**Chapter 9: Sinusoids and Phasors**

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Electricity can be divided into two parts, static, where there is no flow of electrons, and dynamic, where there is a flow of electrons. Dynamic electricity can further be divided into two parts, DC, where there is no change in direction of flow of electrons, and AC, where the direction of flow of electrons changes constantly.

For reference, the symbols , and are used to represent values that change with time and the symbols , and are used to represent values that are constant.

## 9.2 Sinusoids

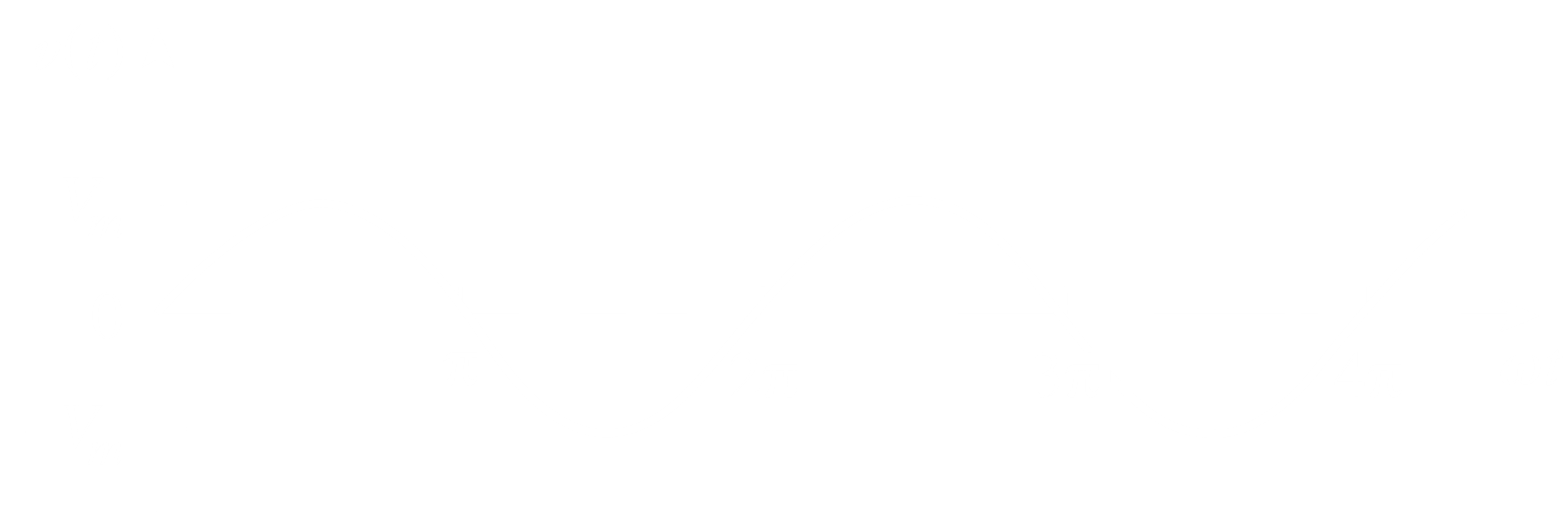
is the amplitude of the sinusoid.

is the angular frequency in .

is the argument of the sinusoid.

Period of the sinusoid,

Frequency of the sinusoid,



A more general expression for a sinusoid is where is the phase.

### Periodic and Aperiodic Functions

A function is periodic if it satisfies for all and all integers .

Trigonometric Formulae:

|  |  |
| --- | --- |
| sin (+) | all (+) |
| tan (+) | cos (+) |

Two sinusoids may also be added.

Let and

Thus,

## 9.3 Phasors

Phasors are complex numbers representing the amplitude and phase of a sinusoid.

For , is the amplitude and is the phase. Thus,  .

A complex number can be represented as

where and .

Here is being used in place of the normal to represent , since the symbol is used in relation to current.

The idea of phasor representation is based on Euler’s Equation, which states that . Thus, is the real part of , represented as and is the imaginary part.

Thus, for a sinusoid .

Here, , the phasor representation of the sinusoid .

Usually, the phasor is represented in terms of .

## 9.4 Phasor Relationships with Circuit Elements

## 9.5 Impedance and Admittance

Here, is the impedance, the ratio of the phasor voltage to the phasor current . It is measured in . is the real part of the equation and is known as the resistance. is the imaginary part of the equation and is known as the reactance.

(for resistors)

(for inductors)

(for capacitors)

We also find that

where is the admittance, which is the reciprocal of impedance. It is measured in siemens ().

Thus,

where is real and is known as conductance and is imaginary and is known as suseptance.

## 9.6 Kirchhoff’s Laws in the Frequency Domain

