Georgia Institute of Technology

Circuits & Electronics

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An introduction to electric circuit elements and electronic devices, and a study of circuits containing such devices. Both analog and digital systems are considered.

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Root Mean Square

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Introduce the root mean square statistic and how to calculate it.

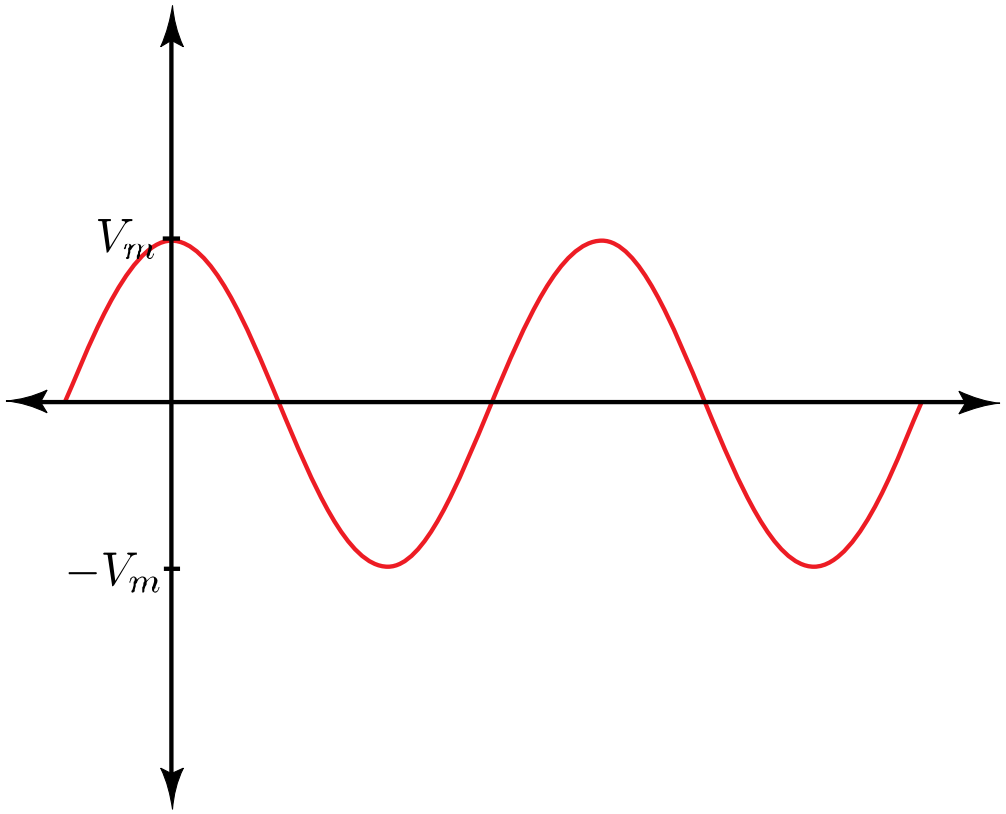
Module 5: Power

- Root-Mean Square
- Power Factor and Power Triangles
- Maximum Power Transfer
- Transformers

Lesson Objectives

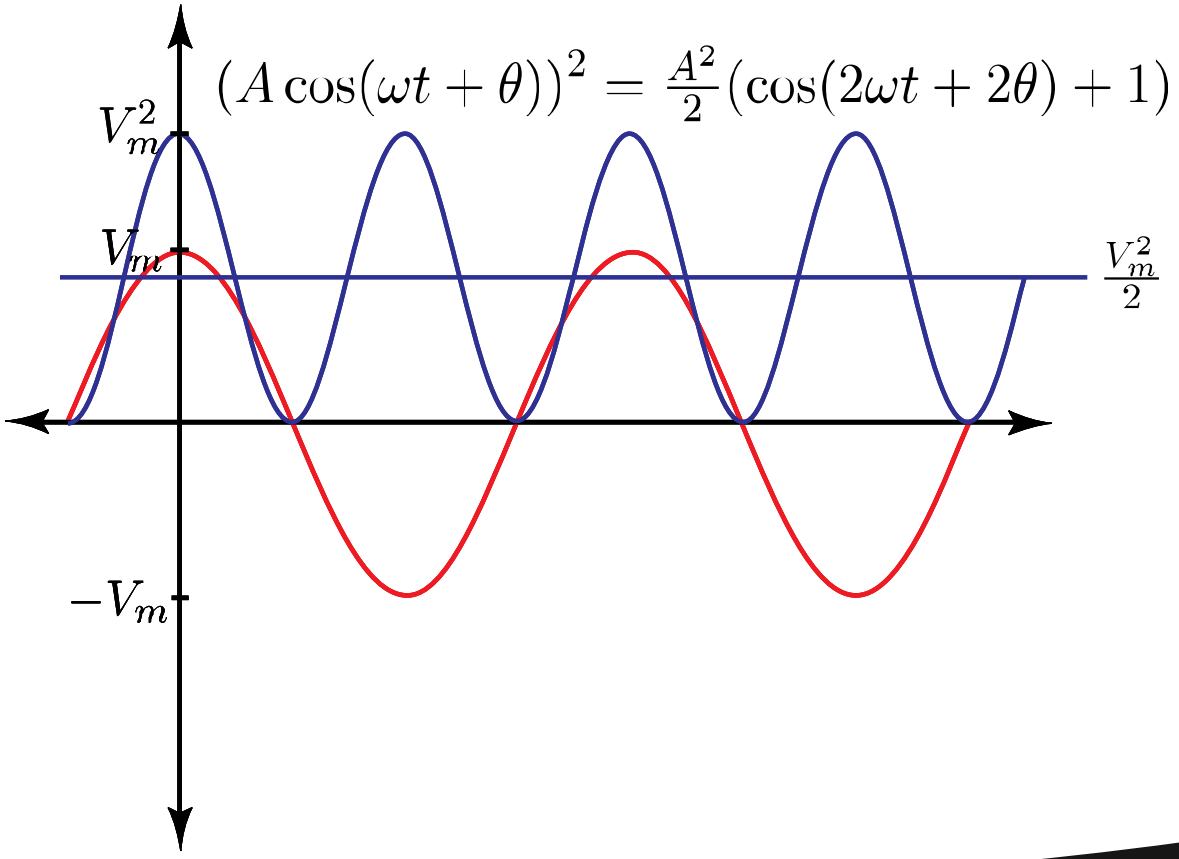
- Identify the equation for calculating root mean square (RMS) value
- Calculate the RMS values of simple periodic functions
- Find peak value from RMS

