

# Linear Circuits



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*An introduction to linear electric components and a study of circuits containing such devices.*

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# Module 4

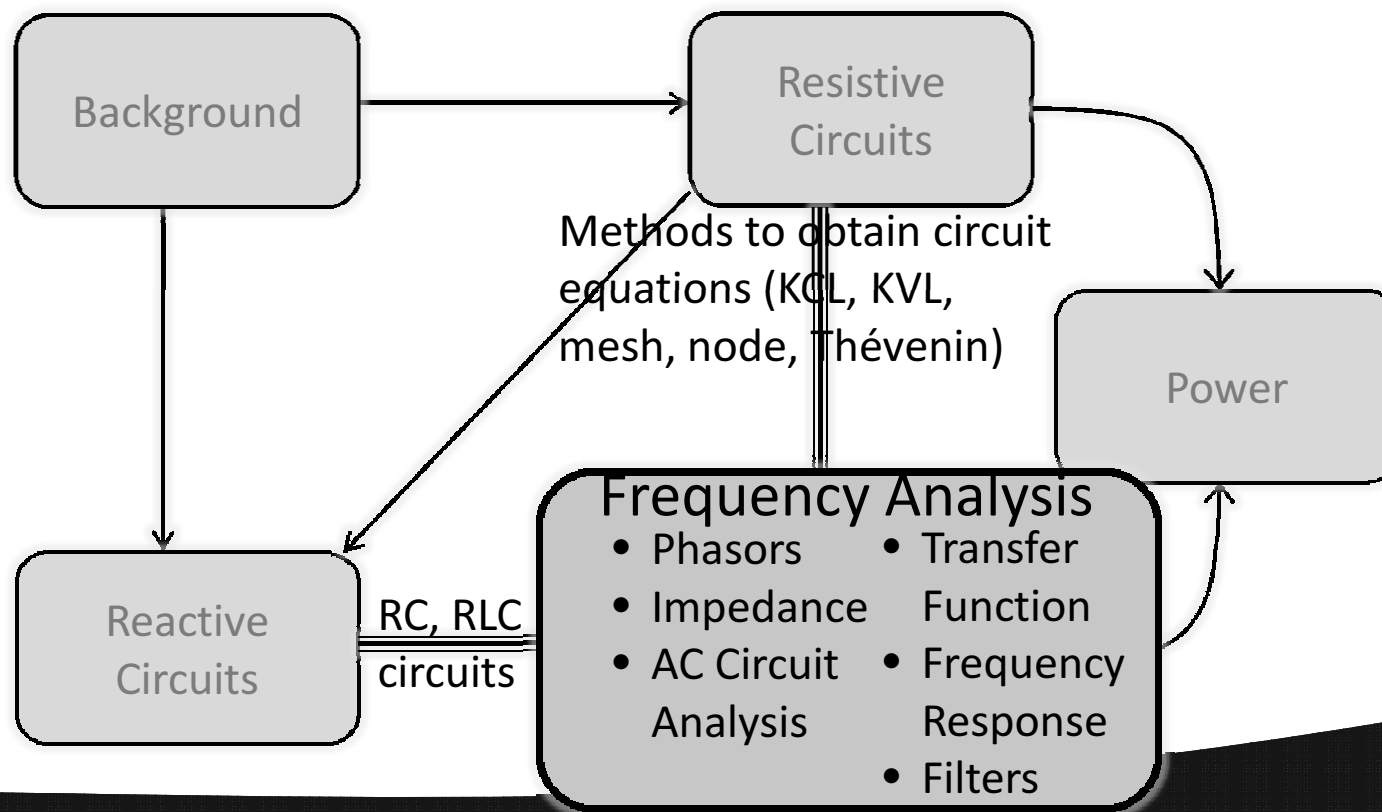
## Frequency

## Analysis Wrap Up

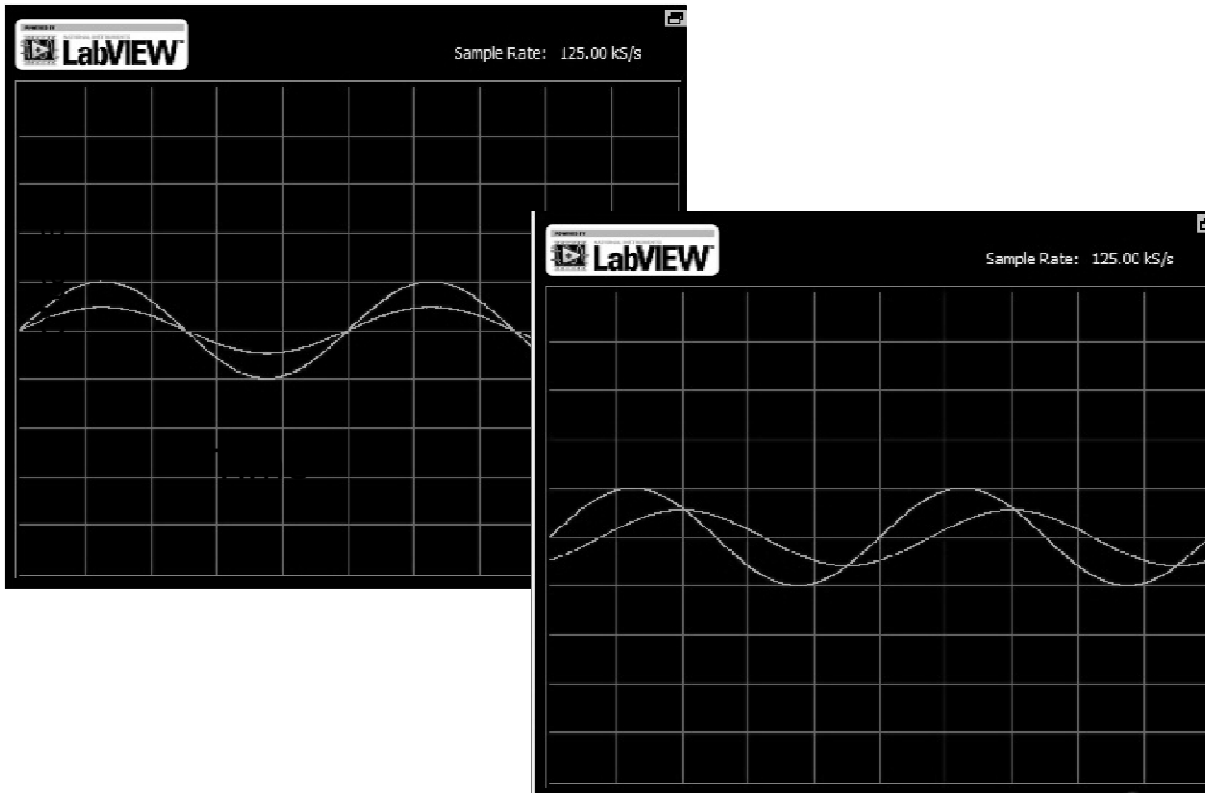


*Summary of the Module*

# Concept Map



# Resistive vs Reactive Circuits



# Important Concepts and Skills

## SINUSOIDS AND PHASORS

- ◎ Be able to
  - identify sinusoid properties (amplitude, frequency, angular frequency, period, phase)
  - find phasors of sinusoidal functions
  - add sinusoids using phasors
- ◎ Understand and describe the properties of sinusoids in capacitors and inductors

# Important Concepts and Skills

## IMPEDANCE

- ◎ Understand impedance
- ◎ Be able to
  - calculate impedances of resistors, capacitors, and inductors
  - identify the relationship between voltage and current based on impedance value

# Important Concepts and Skills

## AC CIRCUIT ANALYSIS

- ◎ Given a source frequency, be able to
  - convert RLC circuits into equivalent circuits with impedances
  - find equivalent impedances for devices in series/parallel
  - solve for voltages and currents using resistor analysis methods  
(Ohm's Law, KCL, KVL, Mesh, Node, Thévenin, Norton)

# Important Concepts and Skills

## TRANSFER FUNCTIONS

- ◎ Know
  - the definition of a transfer function
  - how a linear system responds to a sinusoid in steady state (how the amplitude and phase change but the frequency stays the same)
