SNS COLLEGE OF TECHNOLOGY

Saravanampatti, Coimbatore – 641 035

Approved by AICTE, Recognized by UGC & Affiliated to Anna University, Chennai

Department of Artificial Intelligence and Data Science

23EET103 – Electric Circuits and Electron Devices

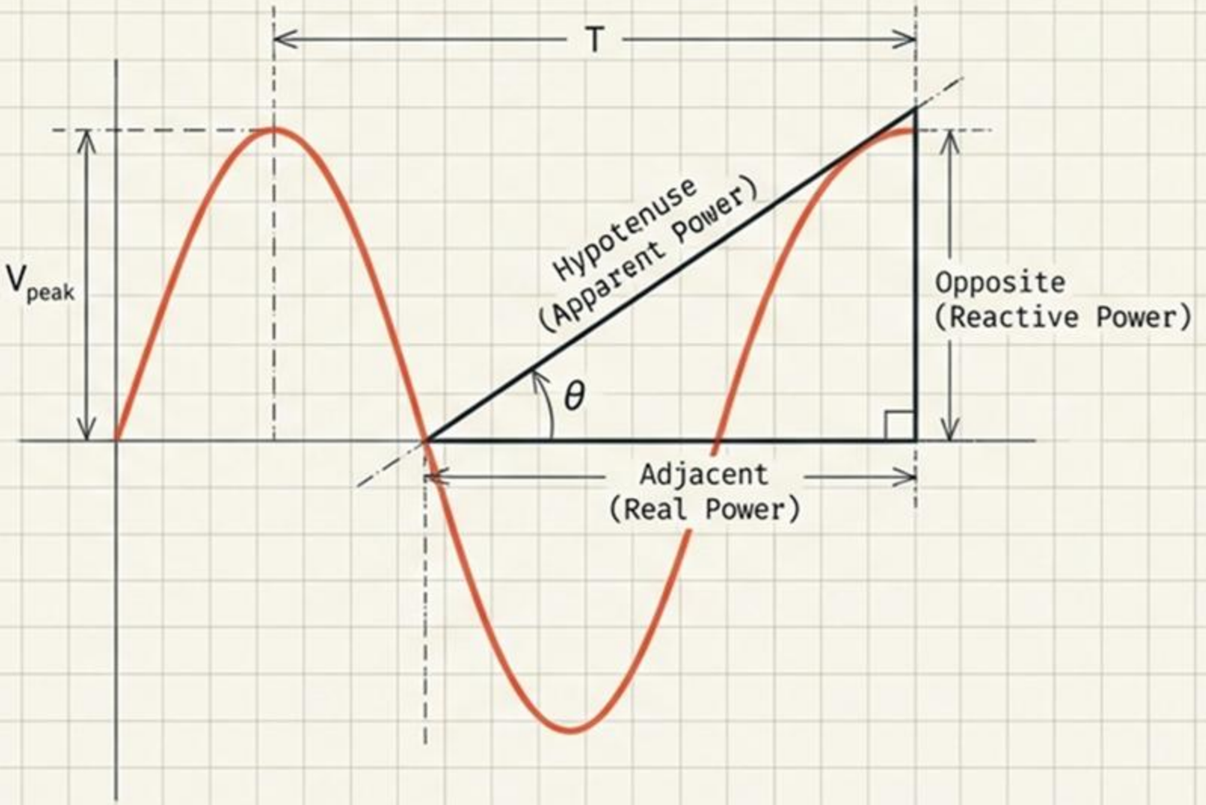
