# Lab Report 1

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## Contents

# 1 Objective

1. Observing and analyzing Lissajous figures on a Cathode Ray Oscilloscope (CRO)
2. Capturing a one-time event using a CRO

# 2 Apparatus and procedure

## 2.1 Materials

- Cathode ray Oscilloscope
- Function Generator (2 channels)
- Probes
- Connecting wires

## 2.2 Procedure

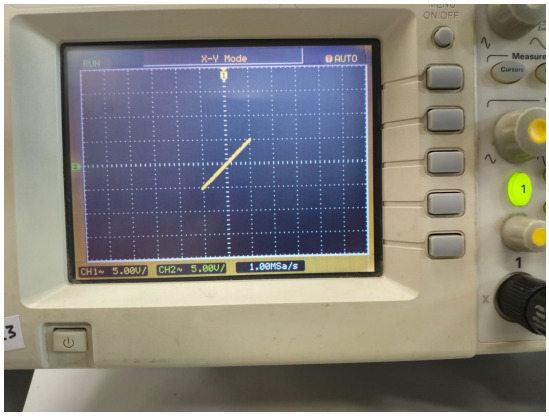
1. Connect the probe to function generator and turn it off.
2. Press Mode/Coupling button and then change sweep mode from auto to normal.
3. In the Trigger menu, press Mode until "Edge" is selected.
4. Then select Single mode. Wait until mode will initiate.
5. Turn on the signal and get a captured one-time event.

# 3 Results

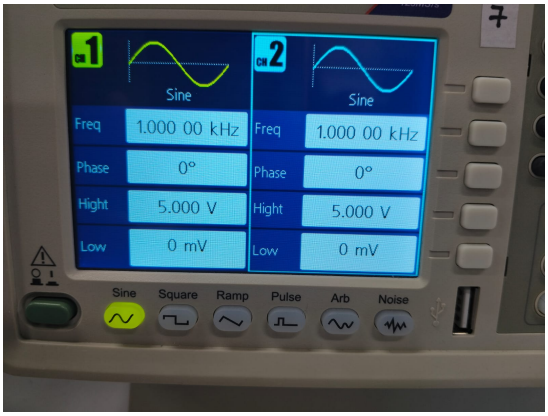
The functions plotted on X and Y axis respectively, are:

$$V_1(t) = A_x \sin(2\pi f_x t),$$
$$V_2(t) = A_y \sin(2\pi f_y t + \phi),$$

Where:
$A_x$ and $A_y$ = Amplitudes of the signals.
$f_x$ and $f_y$ = Frequencies.
$\phi$ = Phase Difference.

