



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

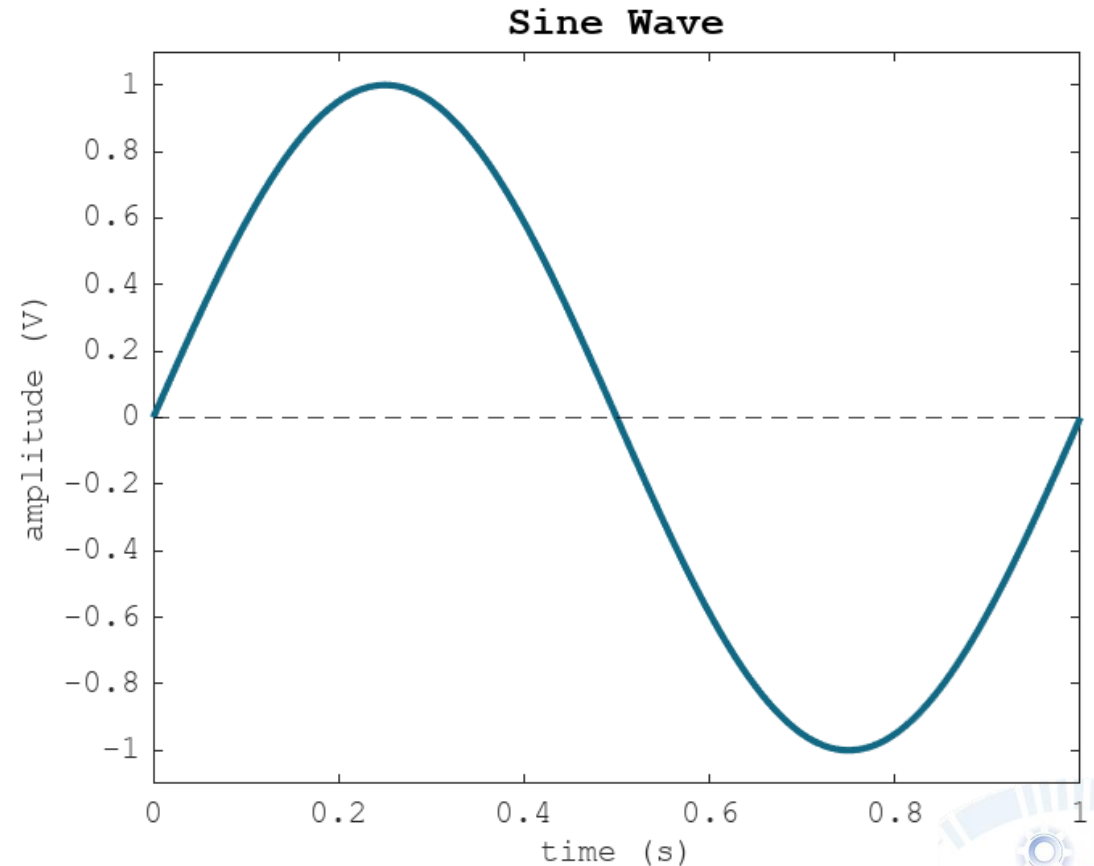


SINUSOIDAL WAVE



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

Formula:

$$v(t) = v_p \sin \omega t$$

where:

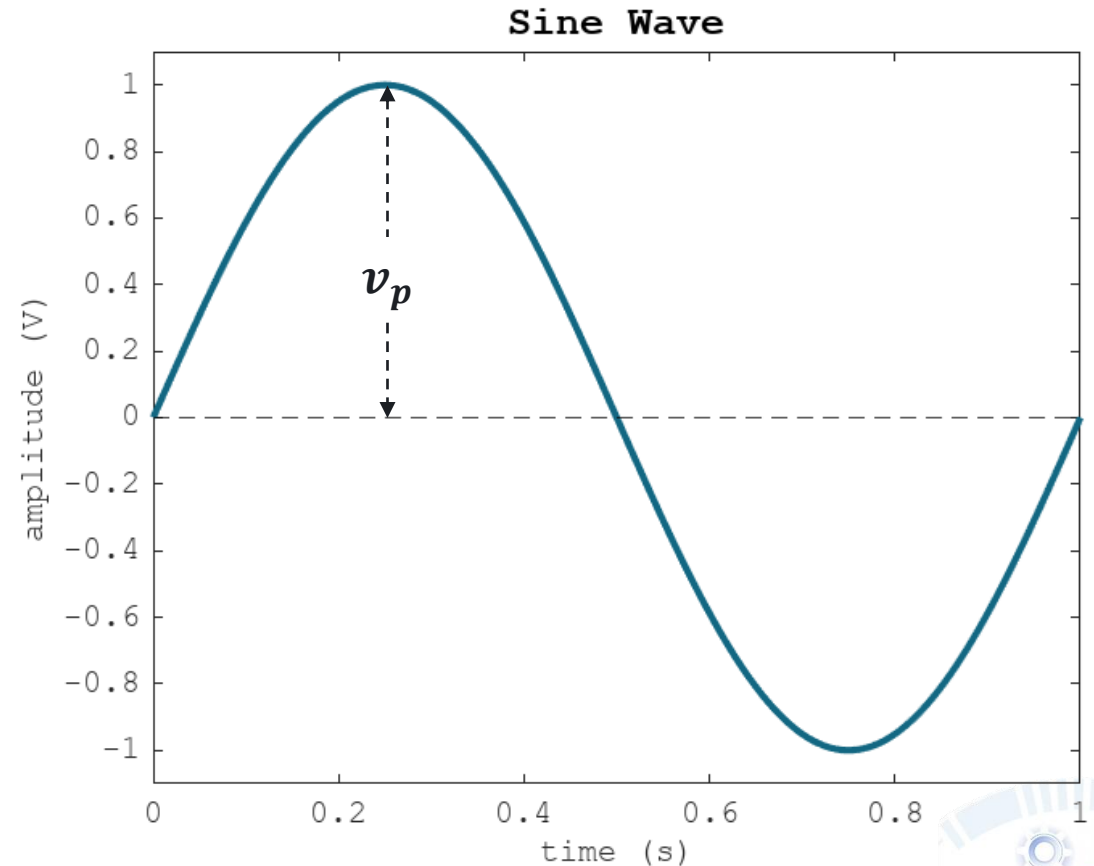
$v(t)$ = instantaneous voltage (V)

V_p = peak/maximum voltage (V)

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

f = frequency (Hz)

t = time (s)