  - the meaning of the plot of the transfer function in terms of finding an output amplitude
- ◎ Be able to
  - find the transfer functions of simple RL, RC and RLC circuits
  - sketch the magnitude and angle of the transfer functions of a first-order system on a linear scale

# Important Concepts and Skills

## FREQUENCY SPECTRUM

- ◎ Know
  - the definition of a frequency spectrum
- ◎ Be able to
  - plot a frequency spectrum of a sum of sinusoids
  - Recognize high and low frequency content in a signal in both the time domain and in the frequency domain

# Important Concepts and Skills

## FREQUENCY RESPONSE

- ◎ Know
  - the what a frequency response is
  - and understand the graphical features of RC and RLC circuits when plotted on linear scales and on Bode scales
- ◎ Be able to
  - sketch a frequency response from a transfer function on linear scales
  - match time domain and frequency domain inputs and corresponding outputs for a circuit with a known frequency response

# Important Concepts and Skills

## **FILTERING**

- ◎ Know
  - the motivation for using filters
  - the definition of a filter
  - the frequency response features of lowpass, highpass, bandpass, and notch filters
- ◎ Be able to
  - identify RC and RLC circuits as being lowpass, bandpass, highpass, or notch
  - determine acceptable circuit parameters to achieve desired bandwidth, corner frequencies, and/or passband or rejection frequencies

## Reminder

- ⦿ Do all homework for this module
- ⦿ Study for the quiz
- ⦿ Continue to visit the forum