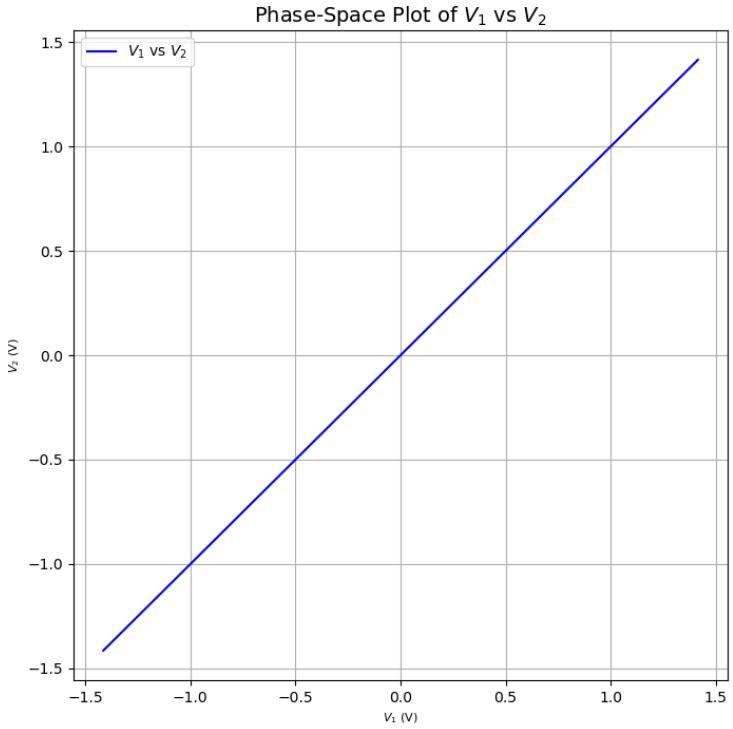



(a) Plot



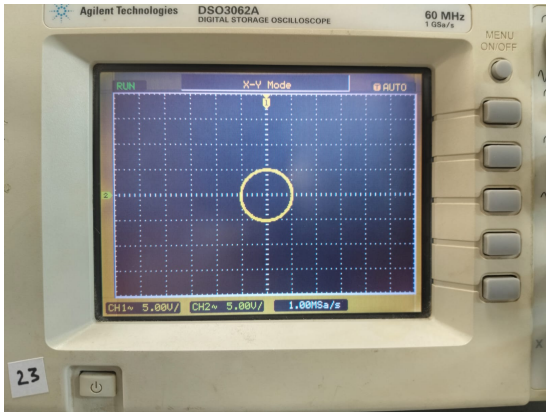

(b) Parameters used

Figure 1: Case 1

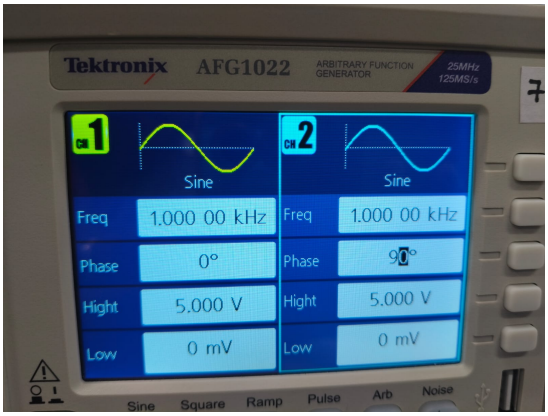



| Parameter | Value |
|---|---|
| $V_1(t)$ | 5 V |
| $V_2(t)$ | 5 V |
| $f_x$ | 1000 Hz |
| $f_y$ | 1000 Hz |
| $\phi$ | 0° |

