SINUSOIDAL WAVE

INTRODUCTION TO AC CIRCUITS

prepared by:

Gyro A. Madrona
Electronics Engineer

TOPIC OUTLINE

Sinusoidal Wave

Instantaneous Voltage

Peak Voltage

Peak-to-peak Voltage

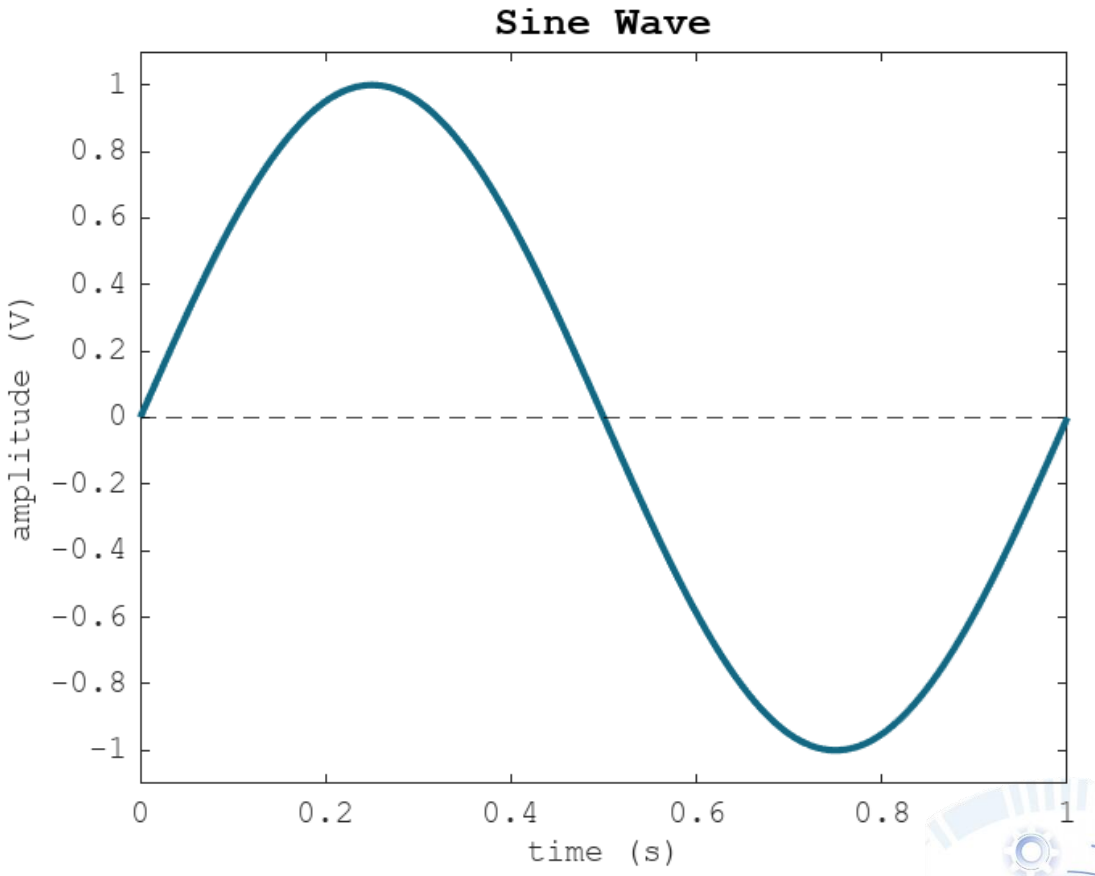
Root-Mean-Square Voltage

Period and Frequency

SINUSOIDAL WAVE

SINUSOIDAL WAVE

A **sinusoidal wave** is a periodic oscillation described mathematically by the **sine** or **cosine function**. It is the foundation for analyzing alternating current (**AC**) circuits, which are essential in power systems, communication systems, and signal processing.



INSTANTANEOUS VOLTAGE

Instantaneous voltage $\boldsymbol{v(t)}$ refers to the value of voltage at a specific instant of time during the cycle of an alternating waveform.

