Expt No - 01

Aim: Characteristics graph for PN Junction in forward bias connection

Apparatus:-
(i) Bread Board.
(ii) P-N Junction diode (Si)
(iii) Resistor (1 kΩ)
(iv) DC power source (5V)
(v) connecting wires.

Theory: The P-N Junction supports uni-directional current flow. If +ve terminal of the input supply is connected to anode (P-side) and -ve terminal of the input supply is connected to cathode (N- side) then diode is ~~side~~ said to be forward biased. In this condition the hight of the potential barrier at the junction is lowered by an amount equal to given forward biasing voltage. Both the holes from p-side and electrons from n-side cross the junction simultaneously and constitute a forward current (injected minority current - due to holes crossing the junction and entering N-side of the diode, due to electrons crossing the junction and entering P-side of the diode). Assuming current flowing through the diode to be very large, the diode can be approximated as short-circuited switch.

Procedure:- (1) Connect the circuit using silicon PN Junction diode.

(2) Very V_f gradually in steps of 0.1 Volts upto 5 volts and note down the corresponding reading of I_F.

(3) Step size is not fixed because of non-linear curve and vary the x-axis variable & afion is more, decrease input step size and vice versa.

(4) Tabulate different forward currents obtained for different forward voltages.

Result:- The I-V characteristic curve of a p-n Junction diode is not a straight line, therefore, diode is ~~not~~ non-ohmic in nature.

Precaution:- (i) While doing the experiment do not exceed the rating of the diode. This may lead to damage the diode.

(ii) Connect voltameter and Ammeter in correct polarities as shown in the circuit diagram.

(iii) Do not switch "ON" the power supply unless you have checked the circuit connections as per the circuit diagram.

Expt No:- 02

Aim:- Designing of a Half wave Rectifier.

Apparates:- (i) Connecting wires.
(ii) Silicon Diode (p-n junction)
(iii) Voltage Source.
(iv) Load (Resistance).
(v) Transformer.

Theory:- A half-wave rectifier is defined as a type of rectifier that only allows one-half-cycle of an AC voltage waveform to pass, blocking other half cycle.

Half-wave rectifiers are used to convert AC voltage to DC voltage, and only require a single diode to construct.

Working Formula:-

- $V_{rms} = V_m / 2$ (rms voltage value (input)).
- $V_{dc} = V_m / \pi$ (Average value of input).
  V_m = peak value of output
- Ripple factor $(r) = V_{r,rms} / V_{dc}$, where $V_{r,rms}$ = rms value of the AC component.
- $V^2_{rms} = V^2_{r,rms} + V^2_{dc}$, ripple factor.
  $r = \sqrt{(V_{rms} / V_{dc})^2 - 1}$
  $= 1.21$

- $I_{rms} = I_m/2$, where I_{rms} is the RMS value of the lead current for a half-wave rectifier.

- Peak Inverse Voltage (PIV) : V_m
- Percentage Regulation : $\left(\frac{V_{no\,load} - V_{full\,load}}{V_{full\,load}}\right) * 100$,

where $V_{no\,load} = V_m/\pi$, $V_{full\,load} = \frac{V_m}{\pi} - I_{dc} \cdot R_f$

$= I_{dc} \cdot R_L$

- Transformer Utilization Factor (TUF) .

$= P_{dc}/ P_{ac\,rated}$.

- Rectification Efficiency : $\eta = \frac{\text{power in the load}}{\text{input power}}$

$= \frac{P_{dc}}{P_{ac}}$

- $P_{dc} = I^2_{dc} R_L / \pi^2$, $P_{ac} = (I^2_m/4) * (R_L + R_f)$

$\therefore \eta = \frac{4}{\pi^2} \left(\frac{R_L}{R_L + R_f}\right)$

Expt - 03

Aim:- Designing of full wave Rectifier.

Apparatus: (i) Connecting wires
(ii) Diodes
(iii) Power Source
(iv) Resistors

Theory: A full-wave rectifier is exactly the same as the half-wave but, allows unidirectional current through the load during the entire sinusoidal cycle. A full-wave rectifier converts the whole of the input waveform to one of constant polarity (positive or negative) at its output. Its output waveform is displayed in the diagram.

There are two types of full-wave rectifier:-
a) centre - Tapped full wave Rectifier.
b) Bridge full wave Rectifier.

Working formula:-

- $I_m = V_m/(R_f + R_L)$; $R_L \gg R_f$ (for every case)
- $I_{dc} = 2I_m/\pi$
- $V_{dc} = I_{dc} \cdot R_L = \frac{2I_m}{\pi} \times R_L = \frac{2V_m}{\pi}$ [Substituting value of I_m]
- $I_{rms} = \frac{I_m}{\sqrt{2}} = V_m/\sqrt{2}\,(R_f + R_L)$ [Substituting value of I_m]

- $V_{rms} = V_m/\sqrt{2}$
- η = power in the load / input power $= P_{dc}/P_{ac}$

$= 8/\pi^2(1 + \frac{R_f}{R_L})$

$= 0.812/(1 + R_f/R_L)$

- $\% \eta = 81.2/(1 + R_f/R_L)$
- Ripple Factor (r) = rms value of ac component / dc component in the output.

$= \sqrt{(I_{rms}/I_{dc})^2 - 1}$

$= \sqrt{(I_m/2\sqrt{2}/2I_m/\pi) - 1} = 0.48$

- Peak Inverse Voltage (PIV) $= 2V_m$
- % Regulation $= (V_{noload} - V_{fullload}/V_{full\ load}) * 100$,
  where, $V_{no\ load} = 2V_m/\pi$ $V_{Fullload} = \frac{2V_m}{\pi} - I_{dc} \cdot R_f$
- TUF = dc power delivered to the load / ac rating of transformer.

$= P_{dc}/P_{ac\ rated}$, where.

$P_{dc} = I_{dc}^2 R_L$ $P_{ac\ rated} = V_{ac(rms)} \cdot I_{rms}$

$= (V_m/\sqrt{2}) * (I_m/\sqrt{2})$

$\therefore TUF = \frac{\left[\left(\frac{2I_m}{\pi}\right)^2 R_L\right]}{\frac{V_m}{\sqrt{2}} \cdot \frac{I_m}{\sqrt{2}}}$

$= 0.812$.

Expt - 04

Aim:- Design Positive and Negative clipper Circuit (Series & Parallel) and draw the graph for that.

Apparatus: (i) Connecting Wires
(ii) Resistor.
(iii) Diode.
(iv) AC Voltage Source (for power).

