Presentation on the topic of Average and RMS Value of AC current

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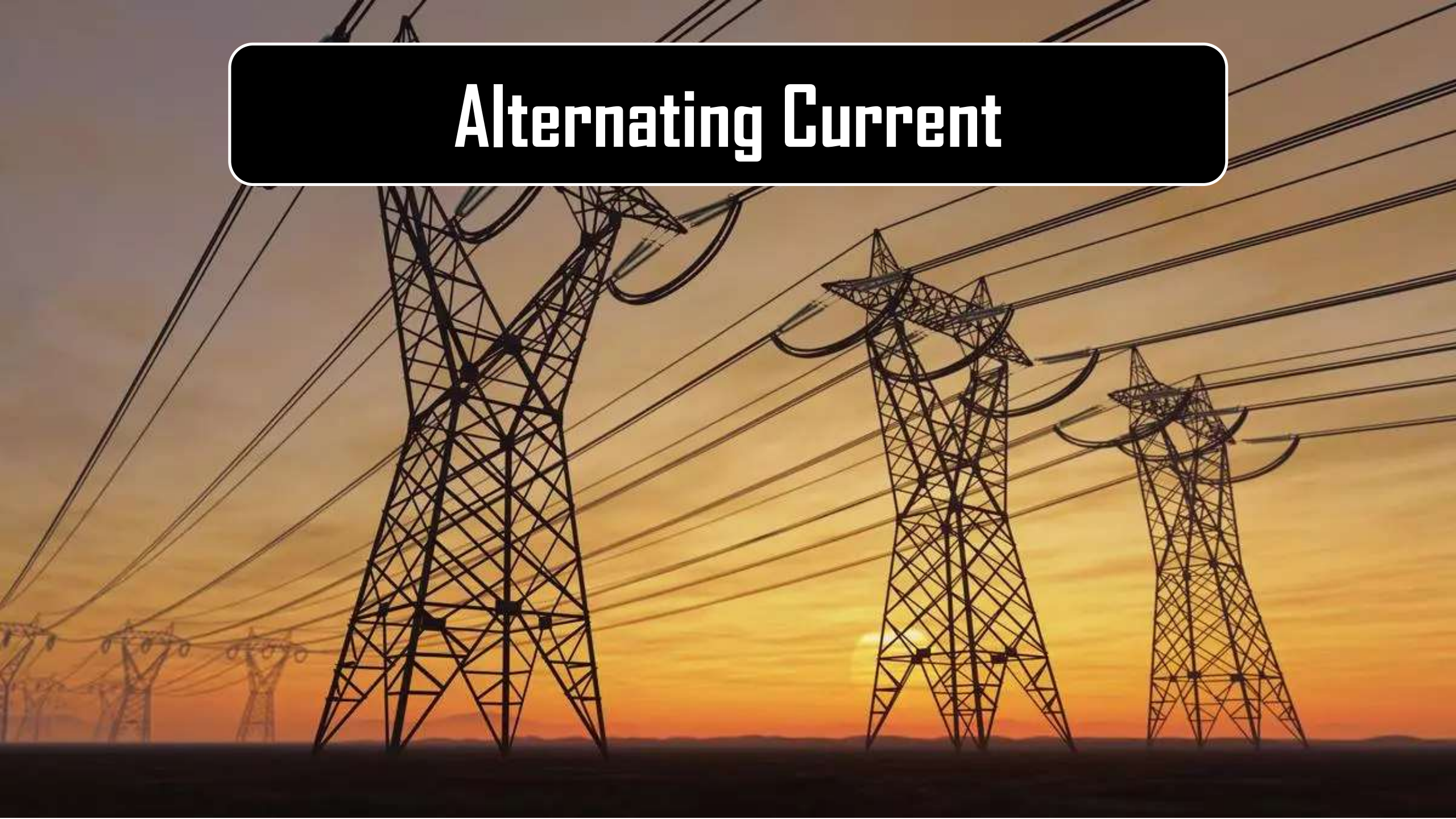
Presented To:

Sarbhagya Saha
Fundamental of Electrical and electronics

Department of Electronics and Computer Engineering IOE, Thapathali Campus

Alternating Current



Alternating Current

Alternating Current

Generation of Ac Voltage

Waveform and its Characteristics

RMS and Average Value of Periodic Waveform

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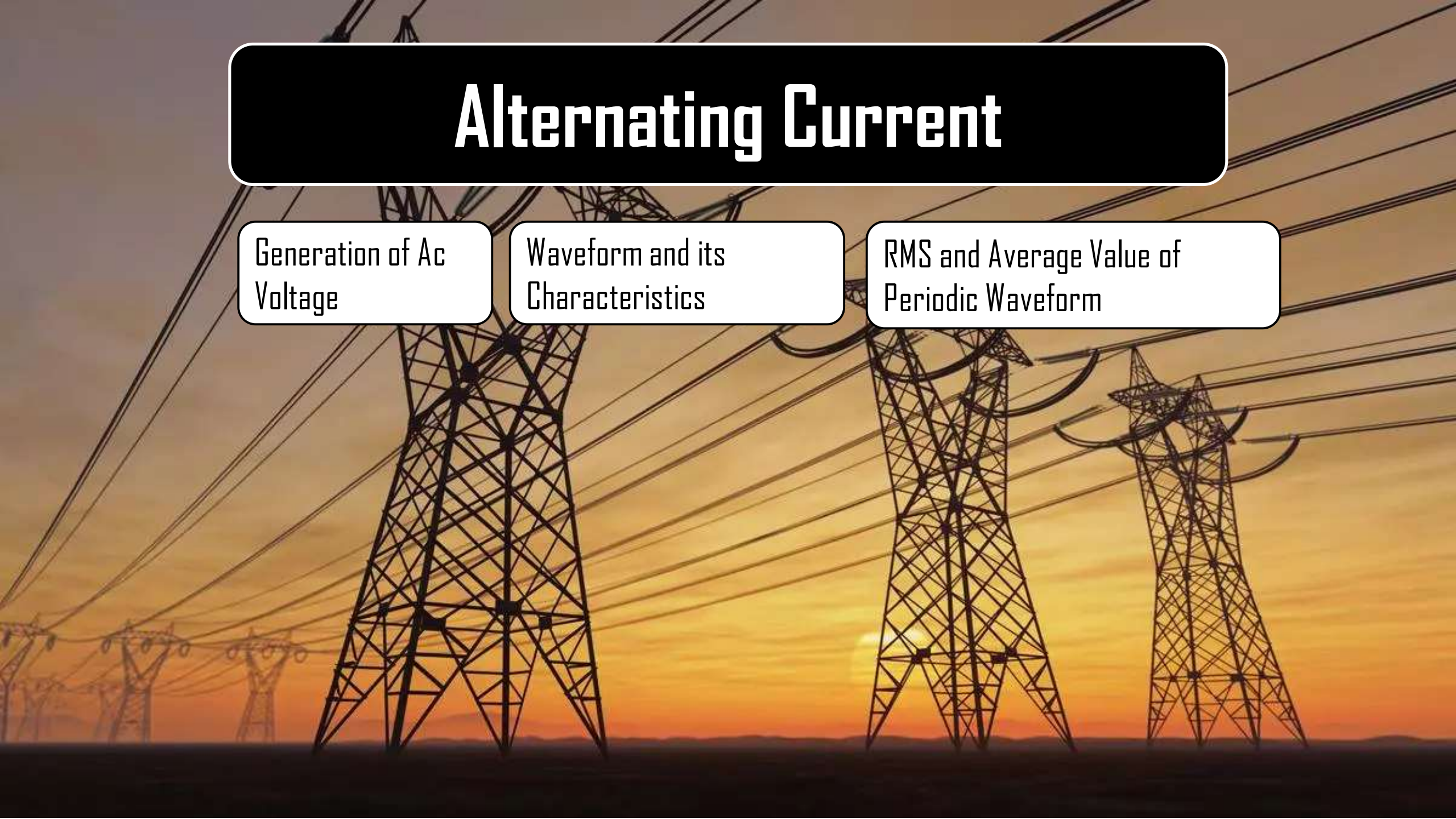