I YEAR /II SEMESTER

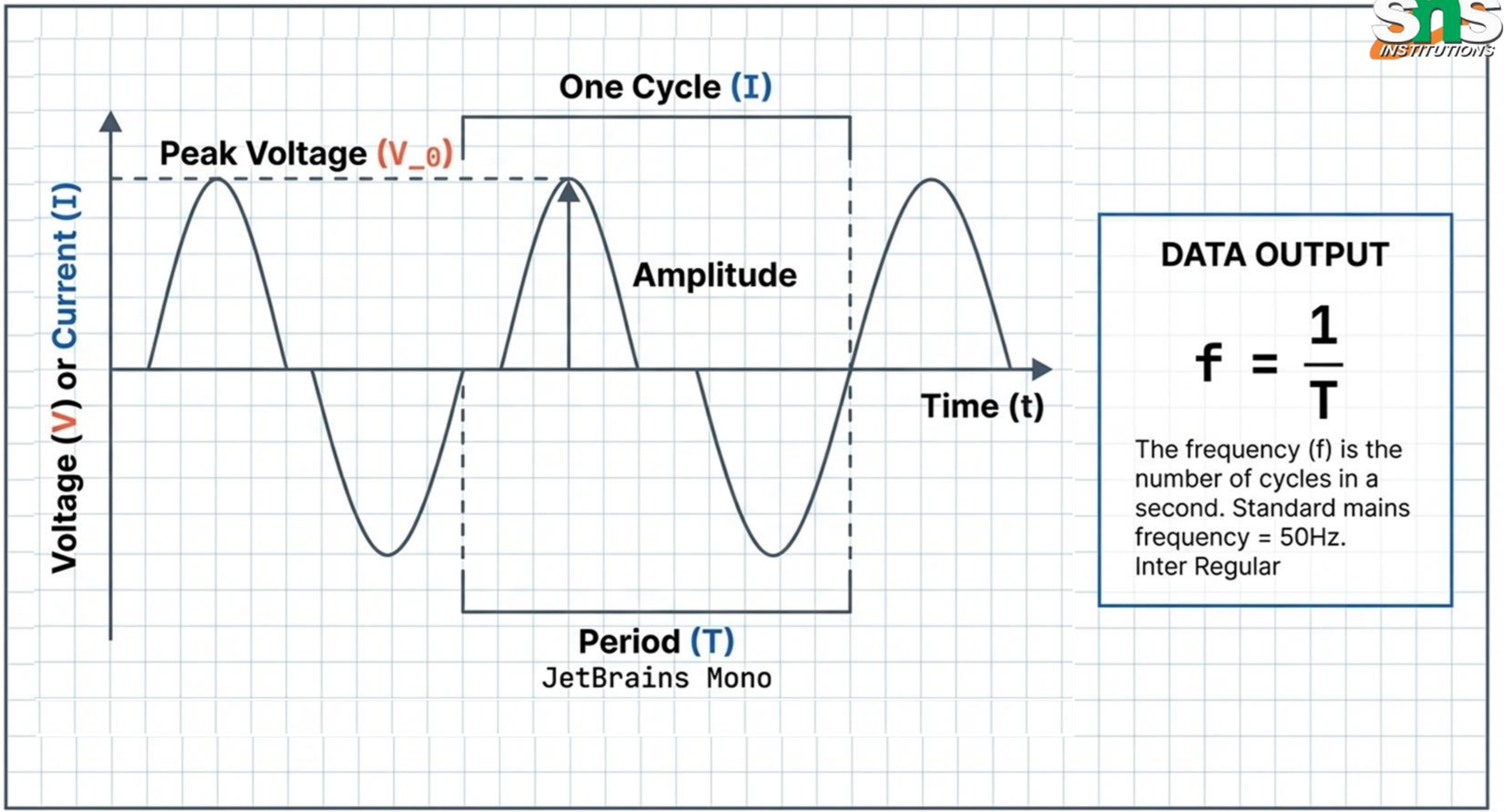
UNIT -2 – Fundamentals of Single Phase Circuits

Fundamentals of AC Power & Single-Phase Circuits

From Waveform Anatomy to Power Factor Optimization

A comprehensive visual guide to electrical circuit analysis.



