

# Resistors, Inductors, and Capacitors in Circuits

Raymond Langehennig

December 13, 2024

## 1 Introduction

### 1.1 Background

In DC circuits, resistance is the only form of opposition the current faces.

In AC circuits, however, the oscillating nature of the current induces a second form of opposition called *reactance*. This occurs mostly in inductors & capacitors, though the exact mechanism by which the alternating current causes this is different in the two components.

#### Inductors

Inductors are components used for a variety of reasons (energy storage, magnetic field manipulation, filters), but at their simplest they consist of a conductive material coiled around a "core" of some material that serves to confine the magnetic field induced by the current running through the conductor better.

Current gives rise to a magnetic field as illustrated by Ampère's Law. It stands to reason, then, that a *changing* current (such as AC) gives rise to a *changing* magnetic field. A changing magnetic field, however, is opposed due to Lenz's Law, resulting finally in a "back-emf" that diminishes the original current through the inductor. This is the *inductive reactance*, symbolized by  $X_C$ .

#### Capacitors

Capacitors, like inductors, also store energy, but they store it in the form of electric potential energy. This is generally accomplished through the separation of two conductors by a dielectric, between which an electric field arises when an electromotive force is supplied due to the accumulation of opposing charge on either conductor (electrons leaving one end/gathering on the other). The voltage across the two conductors approaches that of the supplied electromotive force, while the current in the circuit approaches 0. In a DC circuit,

### 1.2 Objective

The object of this lab is to gain an understanding of and familiarity with and reactance in resistor-capacitor (RC), resistor-inductor (RL), and resistor-inductor-

capacitor (RLC) circuits. This will be achieved mainly through the use of a breadboard, function generator, and oscilloscope.

### 1.3 Theory

dwadawd

## 2 Procedure

For all experiments, a Global Specialties PB-505 breadboard was used in conjunction with a RIGOL DS1104Z oscilloscope & DG1022Z function generator. A multitude of electrical components were also used to construct the circuits, the specifications of which will be laid out below.

Table 1: Components

Component	Nominal value	Actual value
Resistors	$220\ \Omega$	$218.9 \pm awawawaw\Omega$
multirow	$1\ k\Omega$	$1 \pm awawak\Omega$
Capacitor	$0.1\mu F$	$0.1023 \pm \mu F$
Inductor	A	A

### 2.1 RC Circuit

An RC circuit was constructed with the  $220\Omega$  resistor &  $0.1\mu$

## 3 Data

### 3.1 RL

Table 2: Phase Shift

A	A	A	A	A
A	A	A	A	A
A	A	A	A	A
A	A	A	A	A

4

5 Questions

6

7