Table 1: Data Table

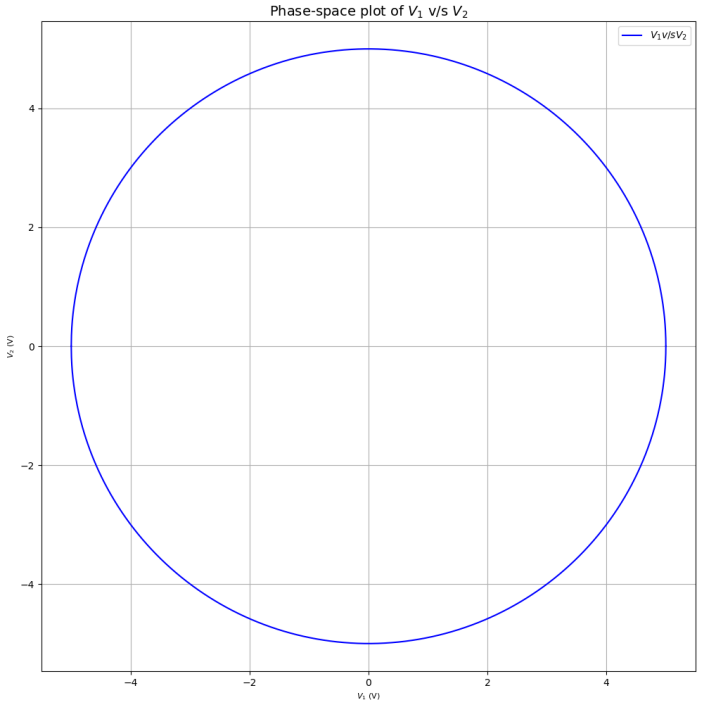



(a) Plot



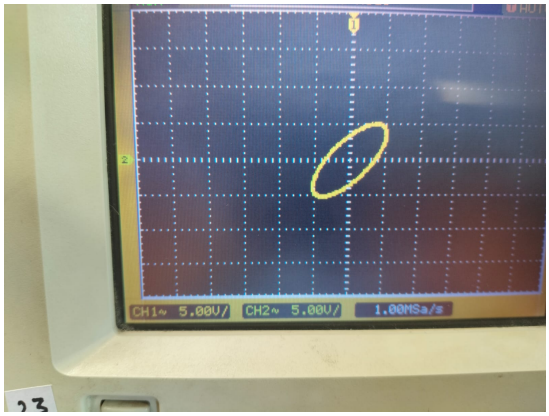

(b) Parameters used

Figure 2: Case 2

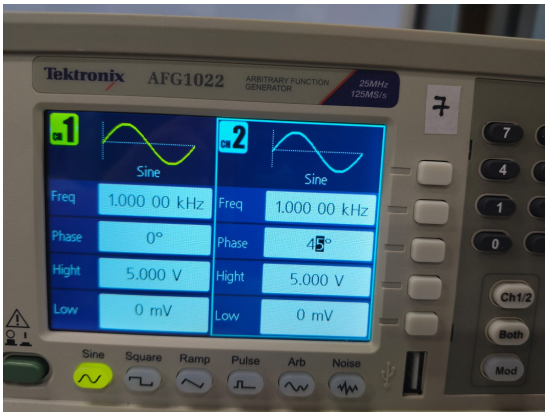



| Parameter | Value |
|---|---|
| $V_1(t)$ | 5 V |
| $V_2(t)$ | 5 V |
| $f_x$ | 1000 Hz |
| $f_y$ | 1000 Hz |
| $\phi$ | 90° |