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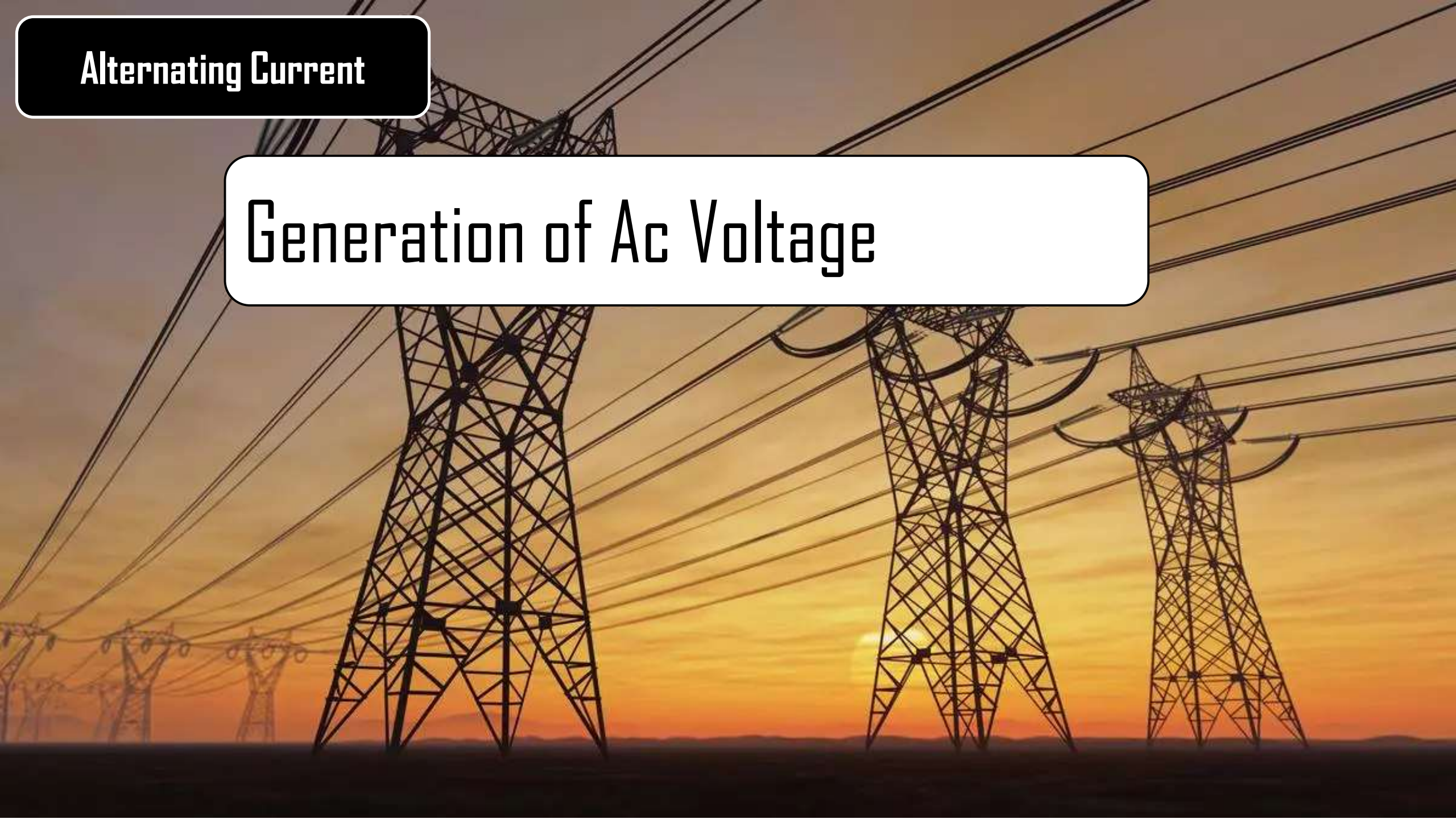

wait

But what is


CURRENT
GUTKHA
सूर्तिजन्य पदार्थ स्वास्थ्यलाई हानिकारक छ,
सूर्तिजन्य पदार्थ सेवनले ज्यान लिन्छ

Alternating Current

AC (alternating current) is an electric current that changes direction periodically. It flows back and forth in a sinusoidal pattern, which is the most common waveform . The voltage also alternates between positive and negative values over time