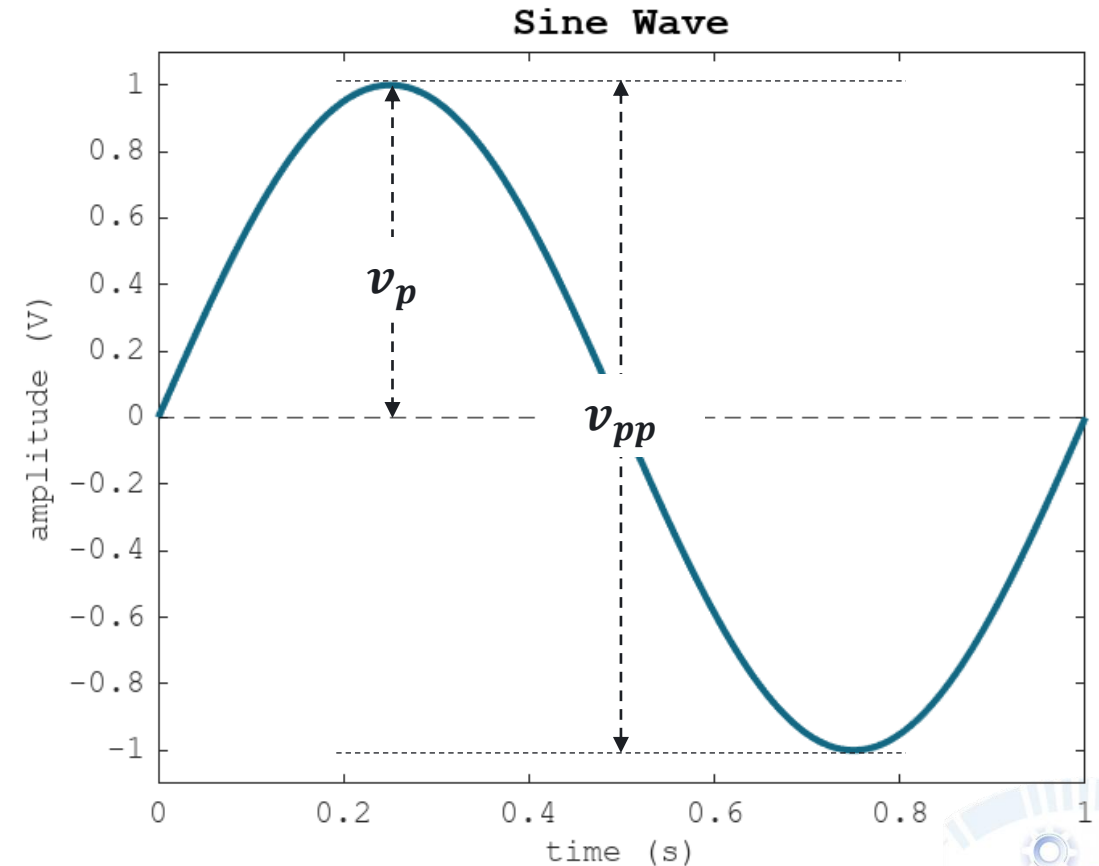


PEAK-TO-PEAK VOLTAGE

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:

$$v_{pp} = 2v_p$$

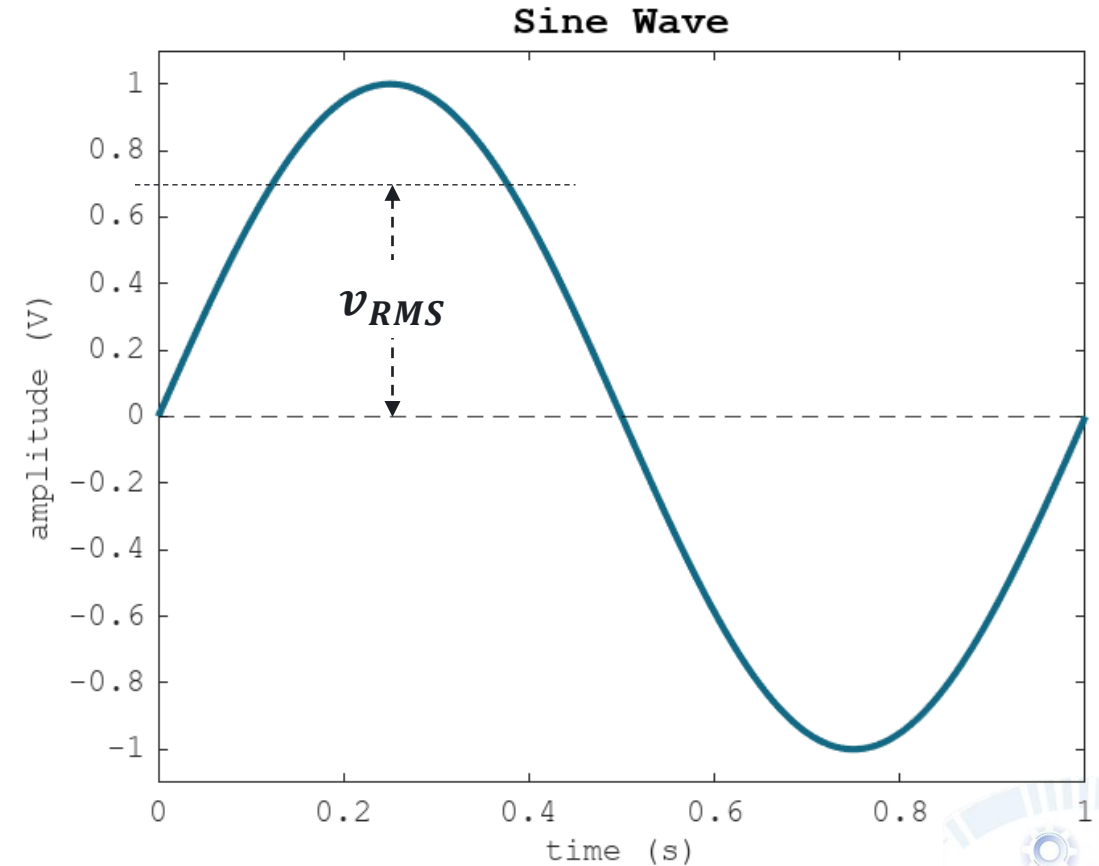


ROOT-MEAN-SQUARE VOLTAGE

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:

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

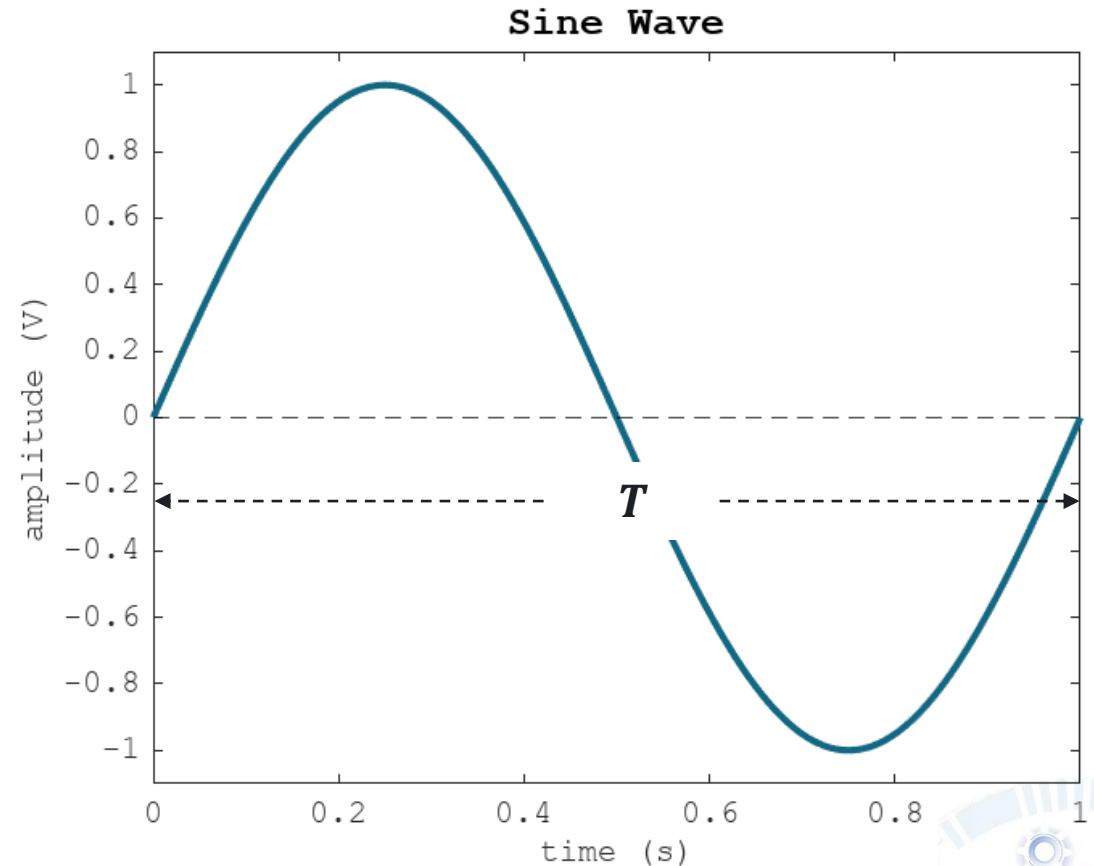


PERIOD AND FREQUENCY

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 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:

$$v(t) = 120 \sin 377t$$

Determine the following:

- Frequency f
- Period T
- RMS voltage v_{RMS}
- Peak-to-peak voltage v_{PP}
- If this voltage is applied across a 10Ω resistor, what is the average power dissipated in the resistor?

Solution:



LABORATORY

