

EXPERIMENT V CAPACITORS AND INDUCTORS



Fall - 2023/2024

EEE 281 – Electrical
Circuits
Lab 5 Prework

Submitted By: Yağmur Can 2637536 | Eda İslam 2585081

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Objective:

We will learn about the different kinds of connections of linear capacitors.

We will learn how to use inductor and capacitor formulas in a circuit.

Results:

1. Capacitor

A.

In Figure 5.2, we have AC source connected to the circuit.

Since the phase relationship between capacitor voltage and current formula is $I = jwCV$ and resistor and capacitor are connected in series, current will be same through the circuit.

To find capacitance we will use the formula $C = I/jwV$ which is the capacitance in the form of angular frequency (w), voltage (rms values) and current (A).

B. When we consider the Figure 5.3

a)

V_1 is the voltage across the resistor. Then $V_1 = IR$

$$I = C(dV/dt) \text{ thus; } V_1 = RC(dV/dt)$$

$$V_2 = K \int_{-\infty}^t RCdV = KRCV$$

$$Q = CV, C = Q/V$$

$$\text{We get; } C = V_2/(KRV)$$

b)

We connect the oscilloscope to the circuit to see the graph of V_2 and get the q-v characteristics.

2. Inductor

In this situation we have inductor instead of capacitor. So let's use the phase relationship between inductor voltage and the current formula $V=jwLI$; and $Z=r+jx$ which Z represents impedance, jx represents the reactance, r represents the resistance.

The resistance of the inductor actually cannot be neglected and therefore it should be taken into account in the calculations in this experiment.

We get the equations:

$$Z = r + jwL \text{ then;}$$

$$|Z| = (\sqrt{r^2 + (wL)^2})^{1/2} = V/A$$

$$L = [(\left(\frac{V}{A}\right)^2 - r^2)^{1/2}] / w$$

Conclusion:

We used phase relationship equation between capacitor voltage and current.

We used phase relationship equation between inductor voltage and current.

We learned how to measure capacitance and inductance.

We learned the effect of using an integrator in a circuit.