Theory: A clipping circuit or a clipper is a device. used to clip the input voltage to prevent it from attaining a value larger than predefined value. The basic component required for a clipping circuit are - an ideal diode and a resistor.

Positive Diode clipper:-

In a positive clipper, the positive half cycles of the input voltage will be removed. The circuit arrangement are illustrated in the diagram.

Negative Diode Clipper:- The negative clipping circuit is almost the same as the positive clipping circuit, with only one difference. If the diode is reconnected with reversed polarity, the circuits will become for a negative series clipper and is illustrated in the diagram.

In this experiment, both the positive clipper circuit and negative clipper circuit are illustrated in series and parallel circuit form.

Reslt: The result of all the circuits, either in series connection or parallel is illustrated in the diagram.

Precautions:- (1) Properly connect the devices to prevent an accidental loss.

(ii) Do not keep the power on when building the circuit.

Expt No: 05

Aim: Design Positive and Negative clamper circuit (both ideal and practical case).

Apparatus: (i) Capacitor.
(ii) Diode
(iii) Dc battery (power supply) (if needed).
(iv) AC power supply.
(v) Resistor.

Theory: A Clamper circuit can be defined as the circuit that consists of a diode, a resistor and a capacitor that shifts the waveform to a desired DC level without changing the actual appearance of the applied signal.
It is also called level shifter.

Positive Clamper: A clamping circuit restores the DC level. When a negative peak of the signal is raised above to the zero level, then the signal is said to be positivity clamped.
It consists of a diode, a resistor and a capacitor and that shifts the output signal to be positivity clamped.
It consists of a diode, a resistor and ~~and a~~ a capacitor and that shifts the output signal to the positive portion of the input signal.

Negative clamper:- A Negative clamper is one that consists of a diode, a resistor and a capacitor and that shifts the output signal to the negative portion of the input signal.

Result: During Positive Half cycle.

During the internal of 0 - T/2, the network will appear with the diode in the ON state effectively "shorting out" the effect of the ressistor R.

During Negative Half cycle:-

The diode will now be in the open state condintion - Applying KVL around the input loop to get the result.

Expt No:- 06

Aim: Design Half Wave Capacitor filter.

Apparatus: (i) AC Voltage supply.
(ii) Diode.
(iii) Capacitor.
(iv) Resistor.
(v) Connecting wires.

Theory:- The main function of half wave rectifier is to change the AC (Alternating Current) into DC. However, the acquired output DC. This DC is not constant and varies with time. Whenever this changing DC is given to any type of electronics device, then it may not function correctly, and that may get damaged. Due to this reason, it will be applicable in most of the applications.

Precautions:- (i) The primary and secondary side of the transfer should be carefully indentified.
(ii) Polarities of all diodes should be carefully indentified.

(iii) All connections should be proper and clean.

Expt No — 07

Aim :- Implementation of Series & Shunt Regulator.

Apparatus: (i) Connecting wires.
(ii) DC voltage supply
(iii) Resistors.
(iv) Zener Diode.
(v) Transistor.

Theory:- Regulator is a circuit used to produces. a constant dc output votage by reducing the ripple to negligible amount. One part of power supply.

Fundamentally there are two basic types of linear regulator are the series regulator and shunt regulator.

Series Regulator circuit :-

- Control element in series with load between input and output.

- Output sample circuit senses a changes in output voltage.

Shunt Regulator Circuit :-

• The unregulated input voltage provides. current to the load.

• Some of the current is pulled away by the control element.

Precautions:-

• All the Connections should be proper, neat and clean..

• Polarity of devices should be checked.

• Power should be turned off while construction of circuit is in progress.

Expt No:- 08

Aim:- To find the bias point of a Si BJT with $\beta = 200$

Apparatus:-
(i) Resistor.
(ii) Capacitor.
(iii) Transistor
(iv) Analog voltage source.
(v) Connecting wires.
(vi) multisim softwares.
(vii) Windows and labs.

Theory: Q point or the operating point of a device also known as a bias point or quiescent point is the steady state DC voltage or current at a specified manual terminal of an active device such as diod or transistor. with no input signal applied.

Result:- The bias point of a Si BJT with $\beta = 200$ is
Q Point = (V_{CE}, I_C)
Q Point = (4.75V, 3.81mA)

Conclusion:- The bias point or Q point of a Si BJT has been when $\beta = 200$ and Q Point has been studied.

Precautions-

- All connection must be neat and tight.
- Wires must be cleaned with sand paper before making connections.

Experiment No.- 8

Aim: To find the bias point of a Si BJT with $\beta = 200$.

Apparatus: Resistors, Capacitor, Transistor, Analog Voltage Source, Connecting Wires, Multisim software, Windows.

Theory:

Q point or the operating point of a device, also known as a bias point, or quiescent point is the steady-state DC voltage or current at a specified terminal of an active device such as a diode or transistor with no input signal applied.

Q-point is defined by IC and VCE.

Q-point = (VCE, IC)

