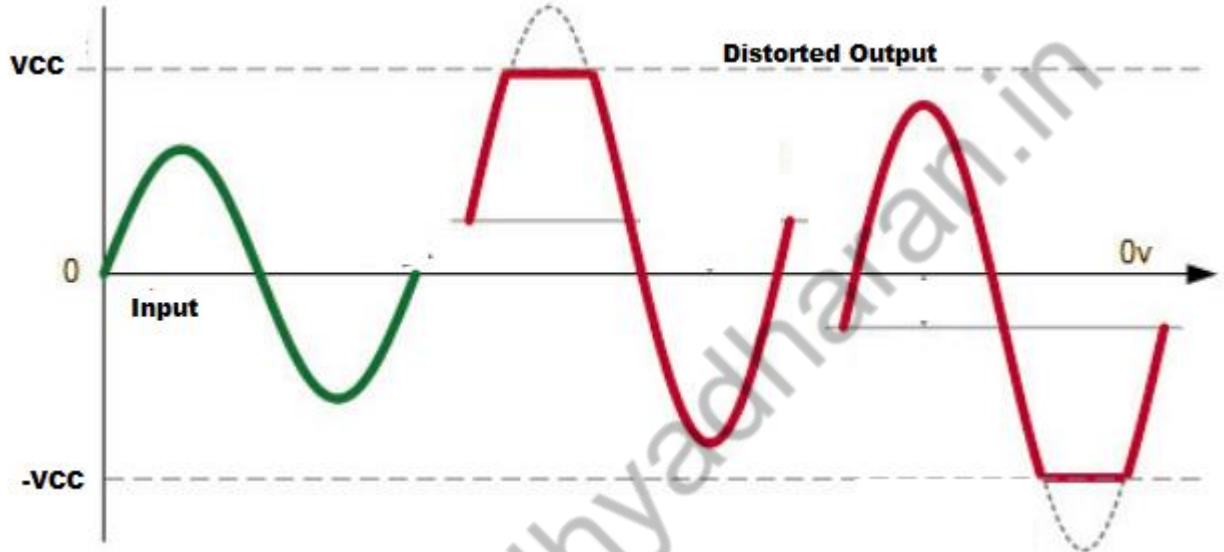
$$y(t) \approx \alpha_0 + \alpha_1 x(t) + \alpha_2 x^2(t) + \alpha_3 x^3(t) + \alpha_4 x^4(t) + \ldots$$

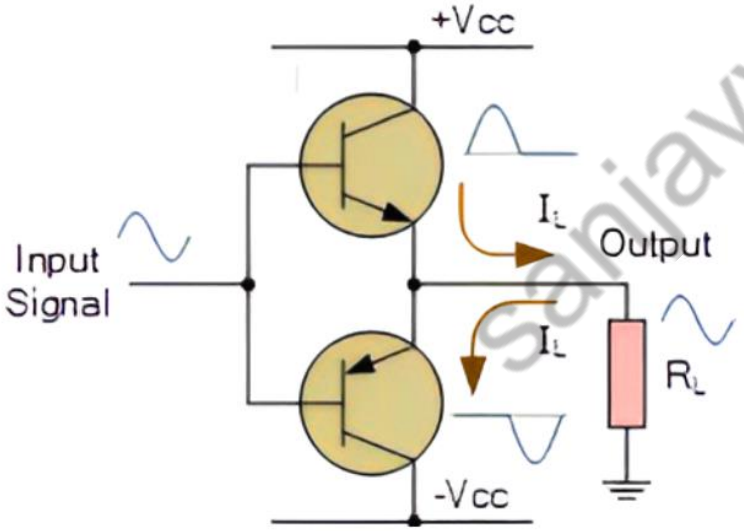
$$\cos^2(\omega t) = (1 + \cos(2\omega t)) / 2$$