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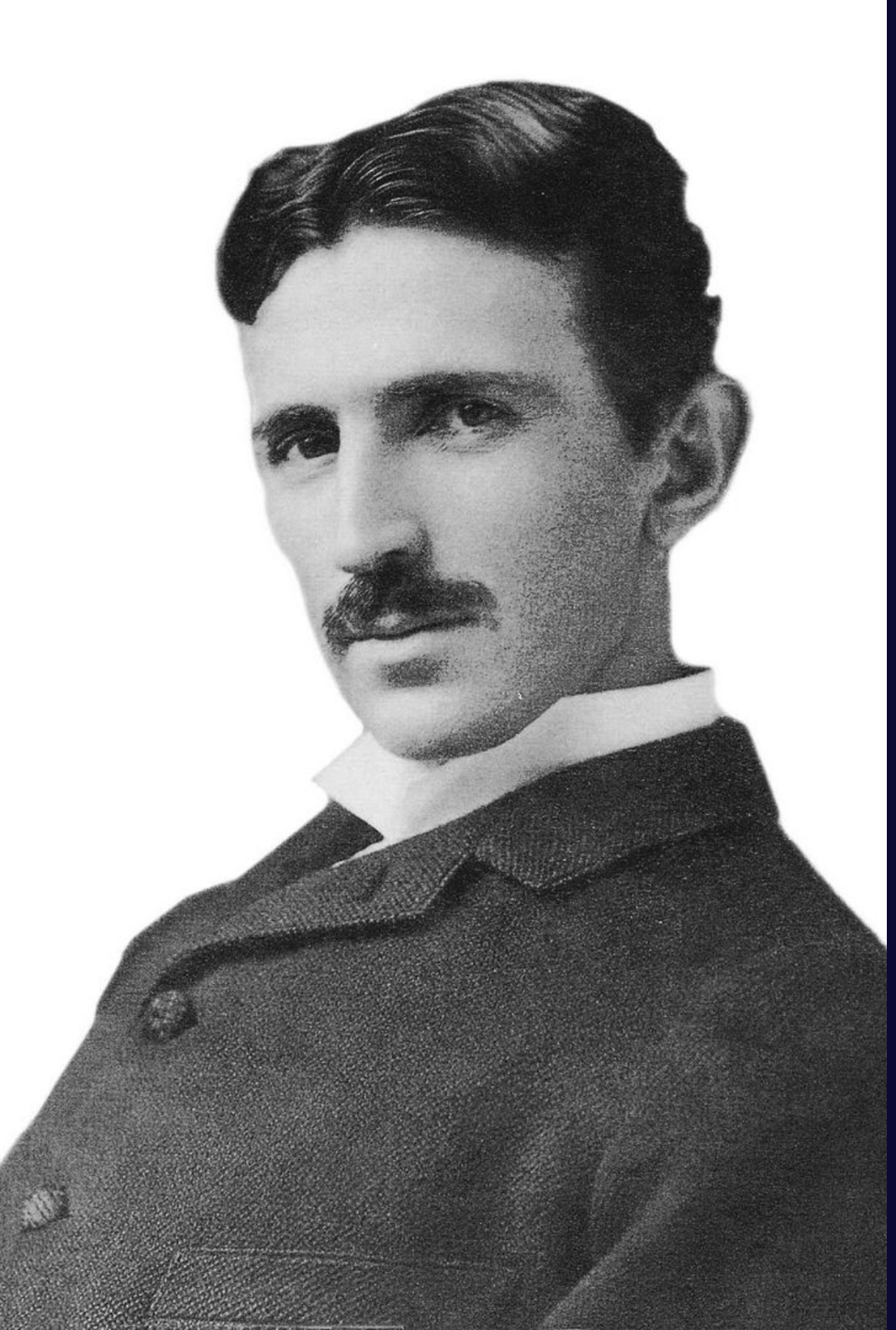
Alternating Current

RMS (root mean square)

The RMS value is a measure of the effective or equivalent value of an AC voltage or current, representing the DC equivalent that would produce the same amount of power in a resistive load. For a sinusoidal AC waveform

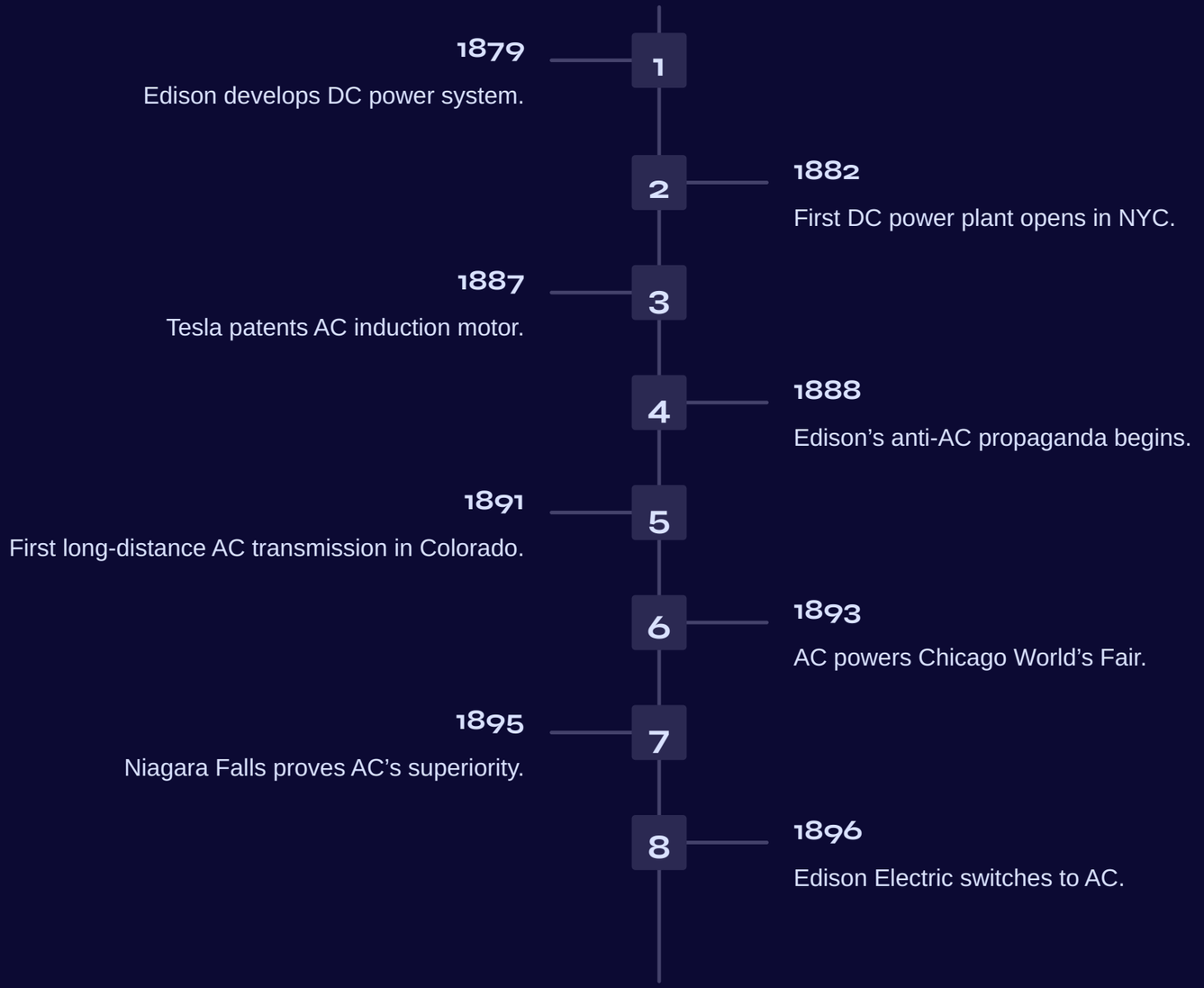
$$\text{RMS Value} = \frac{\text{Peak Value}}{\sqrt{2}}$$