$V_B = V_{CC} * R_2 / (R_1 + R_2)$

$V_B = 9*22/ (18+22)$

$V_B = 4.95V$

$V_E = V_B - 0.7$

$V_E = 4.25V$

Using KVL

$V_B - I_B * R_2 - V_{BE} - (\beta+1) * I_B * R_E = 0$

$I_B = (V_B - V_{BE}) / (R_2 + (\beta+1)*R_E)$

$I_B = 1.90\ uA$

$I_C = I_B * \beta$

$I_C = 3.81\ mA$

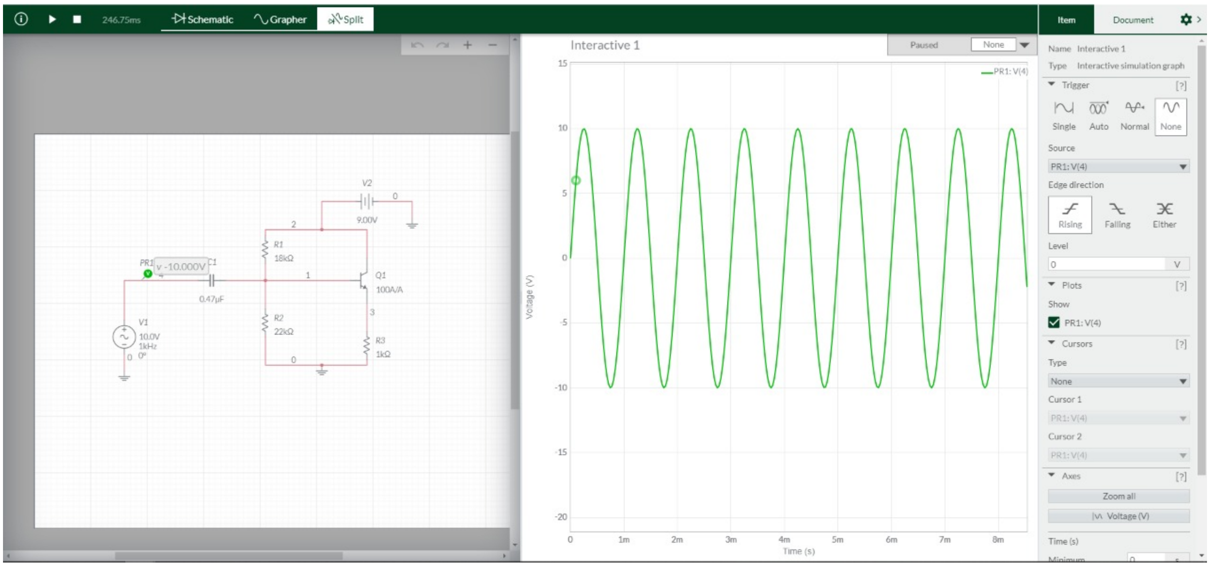
$V_{CE} = V_C - V_E$

$V_{CE} = 4.75V$

Result: The bias point of a Si BJT with $\beta = 200$ is:

Q-point = (VCE, IC)

Q-point = (4.75V, 3.81mA)

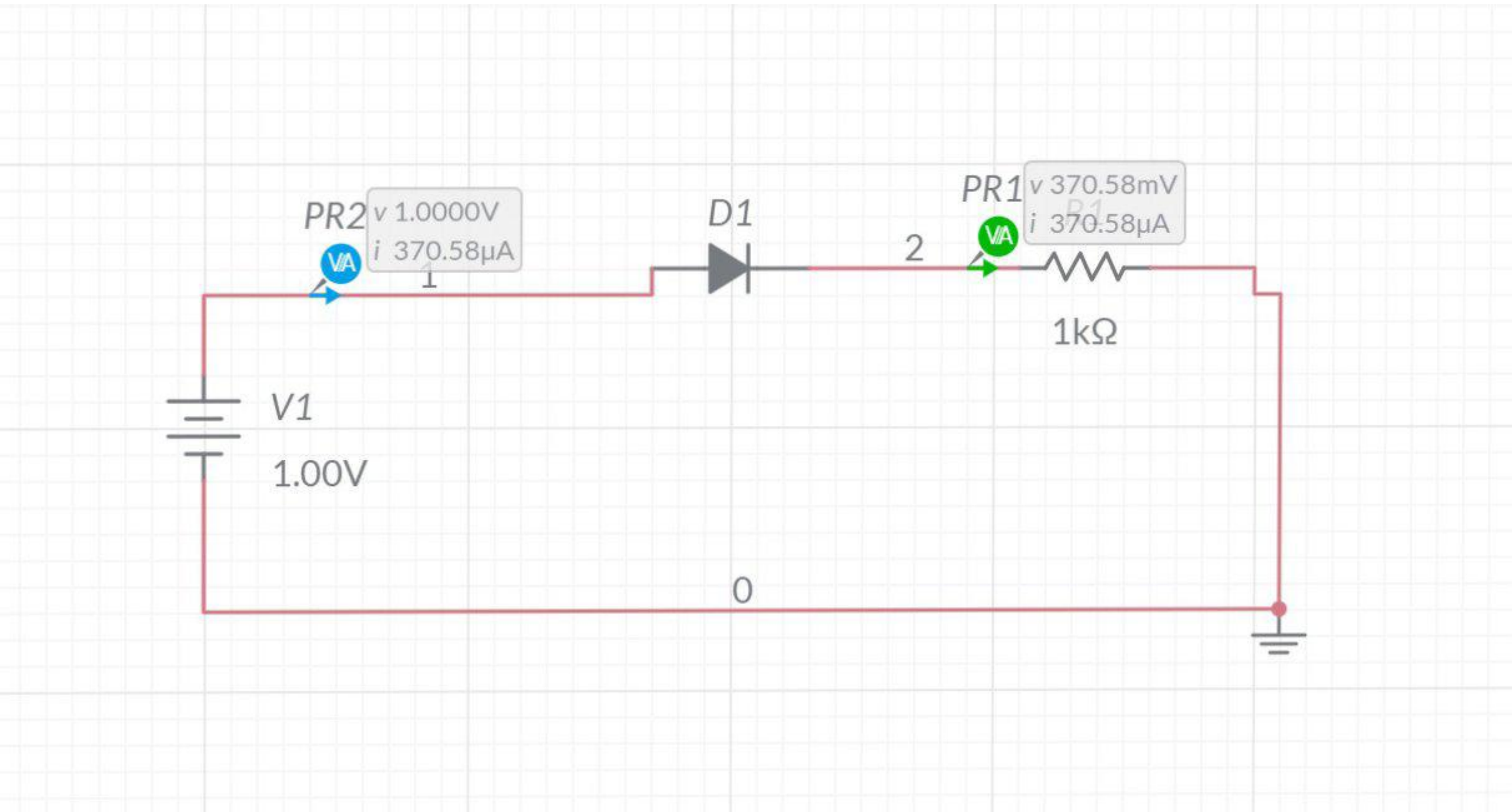


Conclusion: The bias point or Q-point of a Si BJT has been found when β = 200 and Q-point has been studied.

