# Laboratory Application Assignment

In this lab application assignment you will examine how the capacitive reactance, $X_C$, of a capacitor decreases when the frequency, $f$, increases. You will also see that more capacitance, $C$, at a given frequency results in less capacitive reactance, $X_C$. Finally, you will observe how $X_C$ values combine in series and in parallel.

**Equipment:** Obtain the following items from your instructor.

- Function generator
- Assortment of capacitors
- DMM

## Capacitive Reactance, $X_C$

Refer to Fig. 17–18*a*. Calculate and record the value of $X_C$ for each of the following frequencies listed below. Calculate $X_C$ as $1/(2\pi fC)$.

$X_C$ = ____________ @ $f = 100$ Hz
$X_C$ = ____________ @ $f = 200$ Hz
$X_C$ = ____________ @ $f = 400$ Hz

Connect the circuit in Fig. 17–18*a*. Set the voltage source to exactly 5 $V_{rms}$. For each of the following frequencies listed below, measure and record the current, $I$. (Use a DMM to measure $I$.) Next, calculate $X_C$ as $V/I$.

$I$ = ____________ @ $f = 100$ Hz; $X_C$ = ____________
$I$ = ____________ @ $f = 200$ Hz; $X_C$ = ____________
$I$ = ____________ @ $f = 400$ Hz; $X_C$ = ____________

How do the experimental values of $X_C$ compare to those initially calculated? ____________________________________________
Based on your experimental values, what happens to the value of $X_C$ each time the frequency, $f$, is doubled? ________________
Is $X_C$ proportional or inversely proportional to the frequency, $f$?
_____________

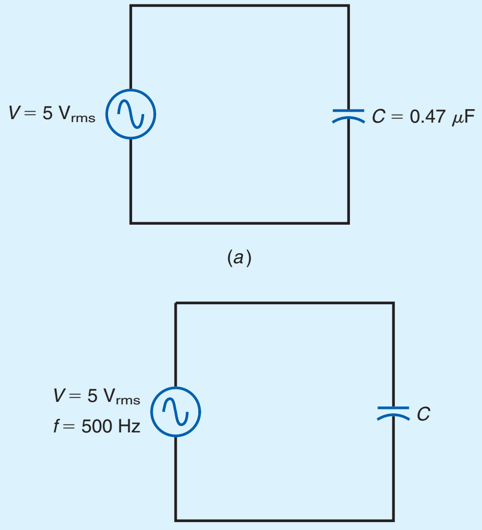
Refer to Fig. 17–18*b*. With the frequency, $f$, set to 500 Hz, calculate and record the value of $X_C$ for each of the following capacitance values listed below. Calculate $X_C$ as $1/(2\pi fC)$.

$X_C$ = __________ when $C = 0.1\ \mu F$
$X_C$ = __________ when $C = 0.22\ \mu F$
$X_C$ = __________ when $C = 0.47\ \mu F$

Connect the circuit in Fig. 17–18*b*. Adjust the frequency of the function generator to exactly 500 Hz. For each of the following capacitance values listed below, measure and record the current, $I$. (Use a DMM to measure I.) Next, calculate $X_C$ as $V/I$.

$I$ = __________ when $C = 0.1\ \mu F$; $X_C$ = ____________
$I$ = __________ when $C = 0.22\ \mu F$; $X_C$ = ____________
$I$ = __________ when $C = 0.47\ \mu F$; $X_C$ = ____________

Figure 17–18




(*a*)

(*b*)

Is $X_C$ proportional or inversely proportional to the value of capacitance? ____________________________________________

## Series Capacitive Reactances

Refer to the circuit in Fig. 17–19*a*. Calculate and record the following values:

$X_{C_1}$ = _________, $X_{C_2}$ = _________, $X_{C_T}$ = _________, $I$ = _________,
$V_{C_1}$ = _________, $V_{C_2}$ = _________
Do $V_{C_1}$ and $V_{C_2}$ add to equal $V_T$?

Construct the circuit in Fig. 17–19*a*. Set the frequency of the function generator to exactly 500 Hz. Next, using a DMM, measure and record the following values:
$I$ = _________, $V_{C_1}$ = _________, $V_{C_2}$ = _________
Using the measured values of voltage and current, calculate the following values:
$X_{C_1}$ = _________, $X_{C_2}$ = _________, $X_{C_T}$ = _________
Are the experimental values calculated here close to those initially calculated above? _______

## Parallel Capacitive Reactances

Refer to the circuit in Fig. 17–19*b*. Calculate and record the following values:
$X_{C_1}$ = _________, $X_{C_2}$ = _________, $I_{C_1}$ = _________, $I_{C_2}$ = _________,
$I_T$ = _________, $X_{C_{EQ}}$ = _________

Do $I_{C_1}$ and $I_{C_2}$ add to equal $I_T$? ________

Construct the circuit in Fig. 17–19*b*. Set the frequency of the function generator to exactly 500 Hz. Next, using a DMM, measure and record the following values:

$I_{C_1}$ = ________, $I_{C_2}$ = ________, $I_T$ = ________

Using the measured values of voltage and current, calculate the following values:

$X_{C_1}$ = ________, $X_{C_2}$ = ________, $X_{C_{EQ}}$ = ________

Are the experimental values calculated here close to those initially calculated above? ________

**Figure 17–19**