The War of Currents: A Clash of Electrical Titans

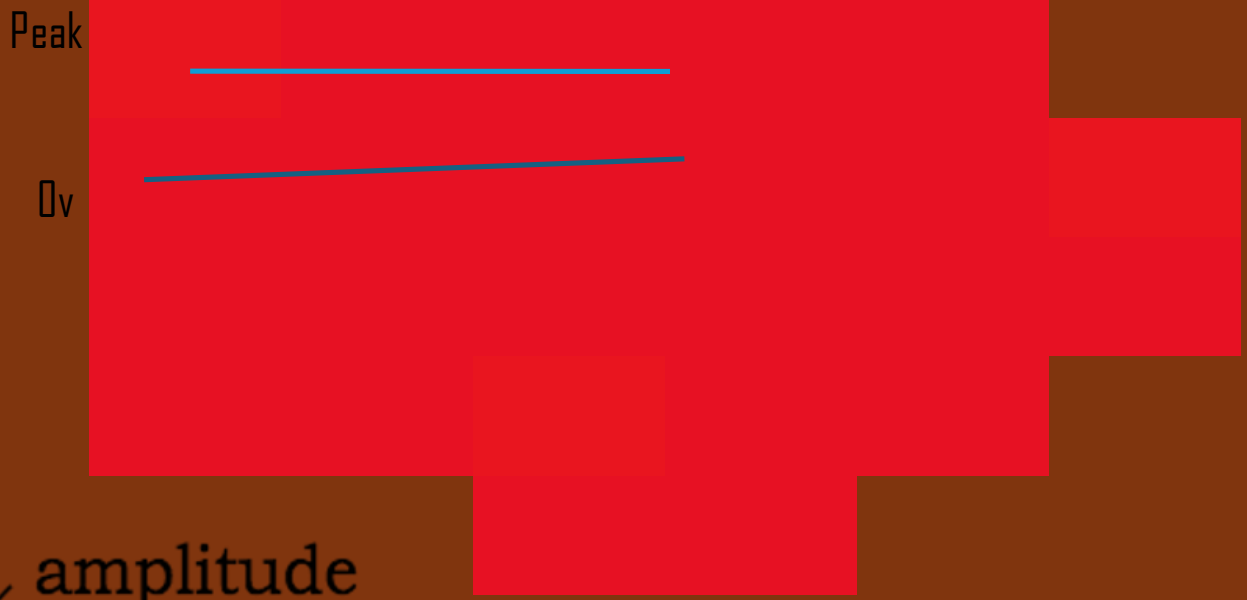
The late 19th century witnessed a fierce battle between two electrical systems: Direct Current (DC) championed by Thomas Edison, and Alternating Current (AC) advocated by Nikola Tesla and George Westinghouse. This "War of Currents" shaped the future of electricity.