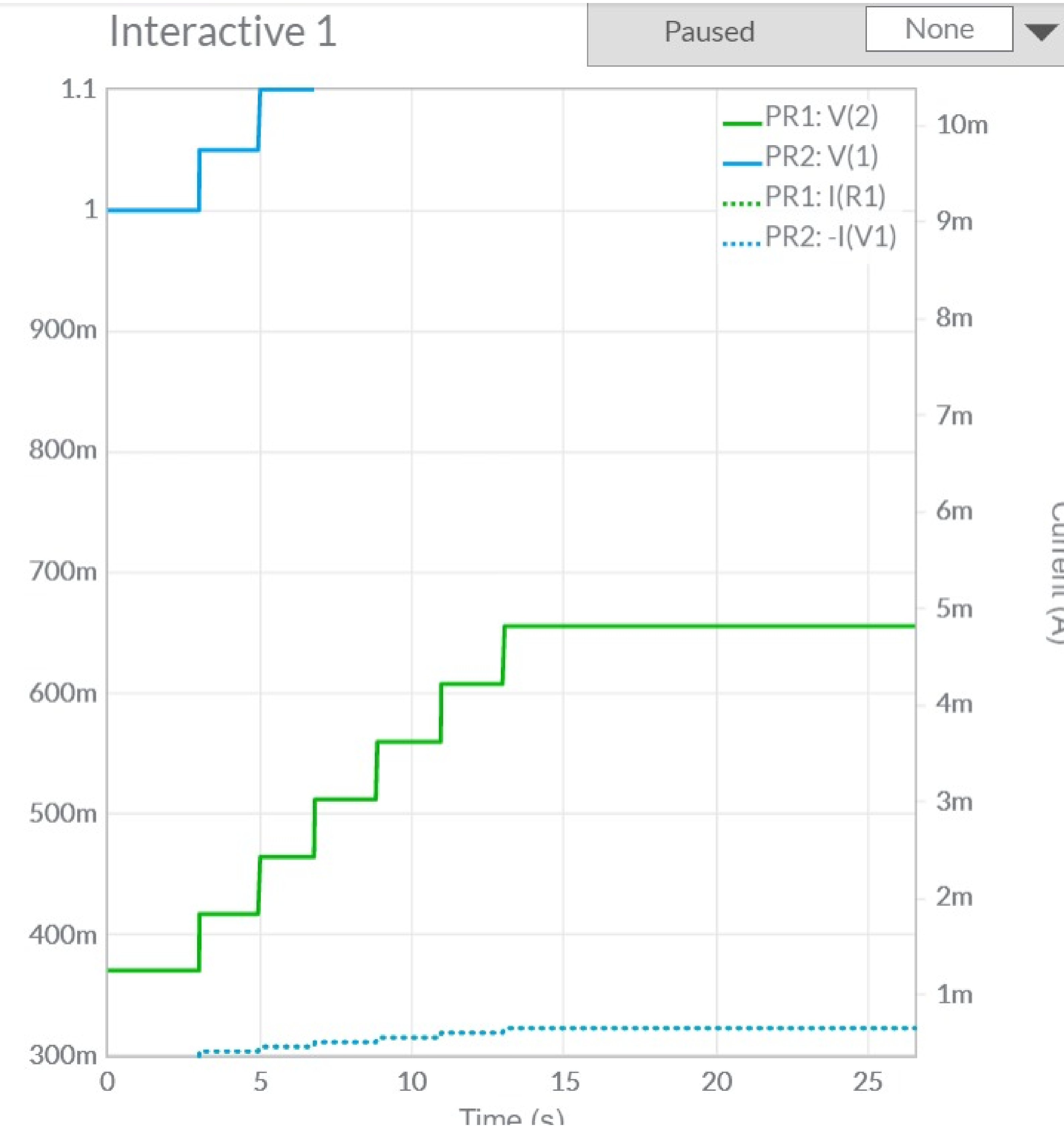
Precautions:

-> All connections must be neat and tight.

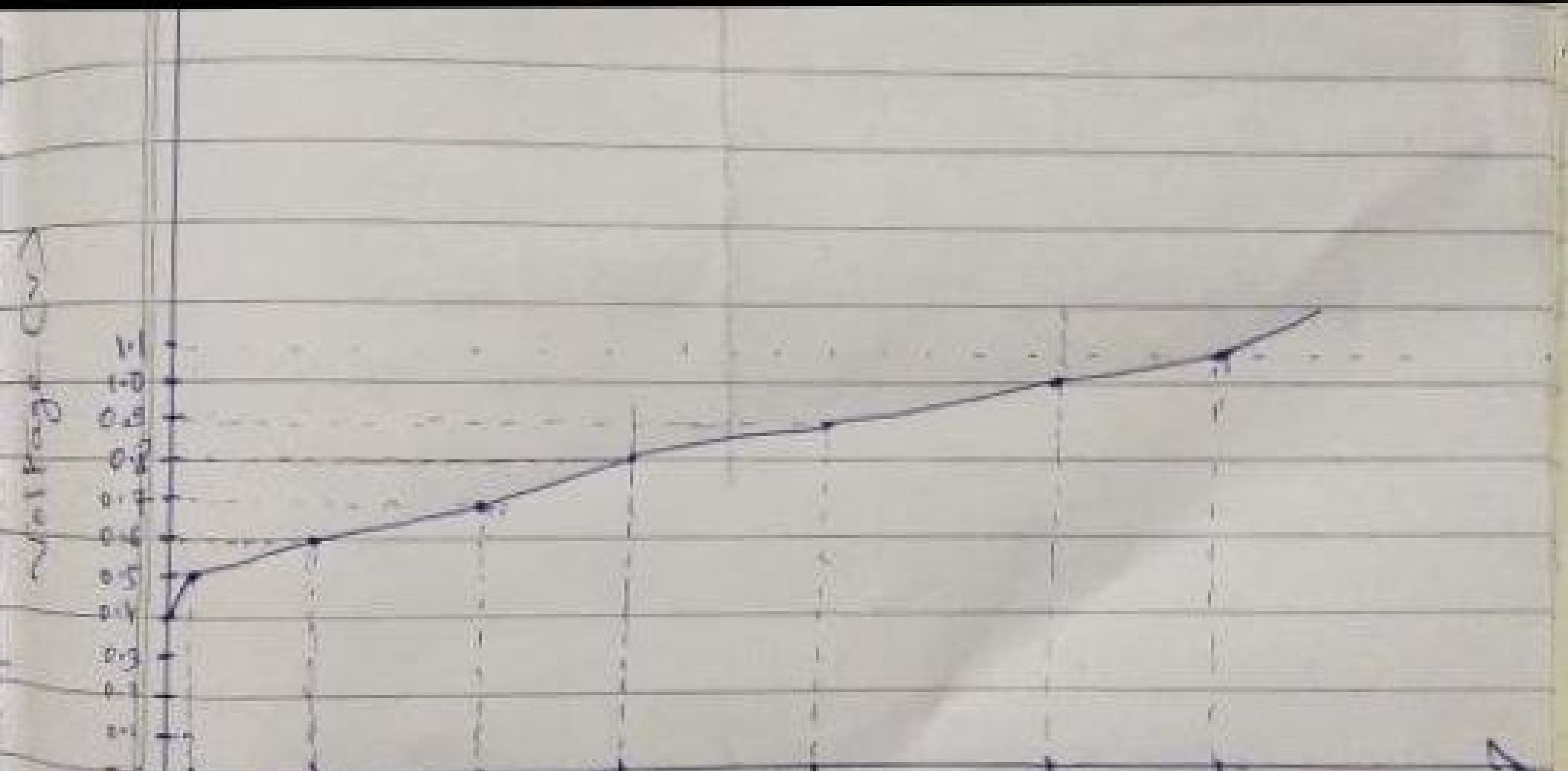
-> Wires must be cleaned with sand paper before making connections.