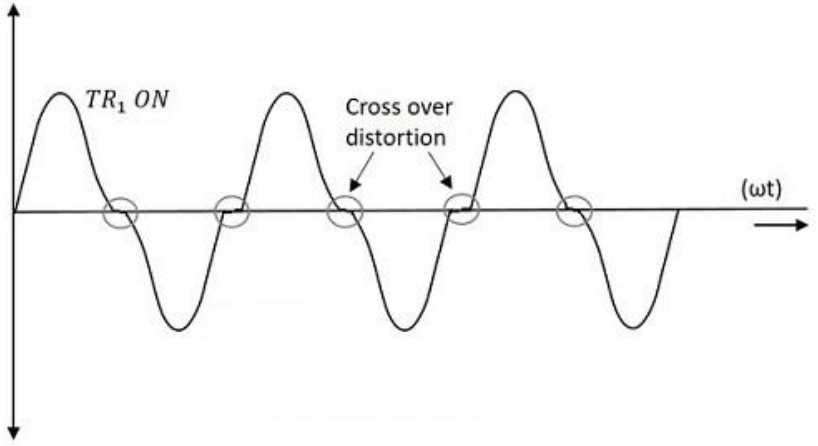




THD







THD

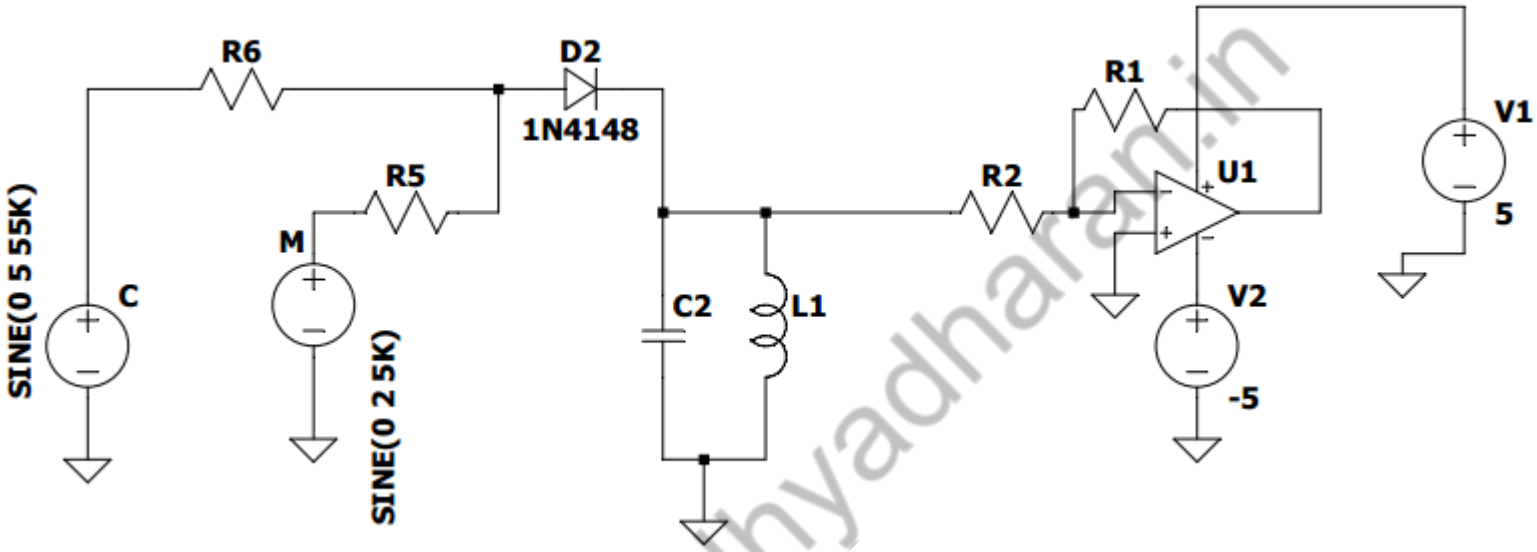
THD is defined as the ratio of the root mean square(RMS) value of all harmonic components (excluding the fundamental frequency) to the RMS value of the fundamental frequency component.

$$THD = \frac{\sqrt{V_2^2 + V_3^2 + V_4^2 + \ldots}}{V_1} \text{ (for voltage)}$$

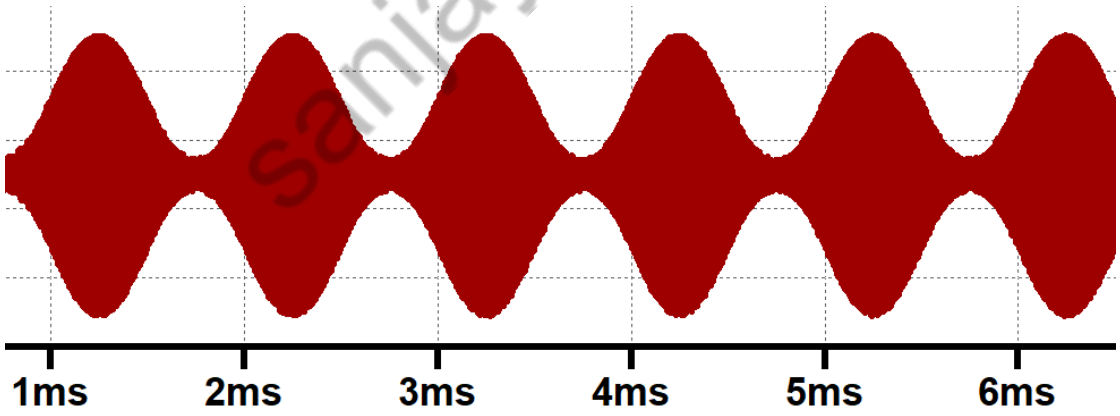
$$THD = \frac{\sqrt{I_2^2 + I_3^2 + I_4^2 + \ldots}}{I_1} \text{ (for current)}$$

High THD can lead to:

- Increased heating.
- Reduced efficiency
- Damage to sensitive devices.
- Errors in measurement



$$Vout = (a + b) + (a + b)^2 \ldots\ldots\ldots\ldots$$



Thank You