

To Study Characteristics of a CR Circuit

Instruction

When a dc voltage is applied to a series CR circuit a transient current is observed during both growth and decay of charge. The rate of growth and decay depends on time constant of the circuit which is the product of C and R . At any instant of time t current through the circuit during growth is given by;

$$i(t) = i_o(1 - e^{-\frac{t}{CR}})$$

and during decay

$$i(t) = i_o e^{-\frac{t}{CR}}$$

; where

$$i_o = \frac{V}{R}$$

V is the supply voltage.

In this experiment we shall observe V_c , voltage across C , with t to study the characteristics of the circuit.

• Procedure for Charging

1. Choose the values of V , R and C using the sliders provided below and set by clicking at the adjacent buttons.
2. Click at positive end of supply and at the same column of bread board where left end of R is connected. For this connection use upper panel of bread board.
3. Click at negative terminal of supply and at the same column of bread board where right end of capacitor is connected. Use upper panel of bread board.
4. Similarly connect voltmeter across C . To connect negative terminal of voltmeter to right end to capacitor use lower panel and for positive terminal use upper panel.
5. Click to connect left end of C and right end of R .
6. Press the power button of supply when circuit connection is complete.
7. Press the "Start" button below to start the stopwatch, as soon as the supply is "ON".
8. Note V_c from voltmeter and t from stopwatch.
9. A real time graph of V_c vs t will be displayed in the bottom.
10. Take data till the voltage reaches 90 percent of the set voltage.

• Procedure for Discharging

1. When data recording will be over press the "Pause" button below.
2. Click at the terminals of R to short circuit and full charge the capacitor. Use lower panel of bread board.
3. Press at the "Power" button and put the supply off.

4. Click at the left end of R and right end of C to short the ends and short circuit of R will be removed. Now discharging of C through R will take place. Use upper panel of bread board.
5. As soon as the discharging starts, press the “Start” button below to start the stopwatch.
6. Note V_c vs t data.
7. Real time plot of V_c vs t during discharging will be displayed below.

• **Tables for Experimental Data**

Table 1: Data During Charging

Time(t)	Vc
5	...
10	...
15	...

Table 2: Data During Discharging

Make similar table for discharging and draw V_c vs t plot.

Plot and fit V_c vs t from these data which will be similar to the real time plot. You can find the time constant of the circuit from these plots.