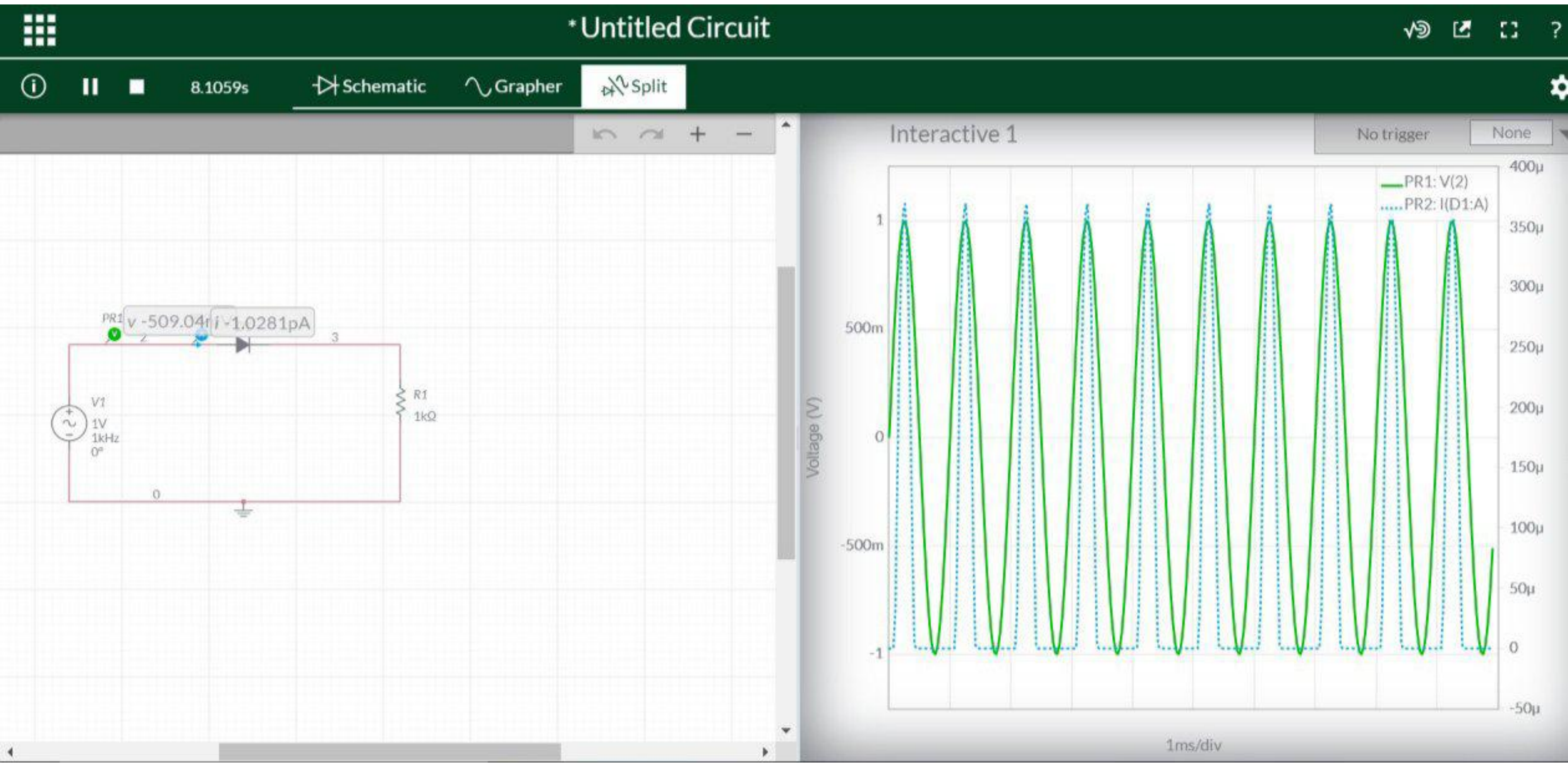
PR2
v 1.0000V
i 370.58µA
1
D1
2
PR1
v 370.58mV
i 370.58µA
1kΩ
V1
1.00V
0



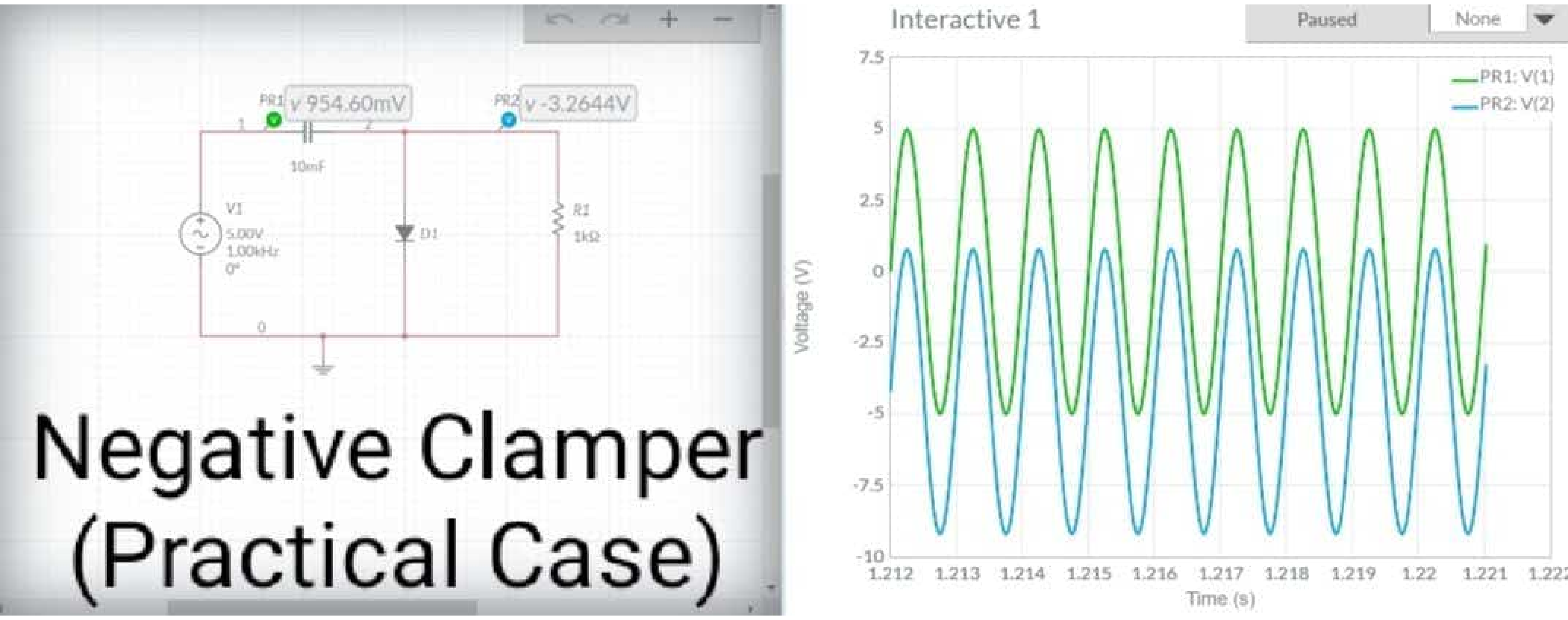
Interactive 1
Paused
None
1.1
1
900m
800m
700m
600m
500m
400m
300m
PR1: V(2)
PR2: V(1)
PR1: I(R1)
PR2: -I(V1)
10m
9m
8m
7m
6m
5m
4m
3m
2m
1m
0
5
10
15
20
25

