

Indian Institute of Information Technology, Allahabad
Department of Electronics and Communication Engineering

Course Name: Electronics Measurement and Instrumentation

EXPERIMENT NO: 06

Objective: To determine the unknown frequency and phase of signal using lissajous pattern on digital storage oscilloscope.

Materials Required:

Function generators, D.S.O, Bread board, BNC cables.

Theory:

Lissajous figure is the pattern which is displayed on the screen where sinusoidal signals are applied to both the horizontal and vertical plates of the DSO. These patterns will vary based on the amplitude, frequencies and phase difference of the sinusoidal signal which are applied in both the horizontal and vertical direction. We can measure these two from a lissajous figure.

- (1) Frequency
- (2) Phase difference between two sinusoidal signals.

Measurement of frequency:

$$f_v / f_H = n_H / n_v ,$$

Where f_v and f_H are vertical and horizontal frequency, respectively.

n_v and n_H are numbers of vertical and horizontal tangents, respectively.

Measurement of phase difference:

$$\phi = \sin^{-1}(X_1/X_2) \text{ if } 0 < \phi < 90^\circ \text{ or } 270^\circ < \phi < 360^\circ$$

$$\text{And } \phi = 180^\circ - \sin^{-1}(X_1/X_2), \text{ if } 90^\circ < \phi < 180^\circ \text{ or } 180^\circ < \phi < 270^\circ$$

Where X_1 is distance from origin to the point on x-axis where the elliptical diagram figure intersects.

And X_2 is the distance from origin to the vertical tangent of elliptically sloped.

Calculation:

$$\text{frequency of channel -2 } (f_v) \text{ (unknown) / frequency of channel-1 } (f_H) \text{ (known) } = n_H / n_v$$

$$f_v / 20 = 1/2$$

$$f_v = 10 \text{ kHz}$$

Result: We have performed and calculated unknown frequency and phase using lissajous pattern on DSO.

Precautions:

- (a) BNC cables should be fitted properly.
- (b) Check the components before use.