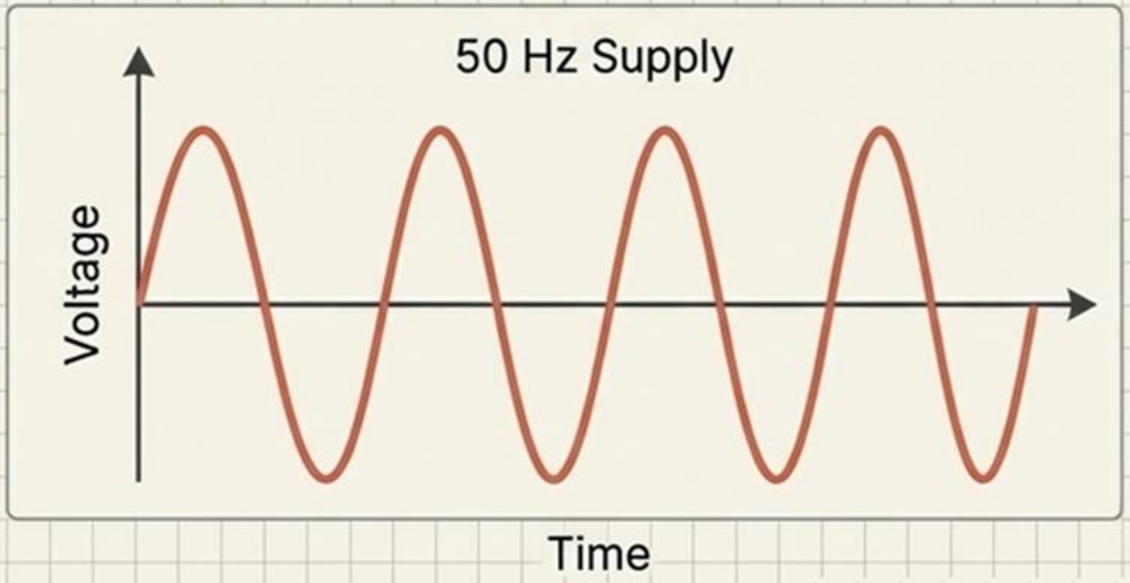


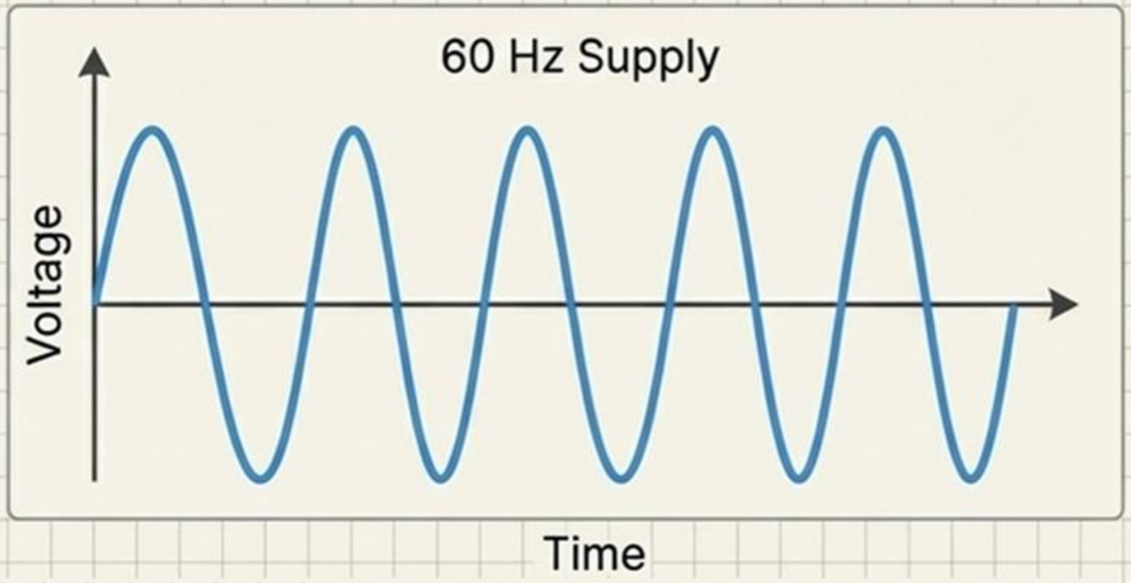
DATA OUTPUT

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

The frequency (f) is the number of cycles in a second. Standard mains frequency = 50Hz.
Inter Regular