Average of a Sinusoid



$$\bar{f} = \frac{1}{T}\int_{t_0}^{T} f(t)dt$$

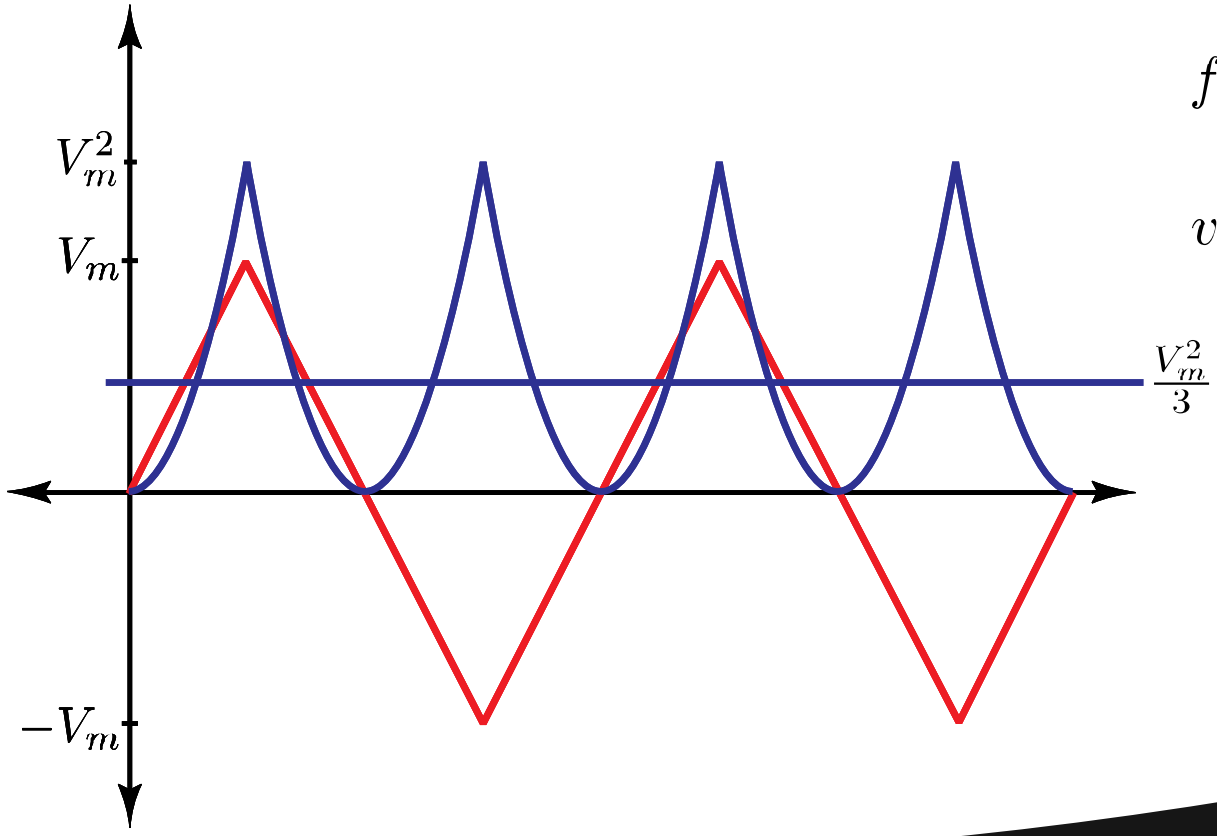
Root Mean Square



$$f_{\text{rms}} = \sqrt{\frac{1}{T}\int_{t_0}^{t_0+T} f^2(t)dt}$$

$$v_{\text{rms}} = \sqrt{\frac{V_m^2}{2}} = \frac{V_m}{\sqrt{2}}$$

Root Mean Square Example



$$f_{\text{rms}} = \sqrt{\frac{1}{T}\int_{t_0}^{t_0+T} f^2(t)dt}$$

$$v_{\text{rms}} = \sqrt{\frac{V_m^2}{3}} = \frac{V_m}{\sqrt{3}}$$

Example

- The voltage that goes into your home is described by the root-mean-square voltage. In the US, the voltage is sinusoidal with 120V rms at 60 Hz. What is the peak amplitude?

$$V_m = 120\sqrt{2} \approx 169.7\text{V}$$

Summary

- Defined the root mean square calculation
- Calculated the RMS values of
  - Sinusoidal functions
  - Triangular functions
- Applied to home power voltages

Next Lesson

- Power factor
- Power triangles