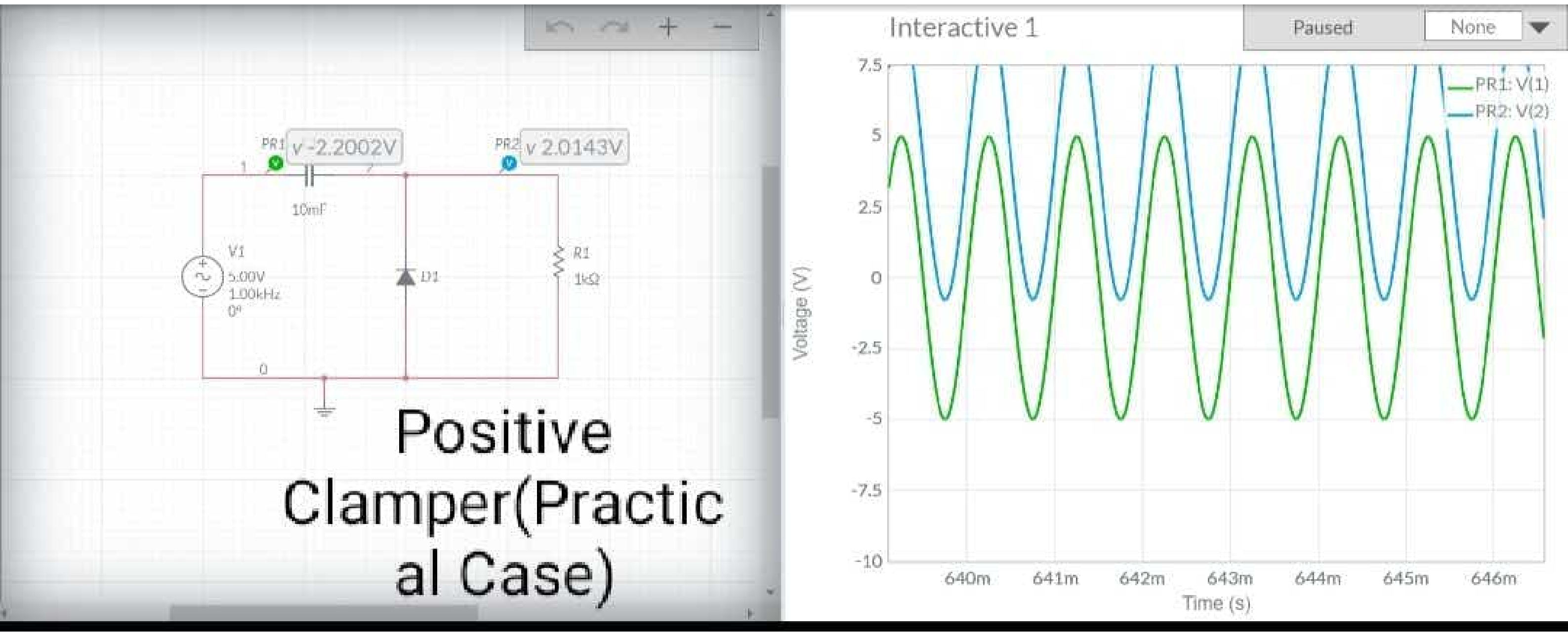


Voltage (V)
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
2.22
32.56
102.70
167.05
226.77
349.17
400μA
Current (μA)