The Rhythm of AC: Time and Frequency





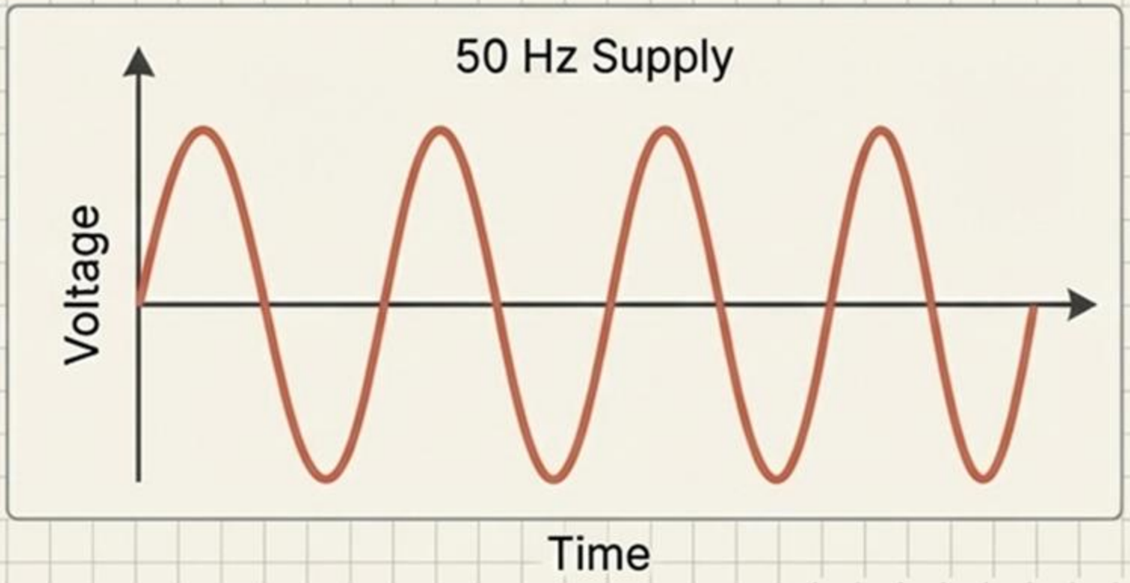
Period (T)

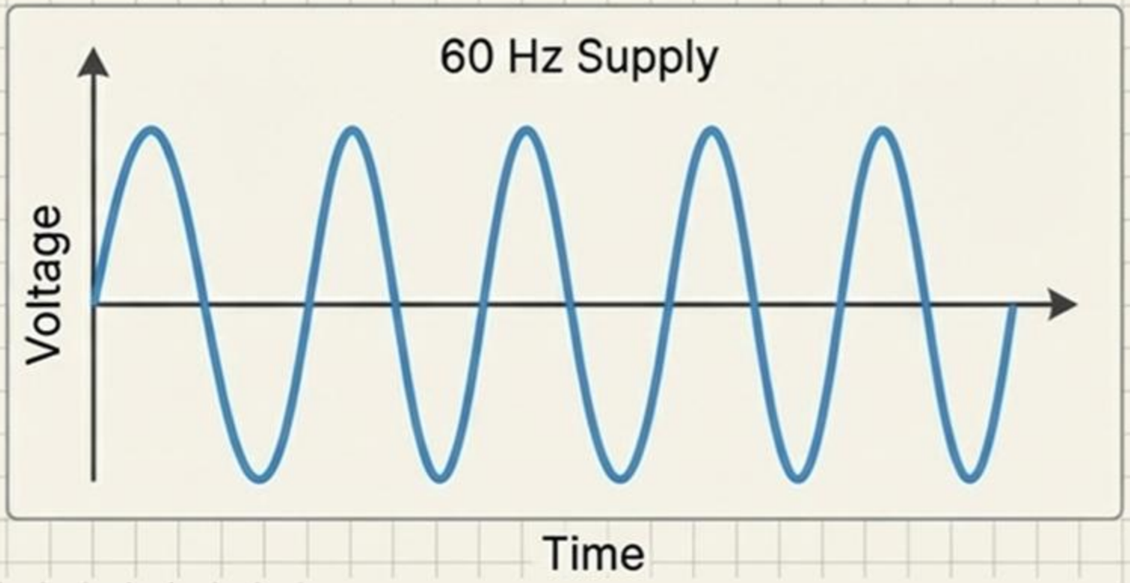
Time taken for one full cycle.

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

(e.g., 20 ms at 50 Hz)