Formula:

$$\boldsymbol{v(t) = v_p \ sin\, \omega t}$$

where:

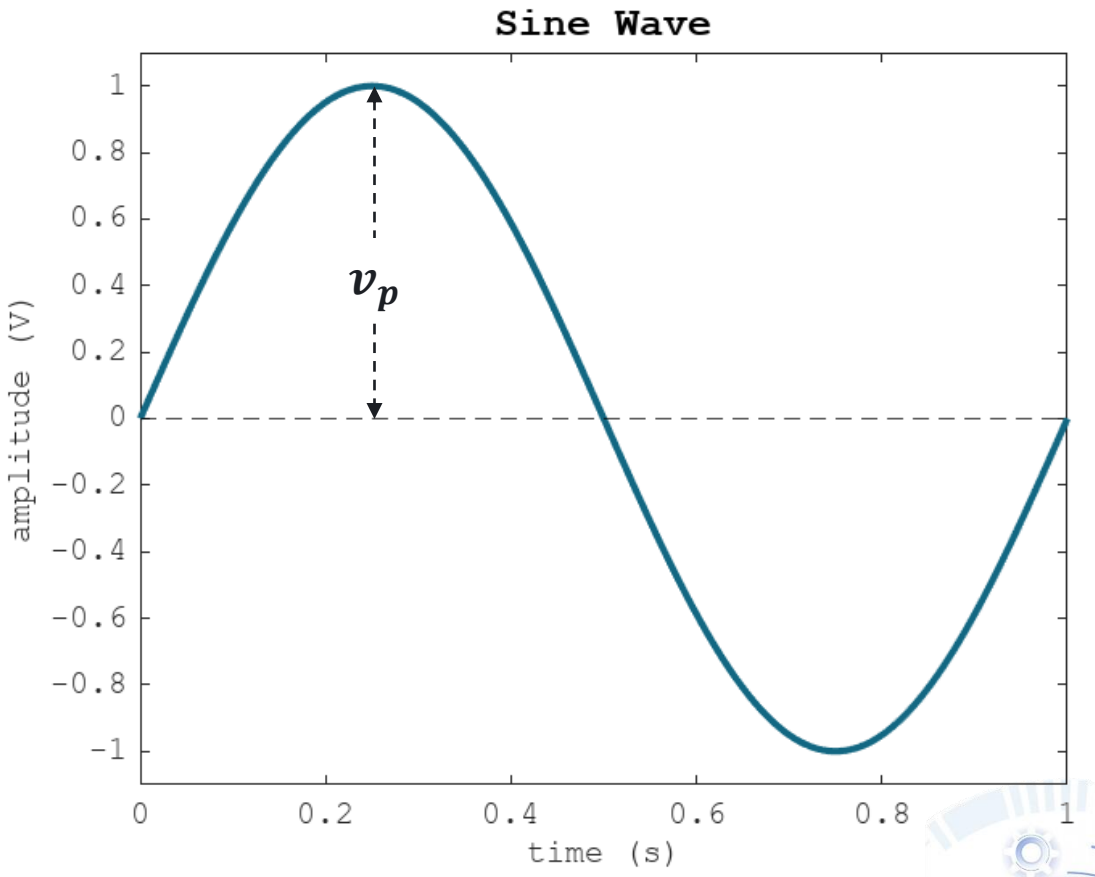
$\boldsymbol{v(t)}$ = instantaneous voltage (V)

$\boldsymbol{V_p}$ = peak/maximum voltage (V)

$\boldsymbol{\omega = 2\pi f}$ = angular speed (rad/s)

$\boldsymbol{f}$ = frequency (Hz)

$\boldsymbol{t}$ = time (s)

