

**INDIAN INSTITUTE OF TECHNOLOGY, KANPUR**

# MANUAL

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## **Experiment No-4**

### **STUDY OF FREQUENCY AND PHASE MEASUREMENT USING LISSAJOUS PATTERNS**

**TRANSDUCERS AND INSTRUMENTATION**

**VIRTUAL LAB**

## **Experiment no-4**

**Aim:** - To study of frequency and phase measurement using Lissajous patterns.

### **Apparatus used:-**

- Personal computer.
- Lab view 2009 run time engine.
- Internet facility for performing (on-line experiment)

For (off-line experiment) executable file of the experiment can be downloaded through the download link given on the website.

### **Introduction: -**

An important electrical quantity with no equivalent in dc circuit is frequency. Frequency measurement very important in many application of alternating current especially in AC power system designed to run efficiently at one frequency and one frequency only. If the AC is being generated by an electromechanical alternator, the frequency will be directly proportional to the shaft speed of the machine and frequency could be measured simply by measuring the speed of the shaft. If frequency needs to be measured at some distance from the alternator, through, other means of measurement will be necessary.

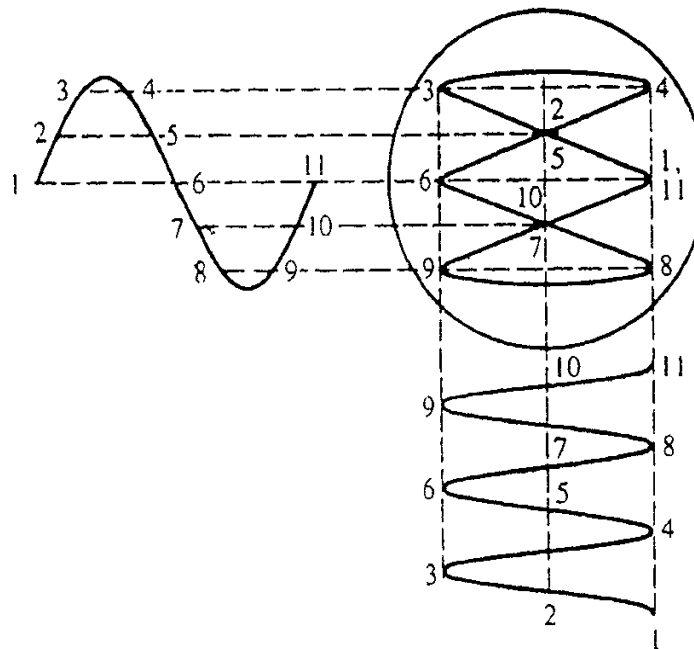
The Lissajous-pattern method is also called the X-Y phase measurement. To use this method, proceed as follow-

- Connect one signal to a vertical and the other to the horizontal input (often de noted X-Y).
- A display known as a Lissajous pattern will appear on the screen. The type of pattern will reveal the phase relationship, and in fact the pattern can be used to calculate the phase angle. It will define the angle by which the horizontal input leads the vertical input.

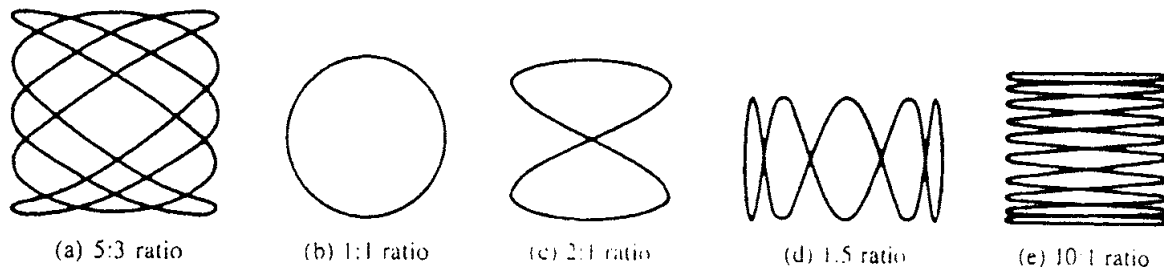
**Aim:** - (a) To study of frequency measurement using Lissajous patterns.

