EEE201
Circuit Analysis II

Ankara University

Faculty of Engineering

Electrical and Electronics Engineering Department

Sinusoidal Steady-State Analysis

EEE201 Circuit Analysis II

Lecture 1

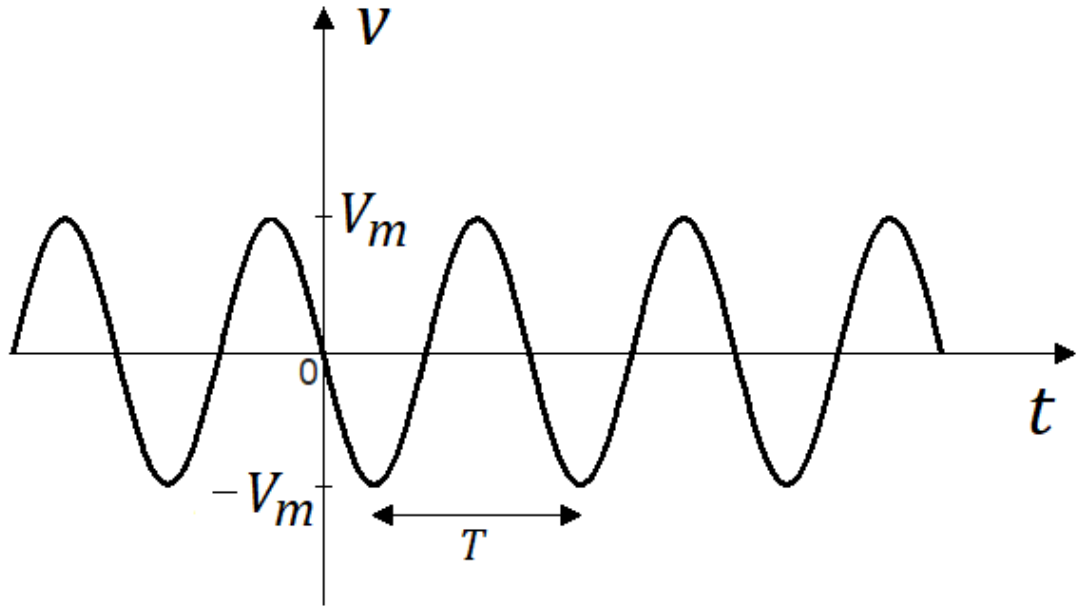
Agenda

- Sinusoidal Source
- Sinusoidal Response

Sinusoidal Source

A sinusoidal voltage:

$$v = V_m \cos(wt + \emptyset)$$

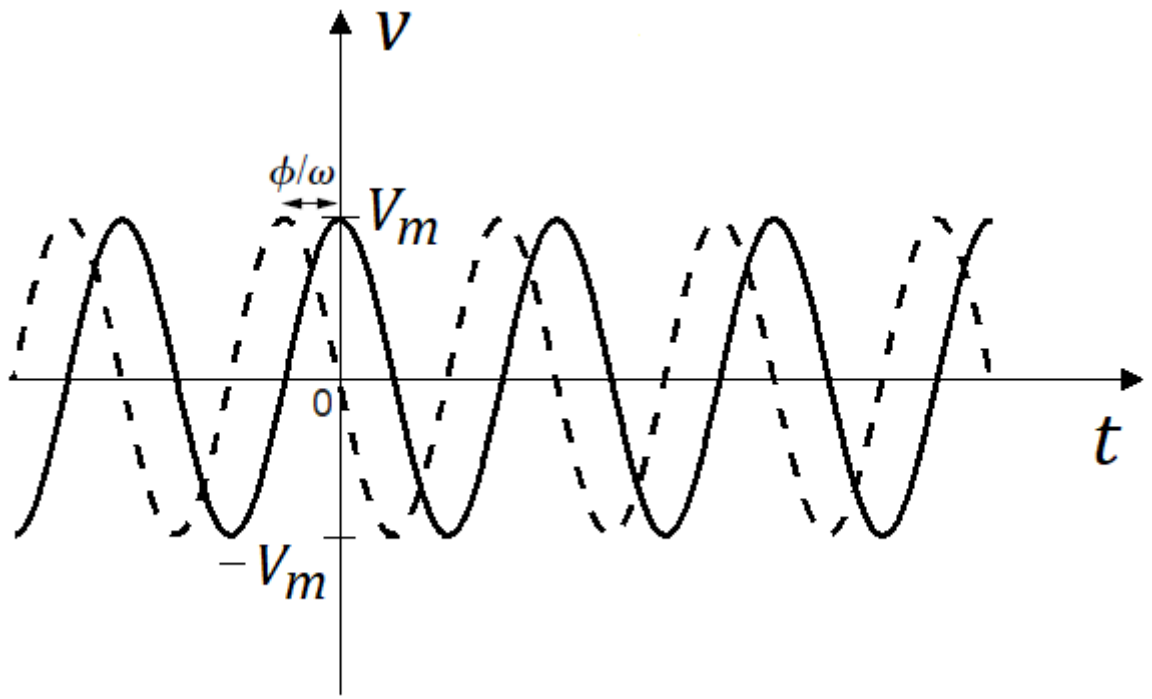


$$f = 1/T \quad (Hz)$$

$$w = 2\pi f = 2\pi/T \quad (radians/second)$$

Sinusoidal Source

Changing the phase angle Ø shifts the sinusoidal function along the time axis:



Sinusoidal Source

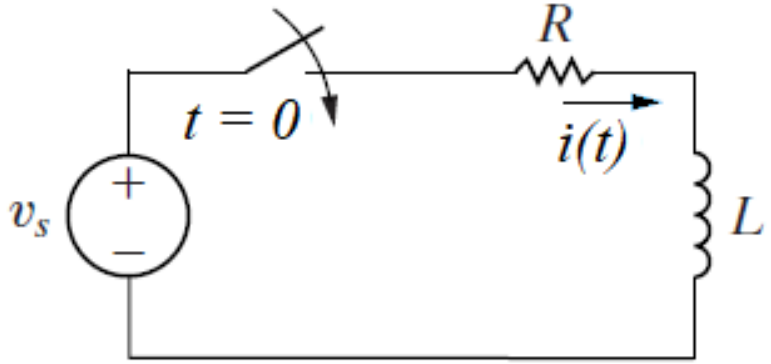
The rms value of a periodic function is defined as the square **r**oot of the **m**ean value of the **s**quared function:

$$V_{rms} = \sqrt{\frac{1}{T}\int_{t_0}^{t_0+T} V_m^2 cos^2(wt + \emptyset)\ dt}$$

$$V_{rms} = \frac{V_m}{\sqrt{2}}$$

Sinusoidal Response

$$v_s = V_m \cos(wt + \emptyset)$$



For $t \geq 0$,

$$L\frac{di}{dt} + Ri = V_m \cos(wt + \emptyset)$$

Sinusoidal Response

$$i = \frac{-V_m}{\sqrt{R^2 + w^2L^2}}\cos(\emptyset - \theta)e^{-(R/L)t} + \frac{V_m}{\sqrt{R^2 + w^2L^2}}\cos(wt + \emptyset - \theta)$$

The first term $\rightarrow$ $Transient\ component$

The second term $\rightarrow$ $Steady - state\ component$

Reference

- Electric Circuits, Tenth Edition, James W. Nilsson, Susan A. Riedel Pearson, 2015