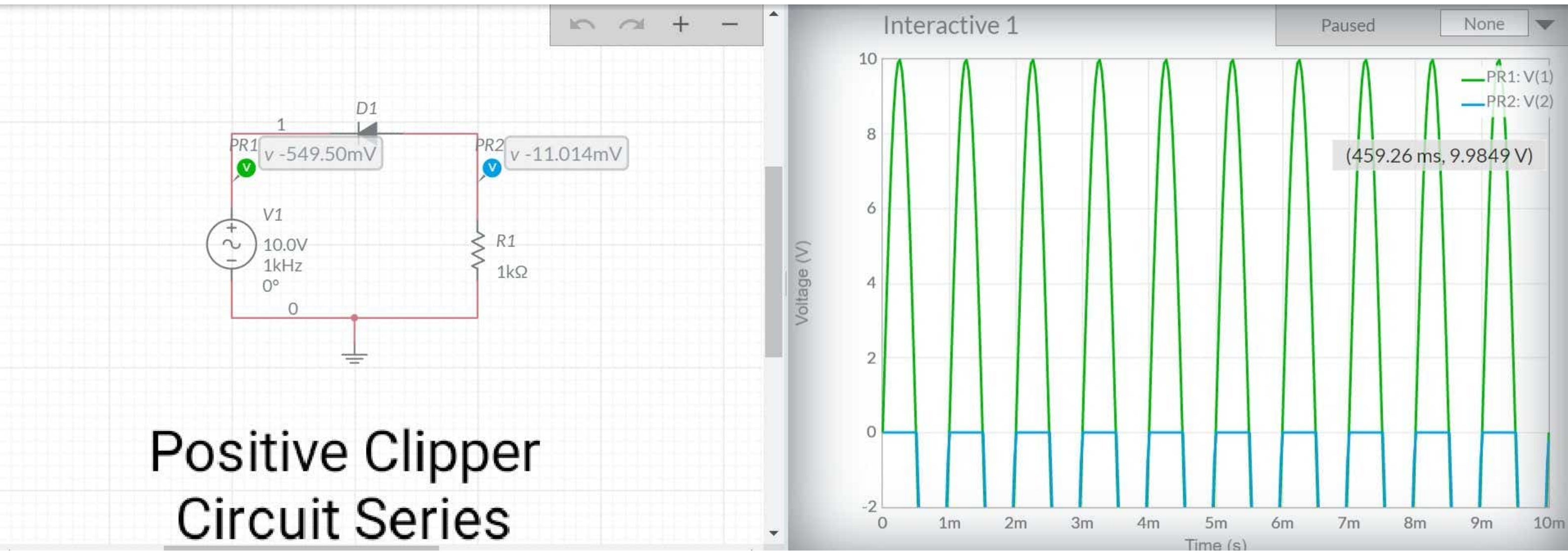


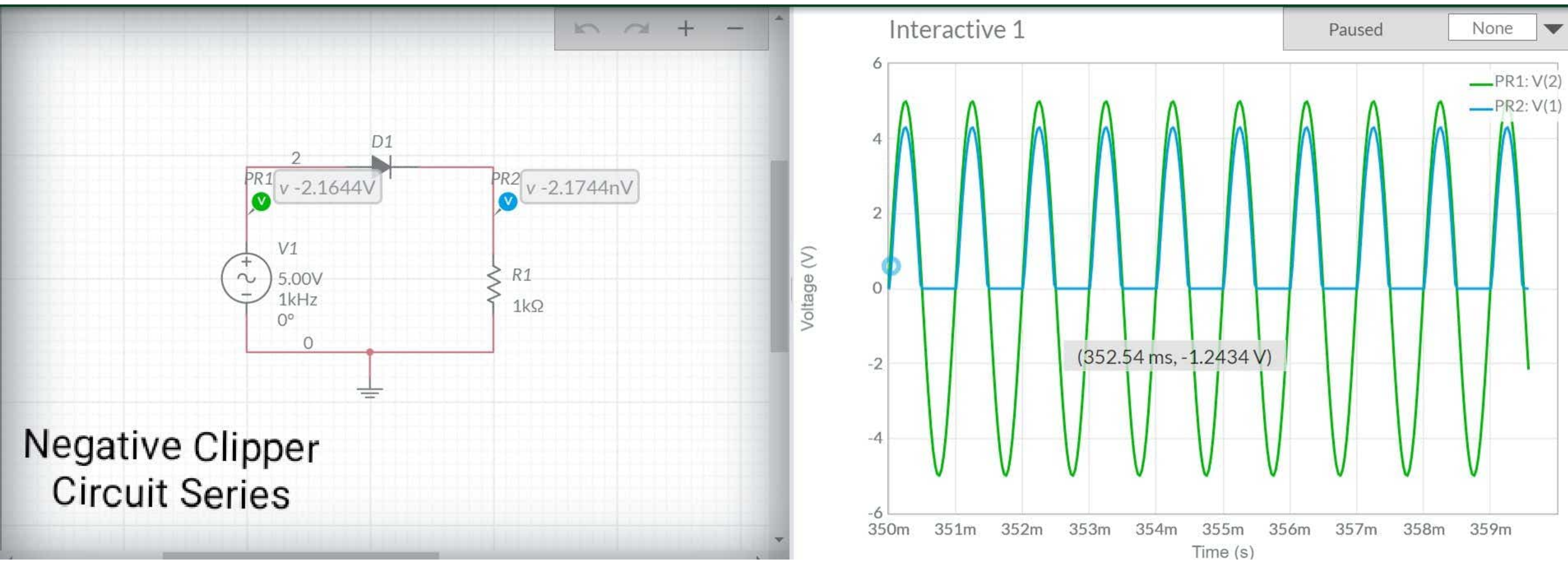
*Untitled Circuit
8.1059s
Schematic
Grapher
Split
PR1
v -509.04
i -1.0281pA
V1
1V
1kHz
0°
R1
1kΩ
Interactive 1
No trigger
None
PR1: V(2)
PR2: I(D1:A)
Voltage (V)
1ms/div

