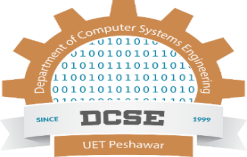
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**University of engineering & technology Peshawar**

**Circuit & system-ll lab**

**Lab report no#02**

**Spring 2020**

**Submitted by: Ashfaq Ahmad**

**Section: B**

**Reg No: 19PWCSE1795**

**Semester: 3rd**

**“On my honor, as a student of University of Engineering and Technology Peshawar, I have neither given nor received unauthorized assistance on this academic work”**

Student signature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Submitted to:**

**Eng: Faiz ullah**

**Department Of Computer System Engineering**

**Lab 2**

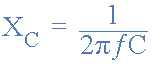
## Capacitive Reactance(RC-circuit)

### Objective

Capacitive reactance will be examined in this exercise. In particular, its relationship to capacitance and frequency will be investigated, including a plot of capacitive reactance versus frequency.

### Theory Overview

The current – voltage characteristic of a capacitor is unlike that of typical resistors. While resistors show a constant resistance value over a wide range of frequencies, the equivalent ohmic value for a capacitor, known as capacitive reactance, is inversely proportional to frequency. The capacitive reactance may be computed via the formula:



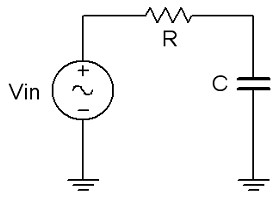
The magnitude of capacitive reactance may be determined experimentally by feeding a capacitor a known current, measuring the resulting voltage, and dividing the two, following Ohm’s Law. This process may be repeated across a range of frequencies in order to obtain a plot of capacitive reactance versus frequency. An AC current source may be approximated by placing a large resistance in series with an AC voltage, the resistance being considerably larger than the maximum reactance expected.

**In RC-circuit current lead by 90 degree.**

### Equipment

1. AC Function Generator
2. Oscilloscope

### Components



**F**

1. 1 µF actual:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. 2.2 µF actual:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. 10 kΩ actual:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Figure 1**

### Procedure

#### Current Source

1.Using Figure 1 with Vin=10Vp-p and R=10kΩ, and assuming that the reactance of the capacitor is much smaller than 10k and can be ignored, determine the circulating current using measured component values and record in Table 1.

#### Measuring Reactance

1. Build the circuit of Figure 1 using R=10kΩ, and C=1 µF. Place one probe across the generator and another across the capacitor. Set the generator to a 200 Hz sine wave and 10Vp-p. Make sure that the Bandwidth Limit of the oscilloscope is engaged for both channels. This will reduce the signal noise and make for more accurate readings.
2. Calculate the theoretical value of Xc using the measured capacitor value and record in Table 2.
3. Record the peak-to-peak capacitor voltage and record in Table 2.
4. Using the source current from Table 1 and the measured capacitor voltage, determine the experimental reactance and record it in Table 2. Also compute and record the deviation.
5. Repeat steps three through five for the remaining frequencies of Table 2.
6. Replace the 1 µF capacitor with the 2.2 µF unit and repeat steps two through six, recording results in Table 3.
7. Using the data of Tables 2 and 3, create plots of capacitive reactance versus frequency.

**Formulae:**

* Current= function generator output/resistance

//(current will be constant in each experiment)

* Voltage across capacitor= no of division in graph \*reading of voltage per division in channel B.
* %deviation= (**Xc theoretical - Xc exp / Xc theoretical)\*100**
* Generator Voltage = 10k v

//(constant in each experiment)

* Theoretical value **= Vc /I(p-p)**
* **Experimental value=**

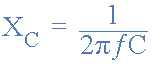


Table 1:

|  |  |
| --- | --- |
| **Current value I(p-p)** | **0.001A** |

Table 2:

For capacitor=1.0uF

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **frequency** | **Xc theoretical** | **Vc (p-p)exp** | **Xc exp** | **%dev** |
| **200** | **800** | **0.8** | **796** | **0.5%** |
| **400** | **400** | **0.4** | **398** | **0.5%** |
| **800** | **200** | **0.2** | **199** | **0.125%** |
| **1.0k** | **160** | **0.16** | **159** | **0.1%** |
| **1.2k** | **132** | **0.14** | **130** | **0.166%** |

Table 3:

For capacitor=2.2uF

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **frequency** | **Xc theoretical** | **Vc (p-p)exp** | **Xc exp** | **%dev** |
| 200 | 361 | 0.36 | 360 | 0.27% |
| 400 | 200 | 0.2 | 180 | %0 |
| 800 | 100 | 0.09 | 90.90 | 0.10% |
| 1.0k | 72.4 | 0.07 | 70 | 3.31% |
| 1.2k | 60.3 | 0.06 | 60 | 0.49% |

### Note:

Voltage across the capacitor decrease as frequency increase. It is because frequency is inversely propositional to capacitive reactance, while capacitive reactance is a resister of capacitor so if frequencies increase then resistance decrease and according to ohm law voltage across capacitor also decrease.

### Questions

1. What is the relationship between capacitive reactance and frequency?

Ans: **Capacitive reactance** of a **capacitor** decreases as the **frequency** across its plates increases. As the frequency approaches infinity the capacitors reactance would reduce to zero acting like a perfect conductor. Therefore, **capacitive reactance** is inversely proportional to **frequency**. ... Also as the **frequency** increases the current flowing into the **capacitor** increases in value because the rate of voltage change across its plates increases.

1. What is the relationship between capacitive reactance and capacitance?

Ans: From the capacitive reactance formula above, it can be seen that if either of the **Frequency** or **Capacitance** where to be increased the overall capacitive reactance would decrease.

1. If the experiment had been repeated with frequencies 10 times higher than those in Table 2, what would the resulting plots look like?

Ans: if the frequency increases more and more than the no of division in plot of channel B decrease due to which voltage across capacitor decrease which is true according to mathematical expression of capacitive reactance and wavelength and time period of the wave also decrease.

1. If the experiment had been repeated with frequencies 10 times lower than that in Table 2, what effect would that has on the experiment?

Ans: if the frequency decrease more and more than the no of division in of channel B increase due to which voltage across the capacitor increase and wavelength and time period of the wave also increase.

**THE END**