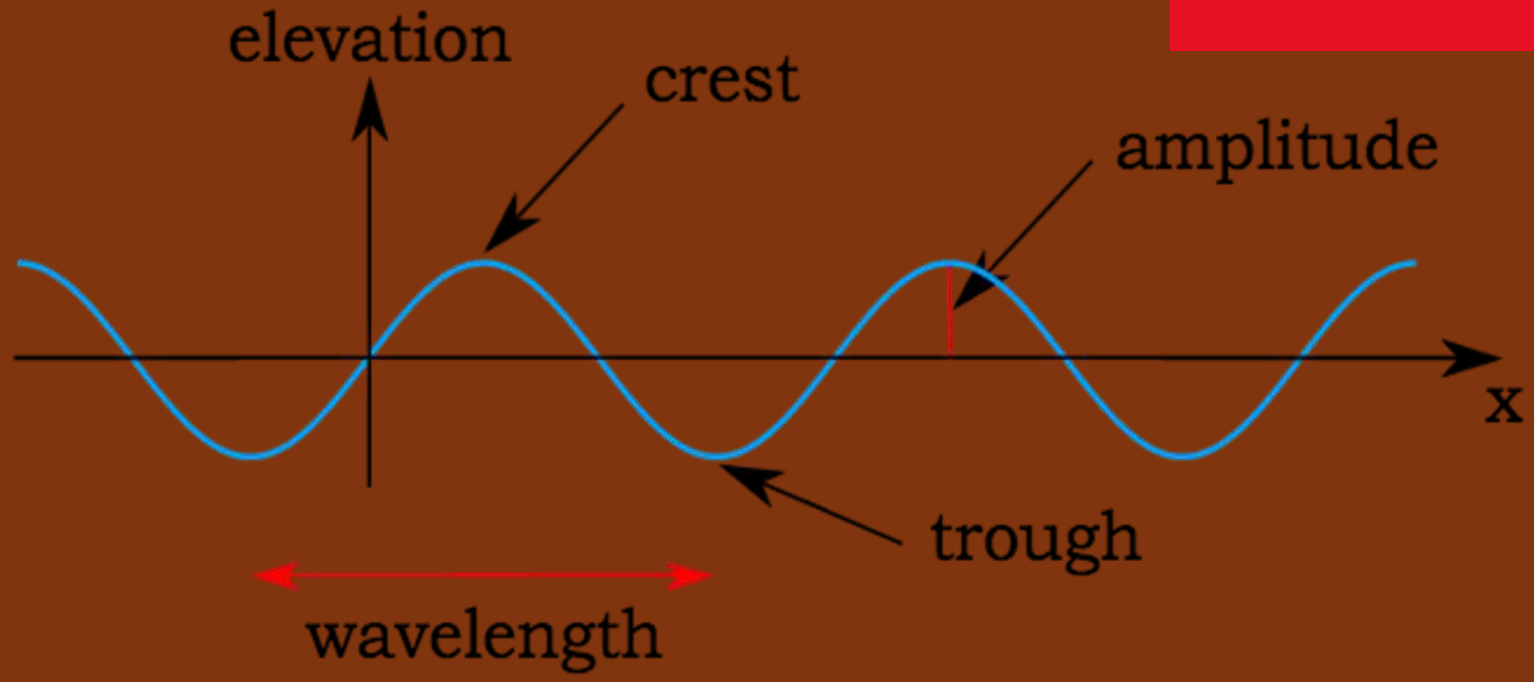
Key Events in the War of Currents



Alternating Current

Alternating Current





Back to the topic of AC current generation

Alternating Current

Generation of Ac Voltage

Alternating Current

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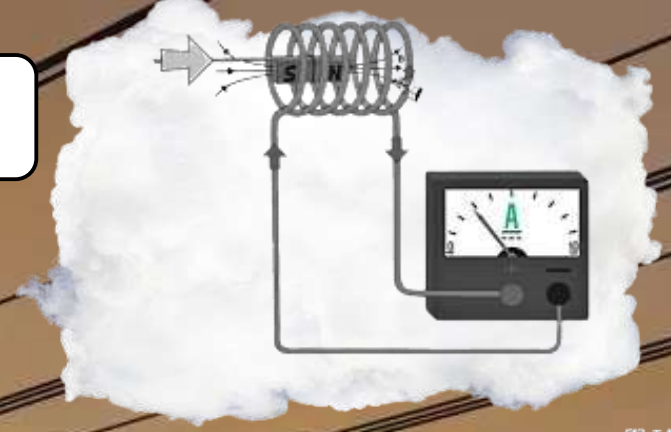
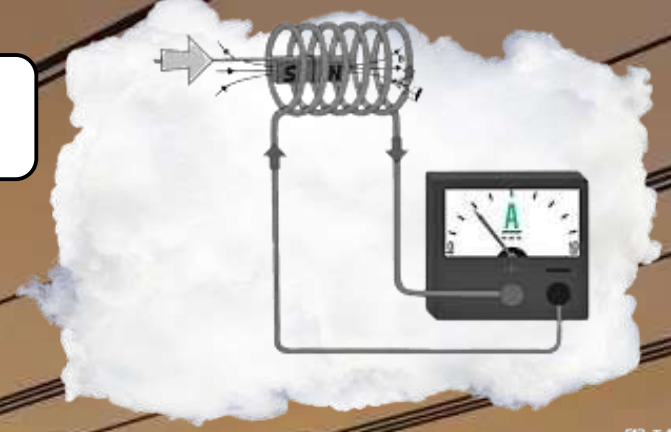


Faraday's Law of Induction: Whenever there is relative motion between set of conductors and uniform magnetic field electromotive force is induced. The induced electromotive force is directly proportional to the rate of change of the magnetic flux through the loop. Mathematically, this is expressed as:

$$E = N d\Phi B / dt$$

Alternating Current

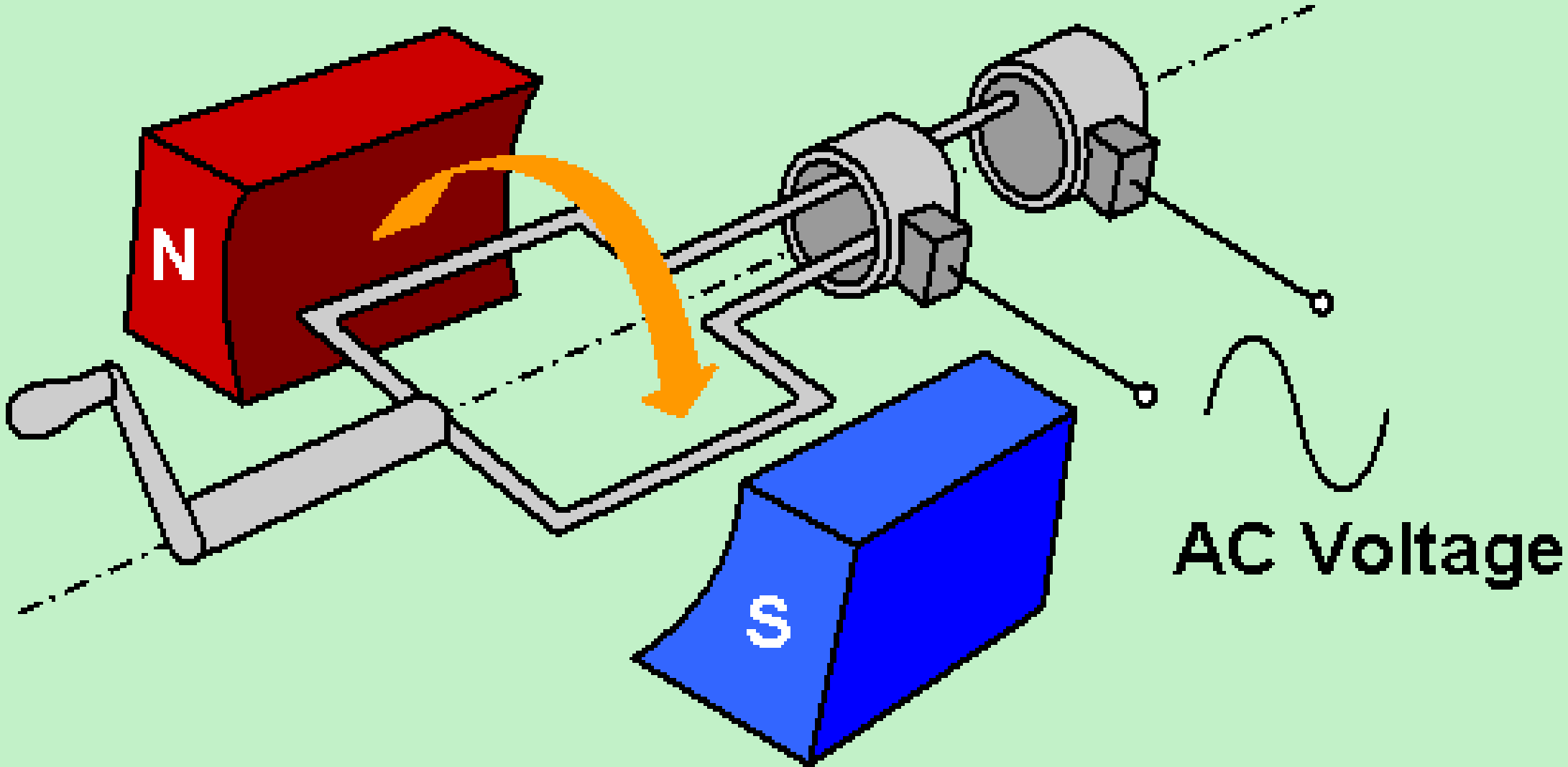
Generation of Ac Voltage



Lenz's Law: The direction of the induced EMF (and hence the induced current) is such that it opposes the change in the magnetic flux that caused it. This is a consequence of the conservation of energy. In other words, the induced current creates a magnetic field that opposes the change in the original magnetic field.