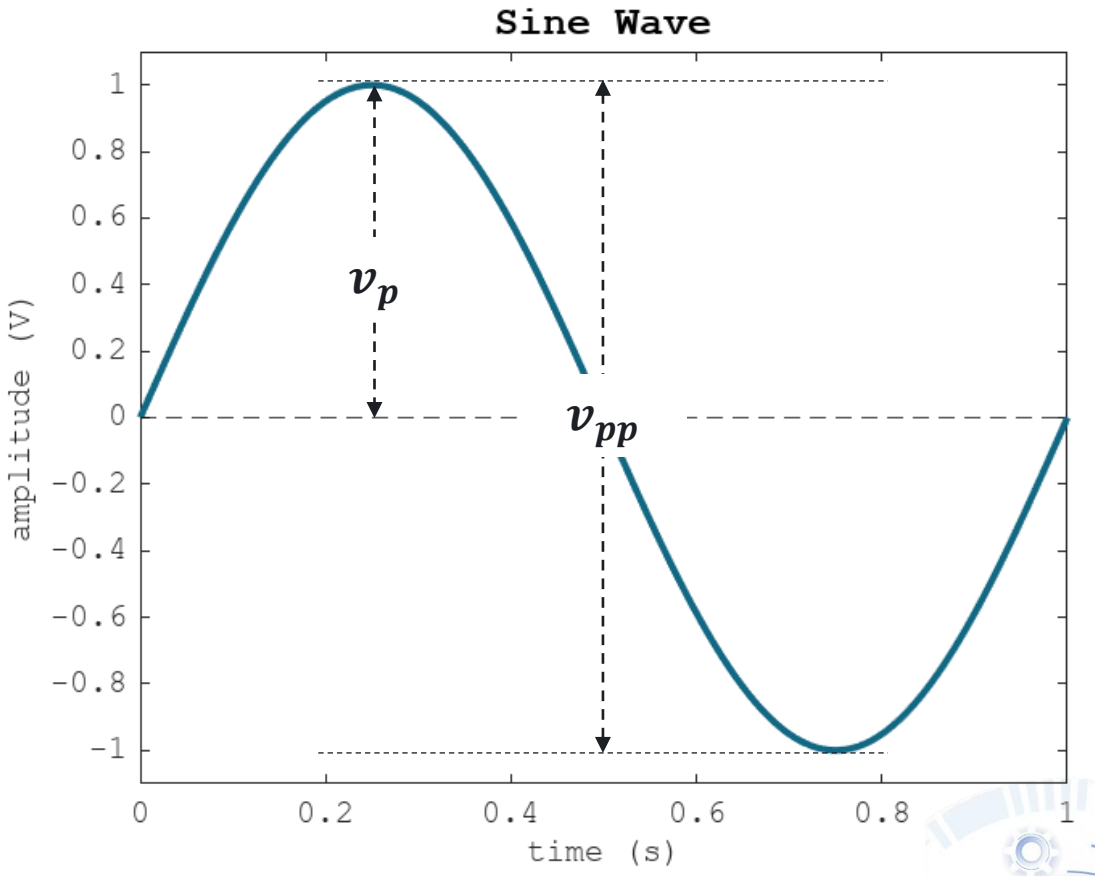


PEAK-TO-PEAK VOLTAGE

Peak-to-peak voltage v_{PP} is a measure of the total voltage swing of a waveform, specifically the difference between the maximum positive peak and the maximum negative peak of an alternating current (AC) or voltage signal.

Formula:

$$v_{pp} = 2v_p$$

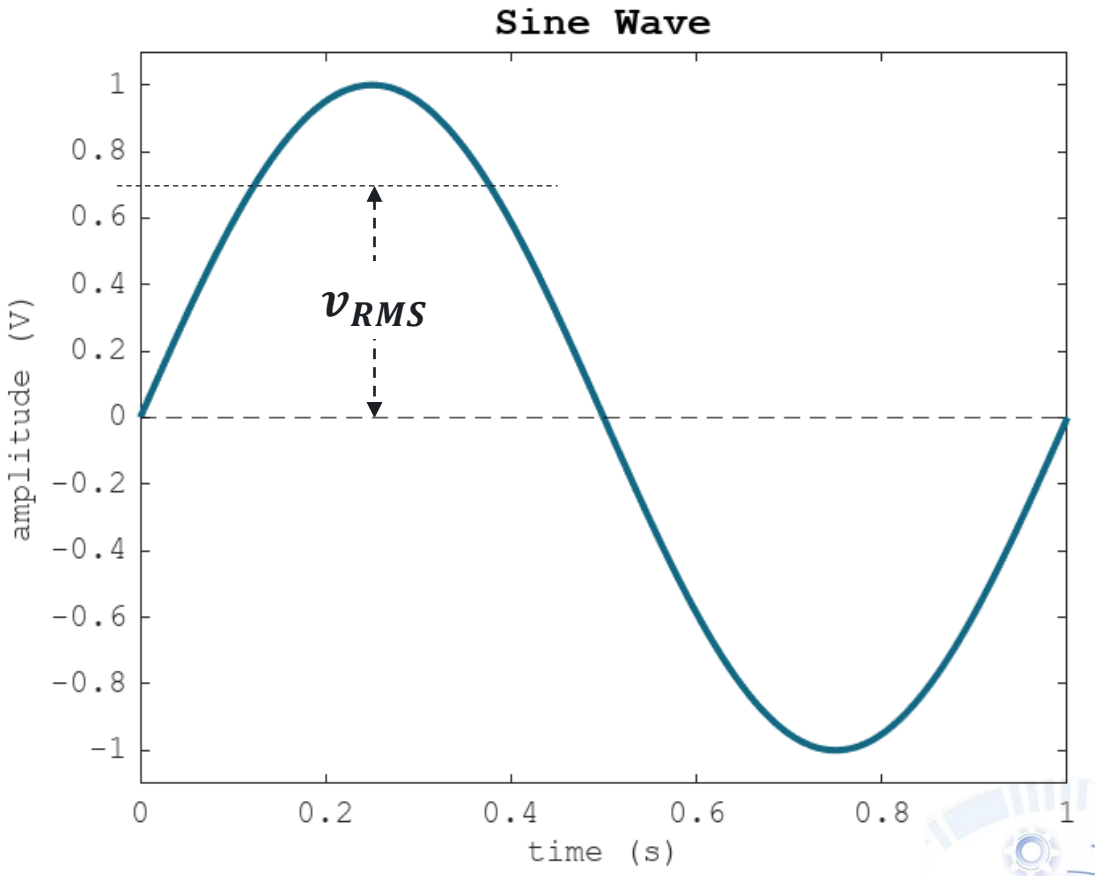


ROOT-MEAN-SQUARE VOLTAGE

The root-mean-square voltage v_{RMS} is a measure of the **effective voltage** of an AC signal. When you measure an AC voltage using a multimeter, the displayed value is the RMS voltage.