Table 2: Data Table

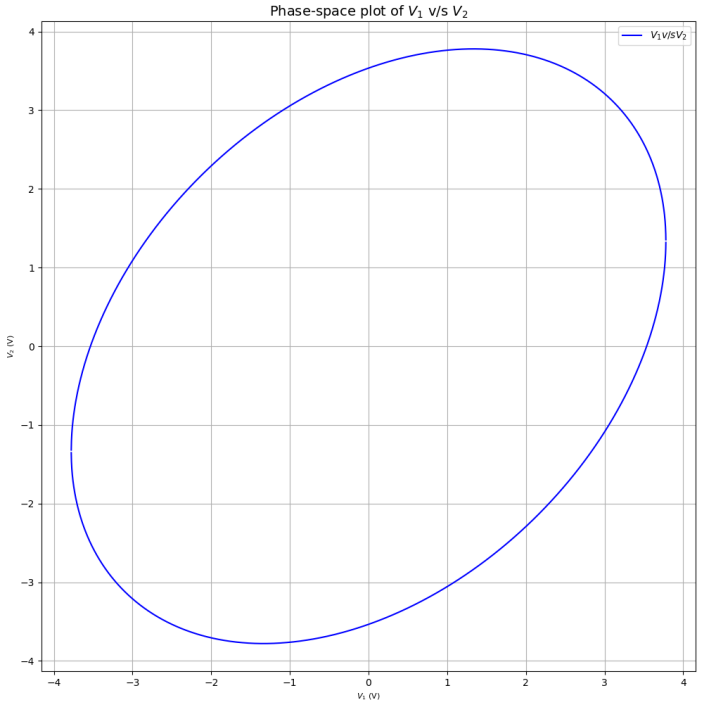



(a) Plot



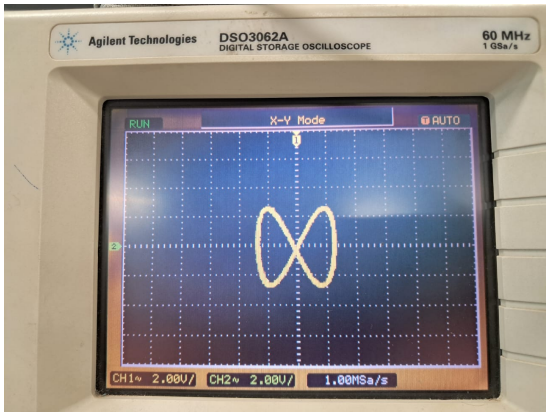

(b) Parameters used

Figure 3: Case 3

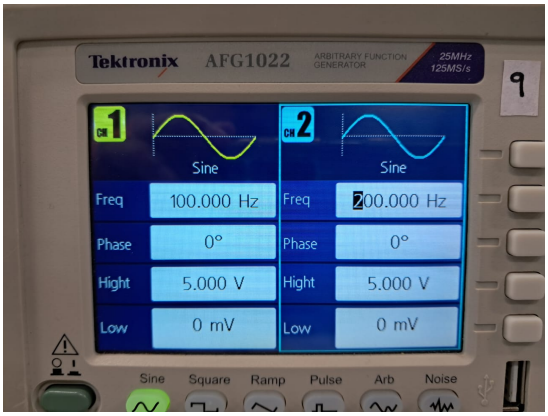



| Parameter | Value |
|---|---|
| $V_1(t)$ | 5 V |
| $V_2(t)$ | 5 V |
| $f_x$ | 1000 Hz |
| $f_y$ | 1000 Hz |
| $\phi$ | 45° |

Table 3: Data Table

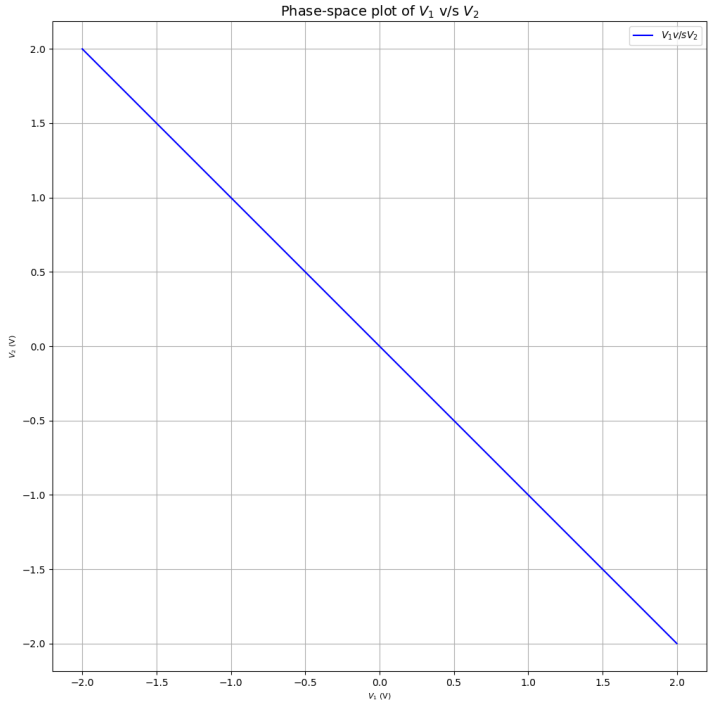



(a) Plot



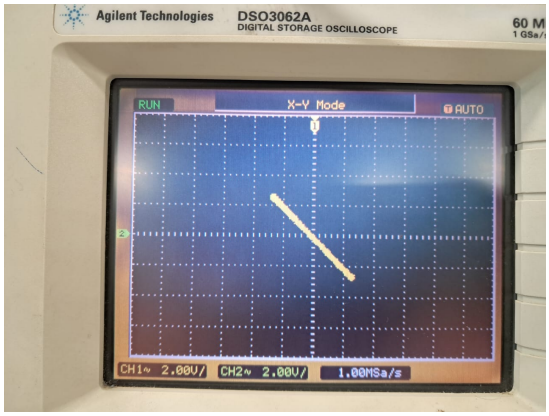

(b) Parameters used

Figure 4: Case 4

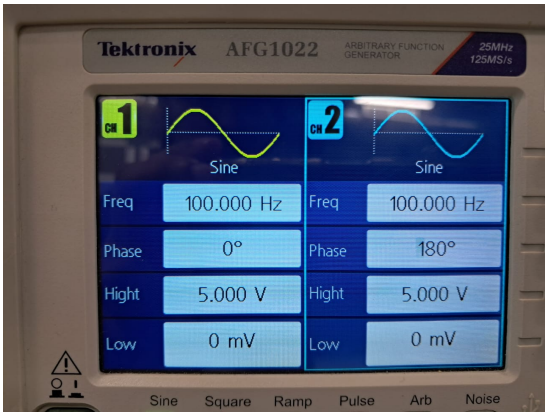



| Parameter | Value |
|---|---|
| $V_1(t)$ | 5 V |
| $V_2(t)$ | 5 V |
| $f_x$ | 100 Hz |
| $f_y$ | 200 Hz |
| $\phi$ | 0° |