$$E = - N d\Phi B / dt$$

Generation of Ac Voltage



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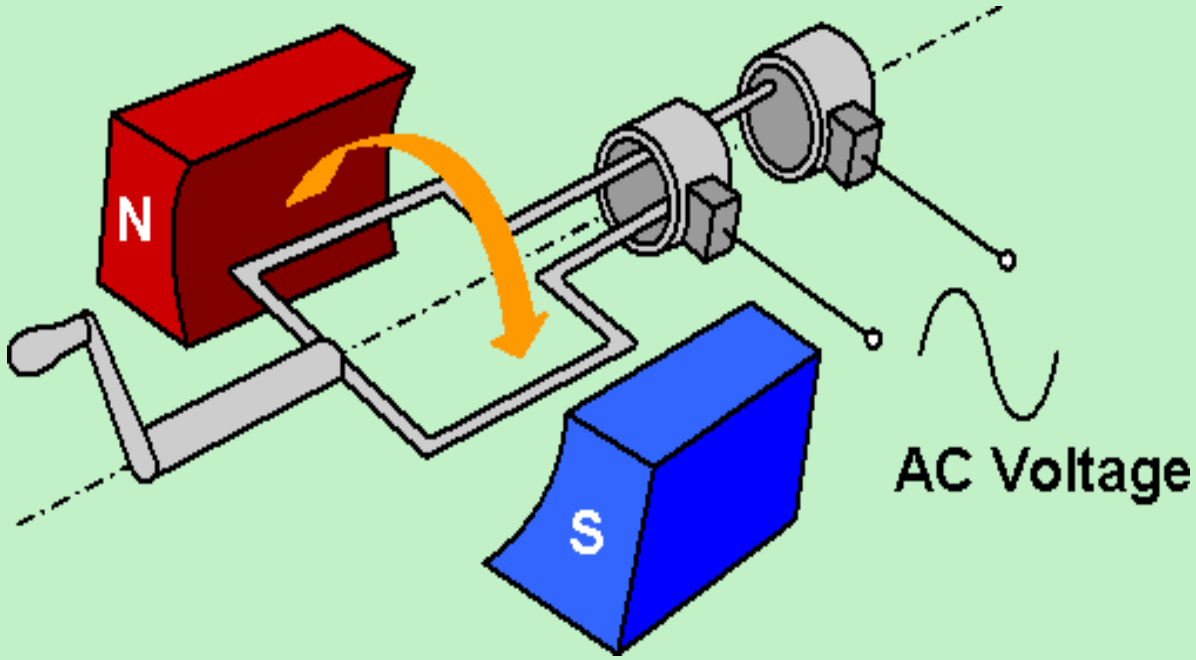


EMF at Key Angles

0

EMF = 0

π/2

EMF = Maximum

π

EMF = 0

3π/2

EMF = Minimum

2π

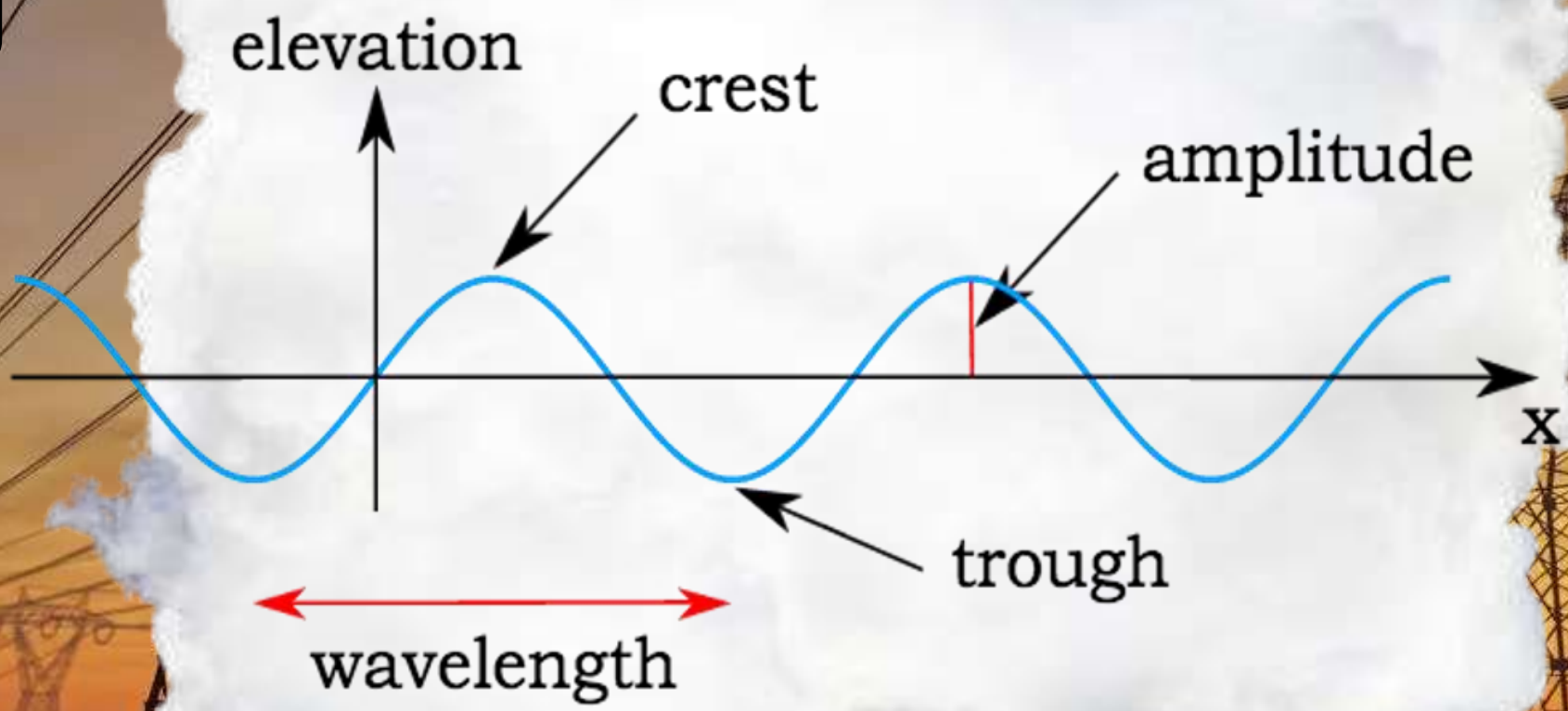
EMF = 0

Alternating Current

Generation of Ac Voltage

RMS and Average Value of Periodic Waveform

Waveform and its Characteristics



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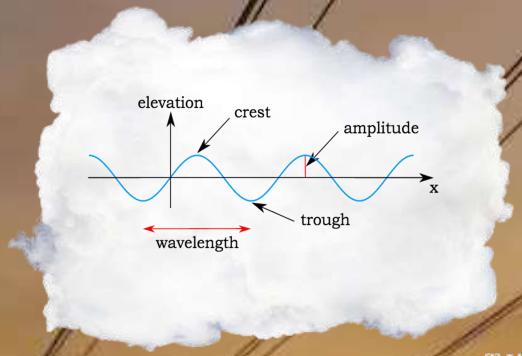