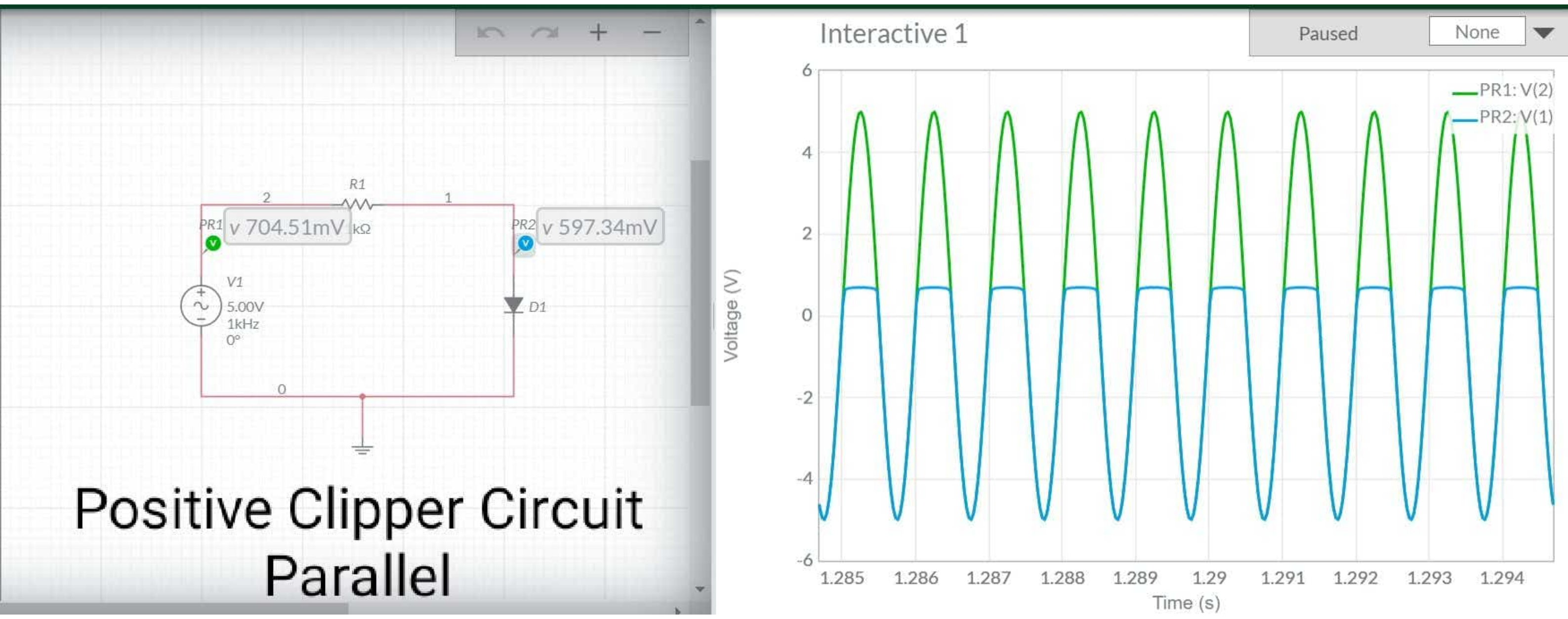

PR1
v 954.60mV
PR2
v -3.2644V
1
2
10mF
V1
5.00V
1.00kHz
0°
D1
R1
1kΩ
0
Negative Clamper
(Practical Case)
Interactive 1
Paused
None
PR1: V(1)
PR2: V(2)
7.5
5
2.5
0
-2.5
-5
-7.5
-10
Voltage (V)
1.212
1.213
1.214
1.215
1.216
1.217
1.218
1.219
1.22
1.221
Time (s)



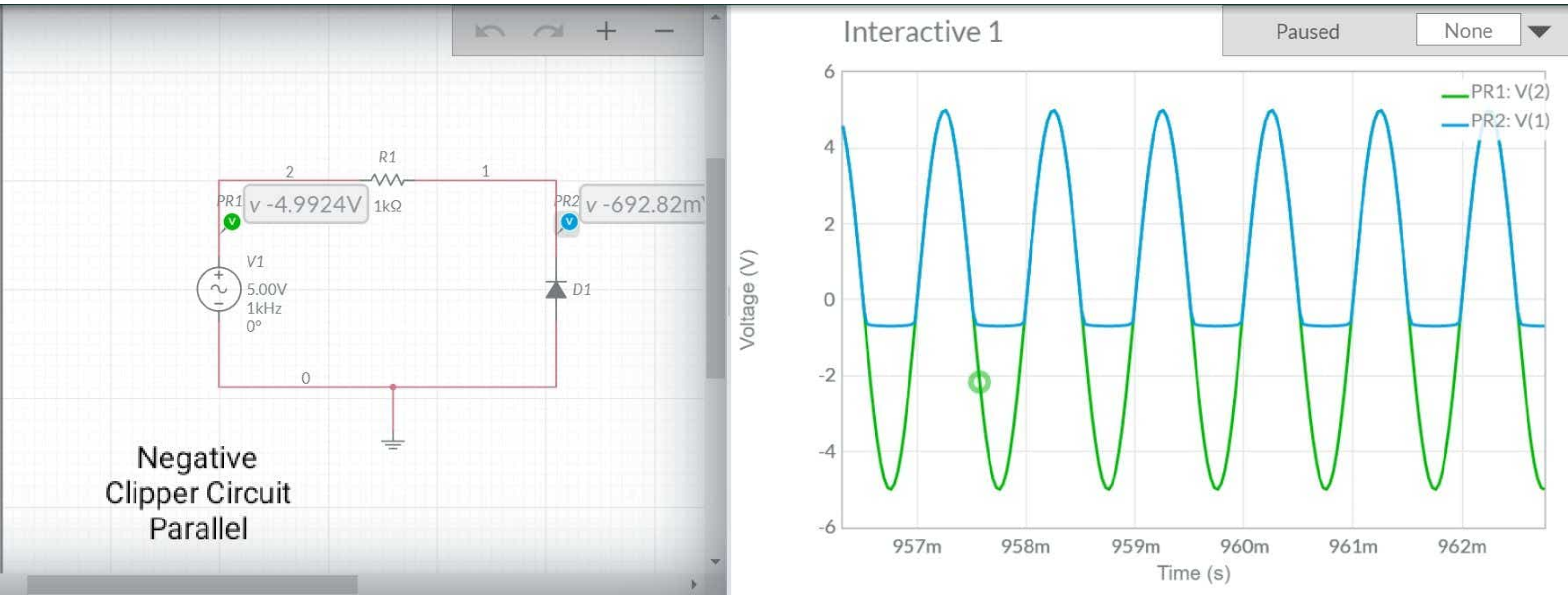
PR1 v -2.2002V
PR2 v 2.0143V
10mF
V1
5.00V
1.00kHz
0°
D1
R1
1kΩ
Positive
Clamper(Practic
al Case)
Interactive 1
Paused
None
PR1: V(1)
PR2: V(2)
Voltage (V)
Time (s)


D1
1
PR1
v -549.50mV
PR2
v -11.014mV
V1
10.0V
1kHz
0°
R1
1kΩ
0
Positive Clipper
Circuit Series
Interactive 1
Paused
None
PR1: V(1)
PR2: V(2)
(459.26 ms, 9.9849 V)
Voltage (V)
10
8
6
4
2
0
-2
0
1m
2m
3m
4m
5m
6m
7m
8m
9m
10m
Time (s)


D1
2
PR1
v -2.1644V
PR2
v -2.1744nV
V1
5.00V
1kHz
0°
R1
1kΩ
0
Negative Clipper
Circuit Series
Interactive 1
Paused
None
PR1: V(2)
PR2: V(1)
6
4
2
0
-2
-4
-6
Voltage (V)
(352.54 ms, -1.2434 V)
350m
351m
352m
353m
354m
355m
356m
357m
358m
359m
Time (s)



R1
2
1
PR1
v 704.51mV
kΩ
PR2
v 597.34mV
V1
5.00V
1kHz
0°
D1
0
Positive Clipper Circuit
Parallel
Interactive 1
Paused
None
PR1: V(2)
PR2: V(1)
Voltage (V)
Time (s)


R1
2
1
PR1
v -4.9924V
1kΩ
PR2
v -692.82m
V1
5.00V
1kHz
0°
D1
0
Negative
Clipper Circuit
Parallel
Interactive 1
Paused
None
PR1: V(2)
PR2: V(1)
Voltage (V)
Time (s)
957m
958m
959m
960m
961m
962m