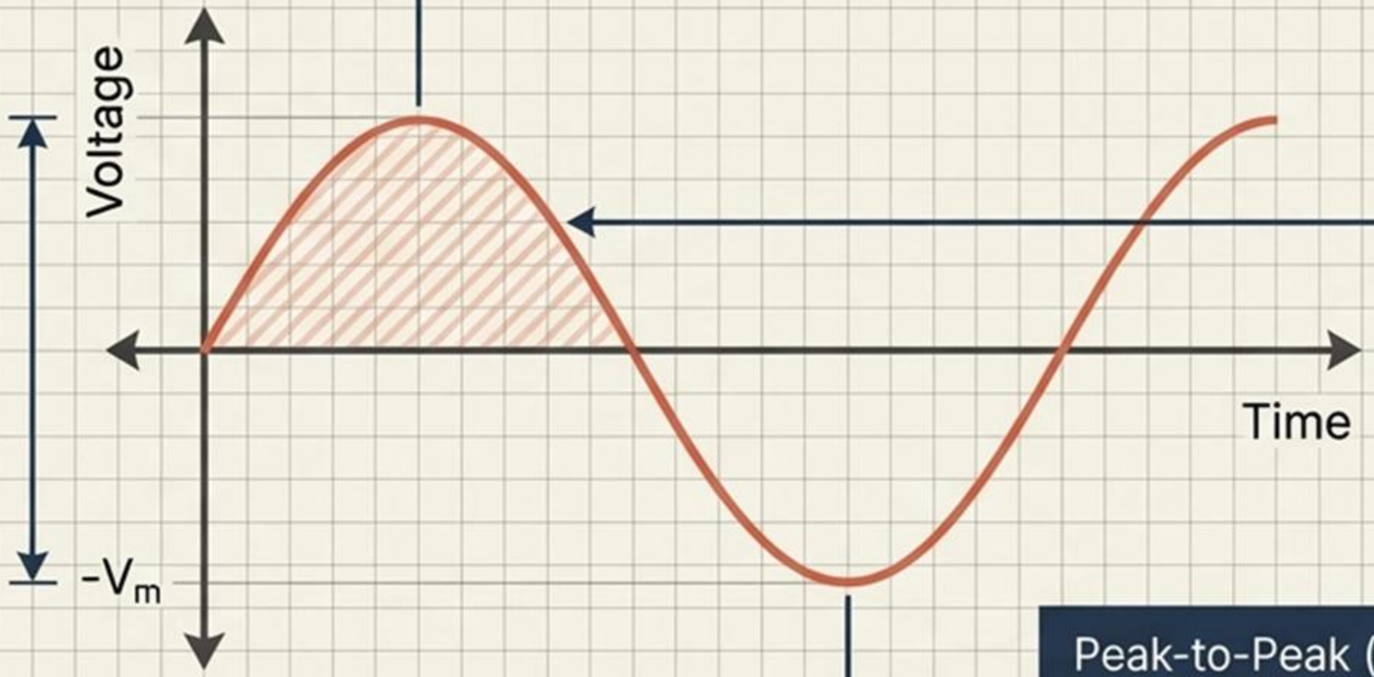
The Rhythm of AC: Time and Frequency





Frequency (f)	Angular Frequency (ω)
Cycles completed per second. Standard is 50 Hz or 60 Hz. $$f = \frac{1}{T}$$	The rotational speed of the phasor. $$\omega = 2\pi f$$ (e.g., 314.16 rad/s at 50 Hz)

Measuring Amplitude and Excursion



Peak Value (V_m)

The absolute highest magnitude reached during one cycle.

Multiplier: × 1.000

Average Value (V_{avg})

The mean taken strictly over a half-cycle, utilized primarily in rectifier analysis.

