Resistors, Inductors, and Capacitors in Circuits

Raymond Langehennig

November 30, 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 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 forms.

1.2 Objective

The object of this lab is to gain familiarity with and an understanding of 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

3 Data

3.1 RL

4

5 Questions