Table 4: Data Table

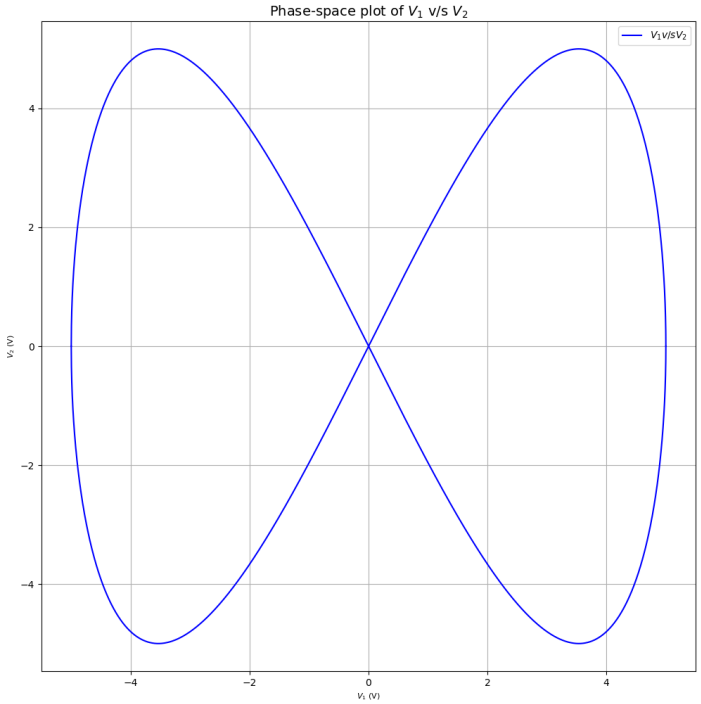



(a) Plot



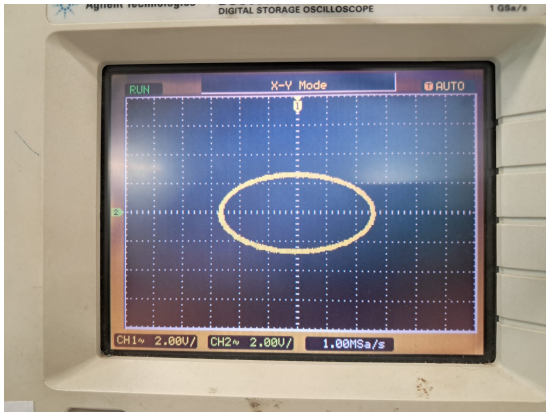

(b) Parameters used

Figure 5: Case 5

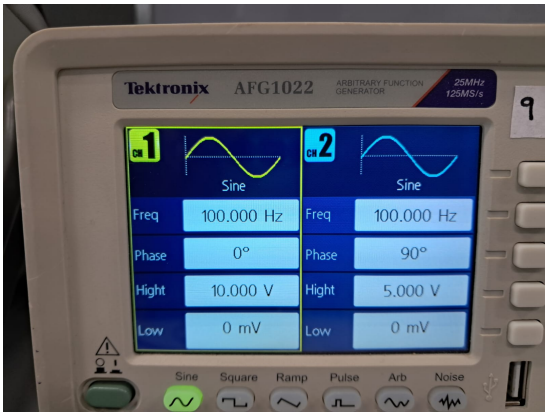



| Parameter | Value |
|---|---|
| $V_1(t)$ | 5 V |
| $V_2(t)$ | 5 V |
| $f_x$ | 100 Hz |
| $f_y$ | 100 Hz |
| $\phi$ | 180° |