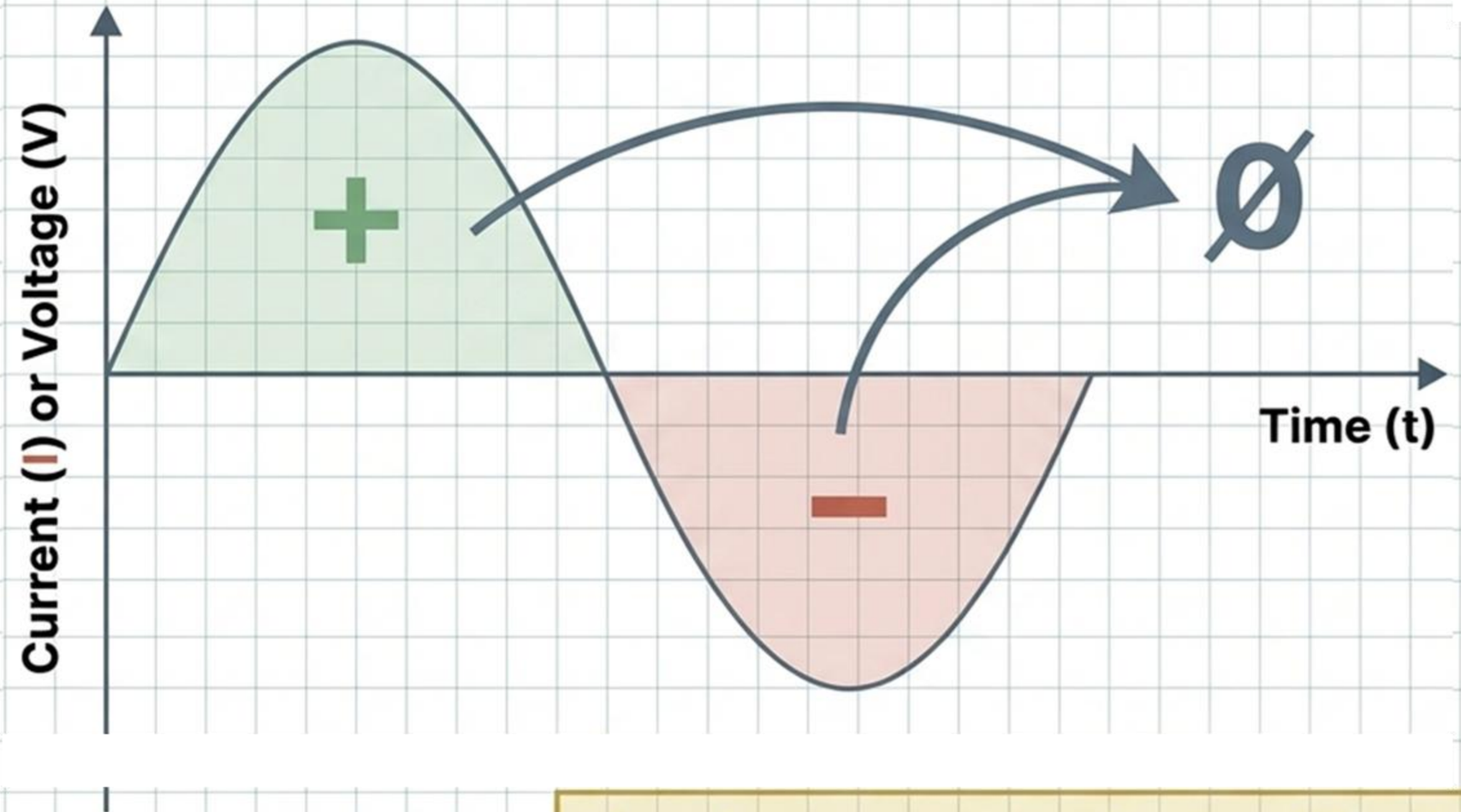
$$\frac{2V_m}{\pi} \approx 0.637 \times V_m$$

Peak-to-Peak (Vpp)

The total vertical swing from most negative to most positive.

$$2 \times V_m$$

The Average Dilemma

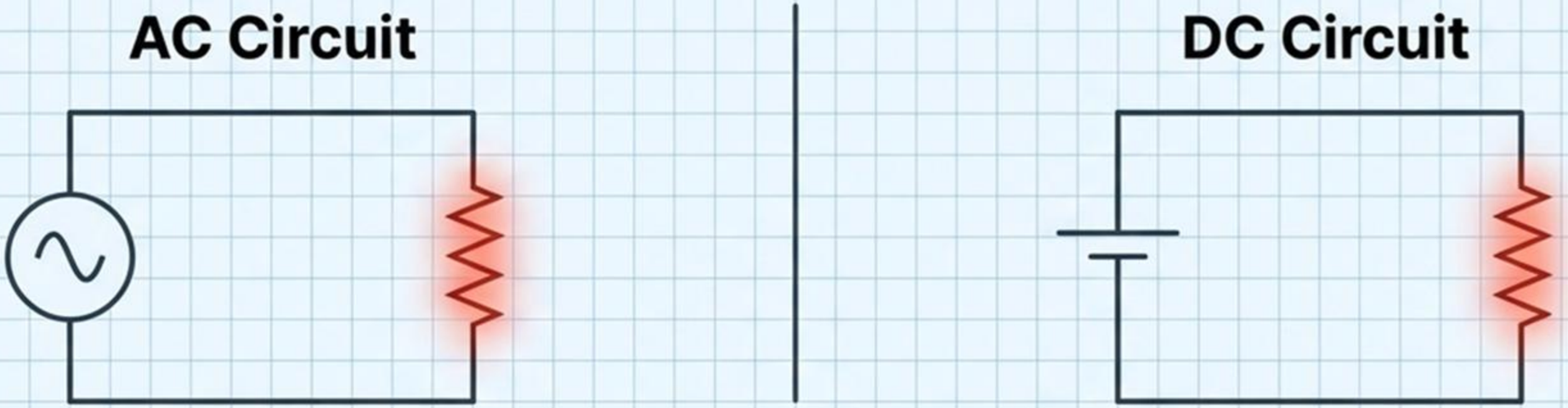


If we take a simple mean of an AC current, the positive and negative halves perfectly cancel.