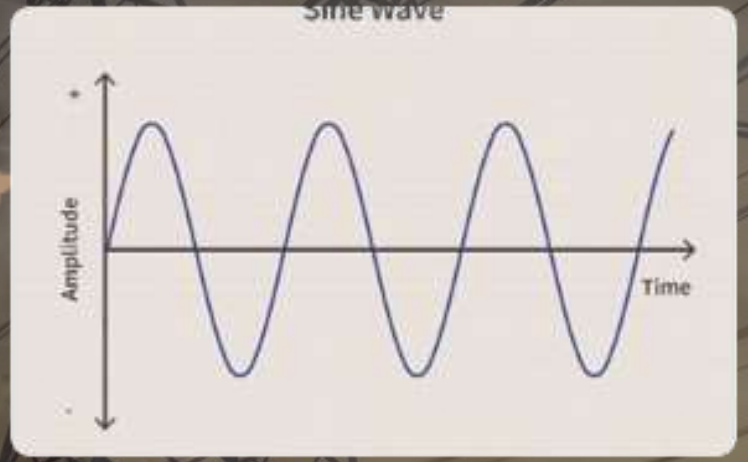

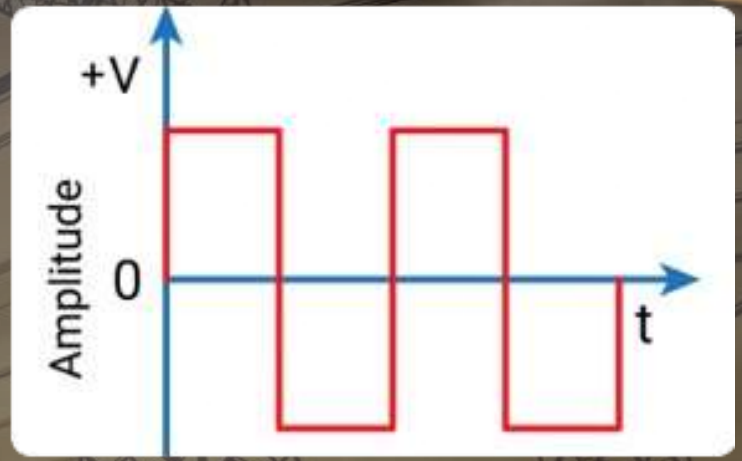

Sine

Smooth, oscillating waveform.

Square

Rapid transitions between two two levels.

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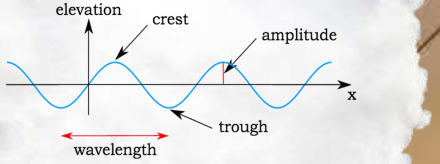
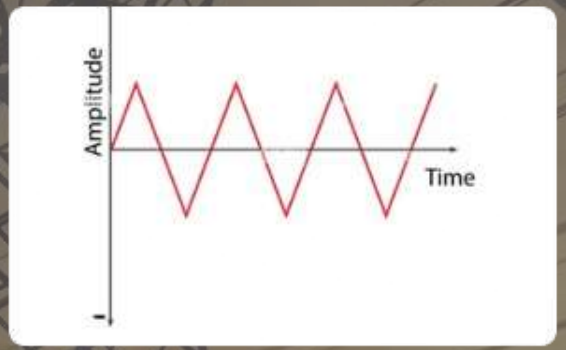
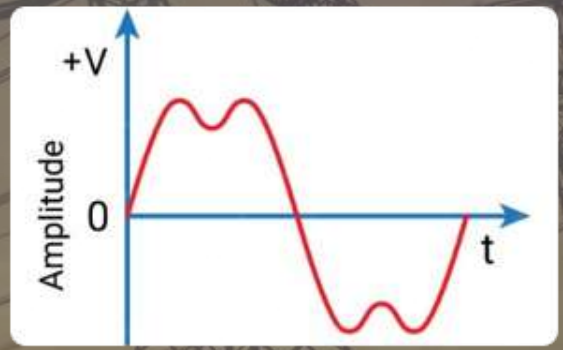




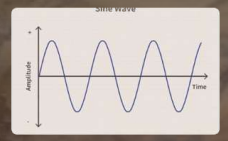
Triangle

Linear rise and fall.



Complex

Combination of multiple waveforms.



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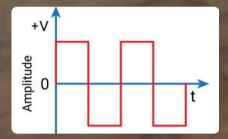

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- Waveform and its Characteristics