Formula:

$$v_{RMS} = \frac{v_p}{\sqrt{2}}$$

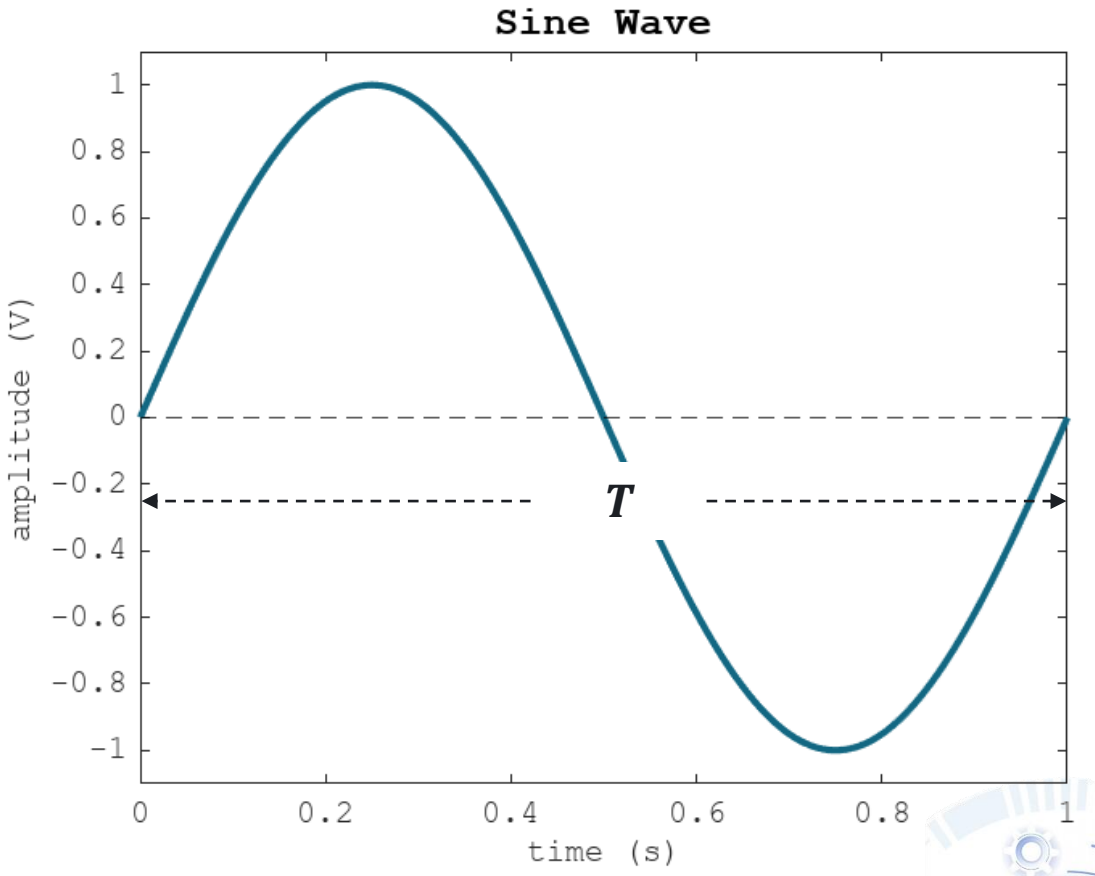


PERIOD AND FREQUENCY

The **period** T of a waveform describes the time it takes for **one complete cycle** of the waveform to occur. It is the inverse of the **frequency** f, which is the **number of cycles** that the occur per second.

Formula:

$$T = \frac{1}{f}$$



EXERCISE

The rms value of the voltage in a **60-cycle** circuit is **115 volts**. Write the **equation** for the sinusoidal wave.

Solution:

EXERCISE

A sinusoidal voltage waveform is described by the equation:

$$\boldsymbol{v(t) = 120 \sin 377t}$$

Determine the following:

a. Frequency f

b. Period T

c. RMS voltage v_{RMS}

d. Peak-to-peak voltage v_{PP}

e. If this voltage is applied across a 10Ω resistor, what is the average power dissipated in the resistor?

Solution:

LABORATORY