$$I_{average} = 0$$

How do we measure the true 'size' or doing-power of an alternating current if its average is zero?

The RMS Solution: Apples to Apples

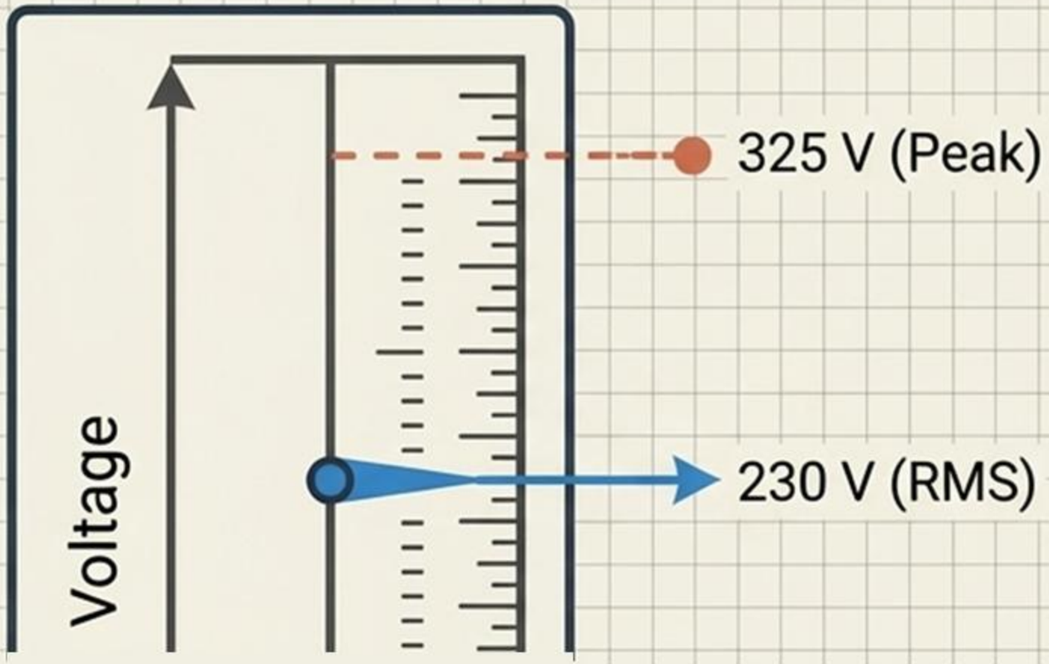


We compare AC to DC based on the Power dissipated through equal resistance. Power depends on current squared (P = I^2R), so the negative signs disappear.

$$I_{rms} = I_0 / \sqrt{2}$$

$$I_{rms} = 0.707 \times I_0$$

The Power of Root Mean Square (RMS)



1. Core Concept

The RMS is the equivalent DC value that produces the exact same heating effect in a resistive load.

2. Key Metrics

$$V_{\text{rms}} = \frac{V_m}{\sqrt{2}} \approx 0.707 \times V_m$$

Real-World Anchor: Standard household appliances are rated in RMS. A 230 V outlet actually peaks at ~325 V.

3. Waveform Factors

Form Factor: $\frac{V_{\text{rms}}}{V_{\text{avg}}} \approx 1.11$ Crest Factor: $\frac{V_{\text{m}}}{V_{\text{rms}}} \approx 1.414$

Summary Cheat Sheet: Multipliers & Formulas

The Multipliers (For Pure Sine Waves)	
Peak (V_m)	= V_{rms} × 1.414
RMS (V_{rms})	= V_m × 0.707
Average	= V_m × 0.637
Peak-to-Peak	= V_m × 2.000

REFERENCES

- https://www.electrical4u.com
- https://www.allaboutcircuits.com
- https://nptel.ac.in/courses/108106172

THANK YOU