### Theory:-

If two different signals are both sine waves. The Lissajous method can be used to determine the frequency ratio of the two signals. If the frequency of one of the signals is known, the frequency of the other can be easily determined from the resulting Lissajous pattern on the oscilloscope screen providing that the frequencies are related by the ratio of two integers. The oscilloscope's internal time base generator is disabled, so the time base control probably reads some other method indicative that the sweep speed no longer applies consequently, one signal applied to the oscilloscope's horizontal amplifier, and the other is connected to the vertical input. The convention is to connect the known signal to the horizontal channel and the unknown to the vertical channel. A laboratory audio or RF oscillator with good frequency calibration and stability is often used as the known.



**Figure 1** Lissajous pattern when the sine wave is applied to the horizontal amplifier is three times the frequency of the sine wave signal applied to the vertical amplifier



**Figure 2 frequency measurement using Lissajous pattern**

The Lissajous pattern method of measuring an unknown frequency may seem simple. In theory this is so, but in practice it requires much skill and patience.

### **Procedure:-**

1. First start the program.
2. The experiment contains two types of transducer for the Lissajous pattern.
3. Select the frequency measurement using Lissajous pattern.
4. As we can see on the front panel there are two graph sinus A and sinus B we can set the frequency of the waves and get the Lissajous pattern accordingly.
5. The other graph give the frequency versus time of the Lissajous pattern obtained with their magnitudes alongside.
6. Finally stop the program

### **Result:-**

The frequency measurement using Lissajous pattern has been studied. Frequency versus time is plotted in the graph.

### **Precaution:-**

- Follow instructions carefully.
- For fetching correct value, wait until the process gets complete.
- Runtime engine should be properly installed.

**Aim:** - (b) To study of phase measurement using Lissajous patterns.

**Theory:-**

The horizontal control may an XY mode that lets you display an input signal rather than the time base on the horizontal axis. This mode of operation opens up a whole new area of phase shift measurement techniques. The phase of a wave is the amount of time that passes from the beginning of a cycle to the beginning of the next cycle, measured in degrees. Phase shift describes the difference in timing between two otherwise identical periodic signals.

One method for measuring phase shift is to use XY mode. This involves inputting one signal into the vertical system as usual and then another signal into the horizontal system. This set up is called an XY measurement because both the X and Y axis are tracing voltage. The waveform resulting from this arrangement is called a Lissajous pattern.

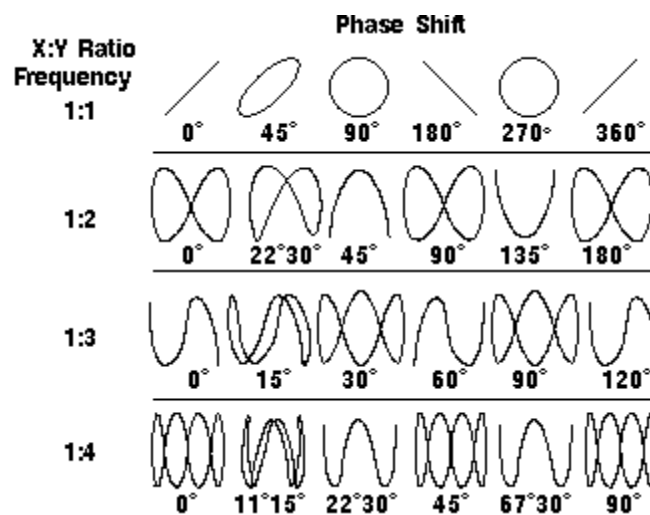


Figure 3 Lissajous pattern

### **Procedure:-**

7. First start the program.
8. The experiment contains two types of transducer for the Lissajous pattern.
9. Select the phase measurement using Lissajous pattern.
10. As we can see on the front panel there are two graph sinus A and sinus B we can set the phase of the waves and get the Lissajous pattern accordingly.
11. The other graph gives the phase versus time of the Lissajous pattern obtained with their magnitudes alongside.

### **Result:-**

The phase measurement using Lissajous pattern has been studied and the graph phase versus time is plotted in the graph.

### **Precaution:-**

- Follow instructions carefully.
- For fetching correct value, wait until the process gets complete.
- Runtime engine should be properly installed.