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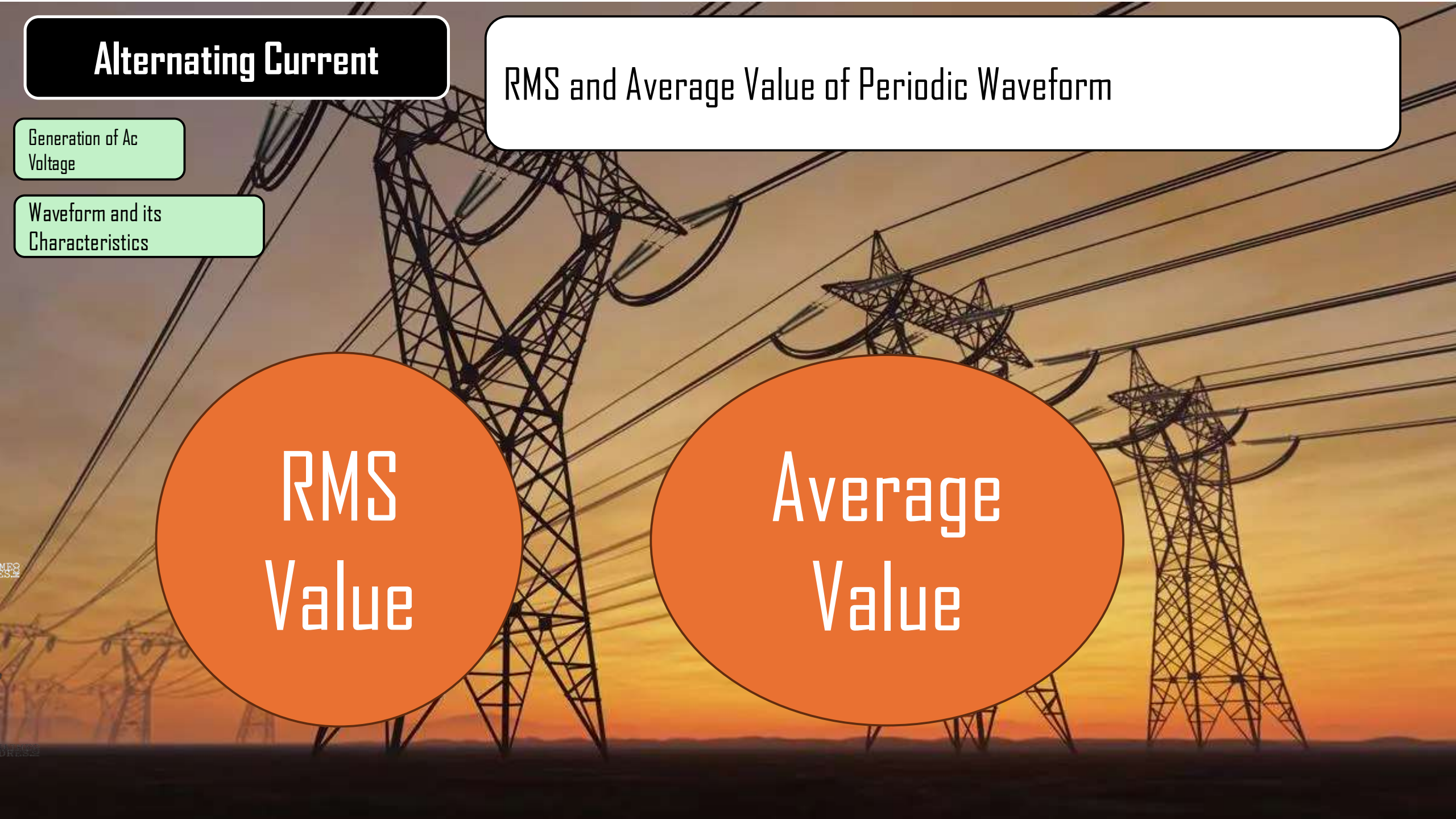

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form

Average Value

RMS Value

Alternating Current

Generation of Ac Voltage

Waveform and its Characteristics

veform

Average Value

RMS Value

The **Root Mean Square (RMS)** value is a measure of the effective or equivalent voltage or current in alternating current (AC) circuits. It represents the value that produces the same heating effect as a DC signal of the same magnitude. For a sine wave, the RMS value is approximately 0.707 times the peak value. It is essential in electrical engineering to calculate power, determine signal strength, and measure energy transfer in AC circuits. RMS values are widely used in audio, instrumentation, and power systems for accurate performance assessments and comparisons.

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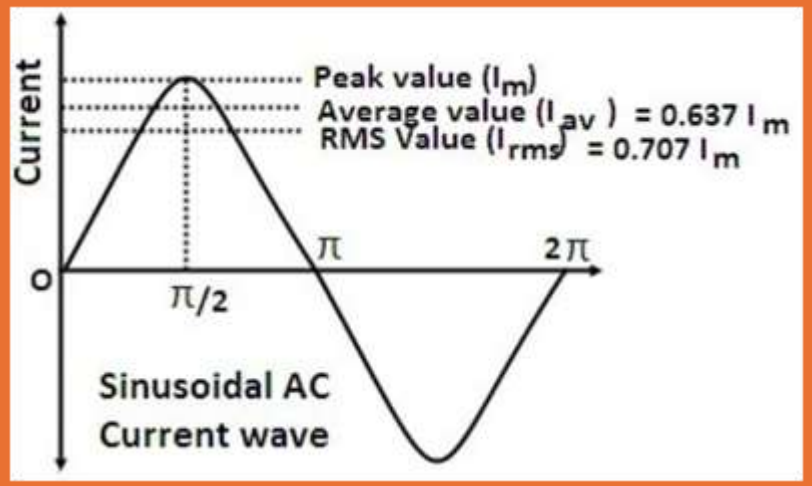

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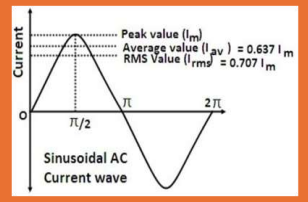
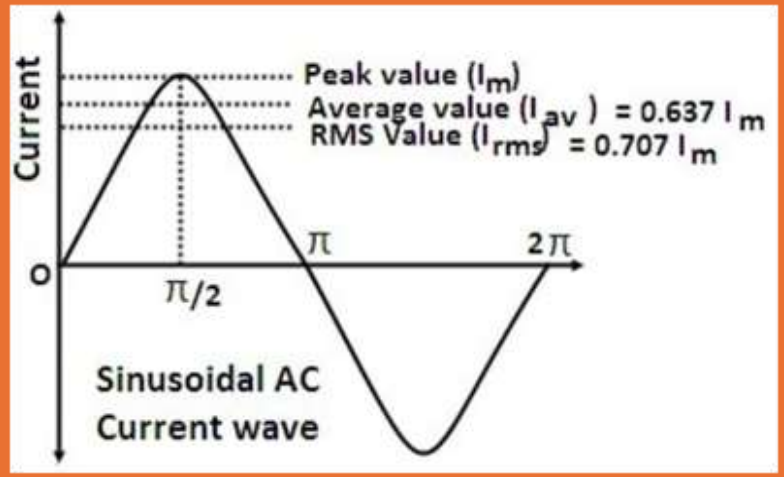


RMS and A...

Average Value

The **Average Value** of an AC waveform represents the average of all instantaneous values over a half-cycle, often used for rectified signals. For a sine wave, the average over a full cycle is zero because the positive and negative halves cancel out. However, in rectified AC (e.g., half-wave rectification), only the positive half is considered, resulting in a meaningful average. This average value is essential in applications like rectifiers and power supplies, where converting AC to DC is required for practical use.



Form Factor

Form factor is the ratio of the RMS value to the average value of an AC waveform:

$$\text{Form Factor} = \frac{\text{RMS Value}}{\text{Average Value}}$$

For a sine wave, the form factor is approximately **1.11**. It helps assess waveform shape and efficiency in AC circuits.

Peak Factor

is the ratio of the peak value to the RMS value of a waveform: .

$$\text{Peak Factor} = \frac{\text{Peak Value}}{\text{RMS Value}}$$

For a sine wave, the peak factor is around **1.414**. It indicates the waveform's peak level compared to its effective value, useful in protecting devices from voltage spikes.


End of Presentation
ANY QUESTIONS?