Table 5: Data Table

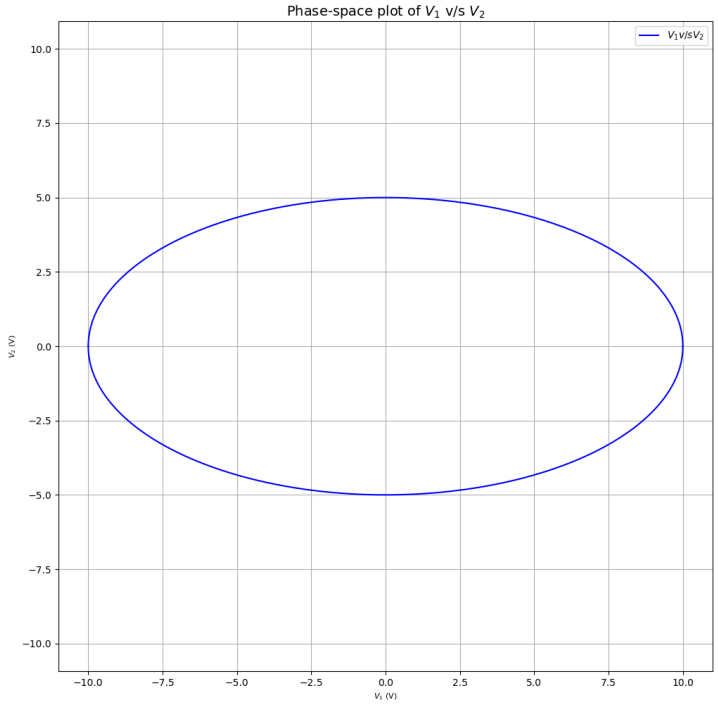



(a) Plot




(b) Parameters used

Figure 6: Case 6




| **Parameter** | **Value** |
|---|---|
| $V_1(t)$ | 10 V |
| $V_2(t)$ | 5 V |
| $f_x$ | 100 Hz |
| $f_y$ | 100 Hz |
| $\phi$ | 90° |

Table 6: Data Table

# 4 Theory

## 4.1 Case 1:

$$V_1 = 5\sin(2\pi 1000t)V$$
$$V_2 = 5\sin(2\pi 1000t)V$$
$$V_1 = V_2$$

## 4.2 Case 2:

$$V_1 = \sqrt{2}\sin(2\pi 5000t)V$$
$$V_2 = \sqrt{2}\cos(2\pi 5000t)V$$
$$V_1^2 + V_2^2 = 25$$

## 4.3 Case 3:

$$V_1 = 5\sin(2\pi 1000t)V$$
$$V_2 = 5\sin(2\pi 1000t + \frac{\pi}{4})V$$
$$2V_1^2 + 2V_2^2 - \sqrt{2}V_1V_2 = 25$$

## 4.4 Case 4:

$$V_1 = 5\sin(2\pi 100t)V$$
$$V_2 = 5\sin(2\pi 200t)V$$
$$V_2 = 2V_1(\sqrt{1 - \frac{V_1^2}{25}})$$

## 4.5 Case 5:

$$V_1 = 5\sin(2\pi 100t)V$$
$$V_2 = 5\sin(2\pi 100t + \pi)V$$
$$V_1 = -V_2$$

### 4.6 Case 6:

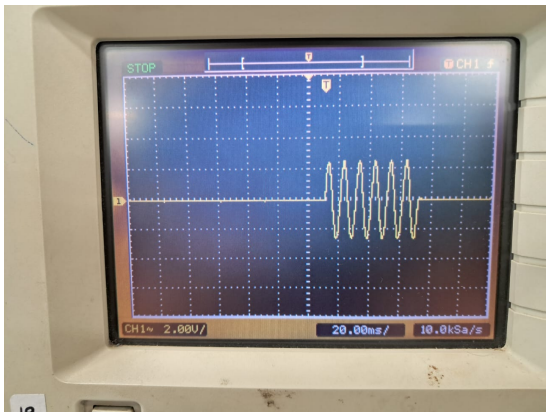
$$V_1 = 10\sin(2\pi 100t)V$$
$$V_2 = 5\sin(2\pi 100t + \frac{\pi}{2})V$$
$$\frac{V_1^2}{100} + \frac{V_2^2}{25} = 1$$

## 5 Capturing One time event Using CRO

### 5.1 Procedure

1. Connect probe to signal generator and then turn it off.
2. Press Mode/Coupling and change sweep mode from Auto to Normal.
3. In the Trigger menu, press Mode until "Edge" is selected.
4. Now press Single mode. After that wait mode will initiate.
5. Next, Turn on the signal and get a captured one-time event.

### 5.2 Plots




(a) Plot


(b) Parameters used

Figure 7: Plot for One time event