Course Overview

- EE 105 – new version
  - Prerequisite: EECS 40
  - *analog* integrated circuits + basic IC device models needed to design them
  - course incorporates a laboratory
- Related courses :
  - EE 130, 140, 141, 142

Sinusoidal Function Review

$$v(t) = v\cos(\omega t + \phi)$$

amplitude (half of peak-to-peak)

frequency (radian) ... $\omega = 2\pi f = 2\pi\,(1/T)$

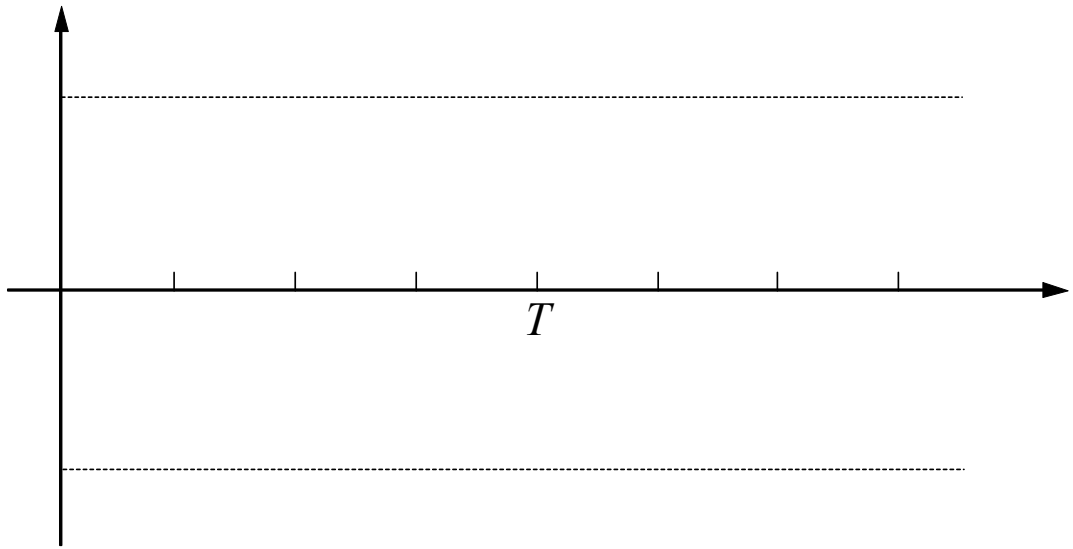
phase (degrees or radians)

Graphical Description

$$v_1(t) = v\cos(\omega t)$$

$$v_2(t) = v\cos(\omega t - 45)$$

$$\omega = \frac{2\pi}{T}$$



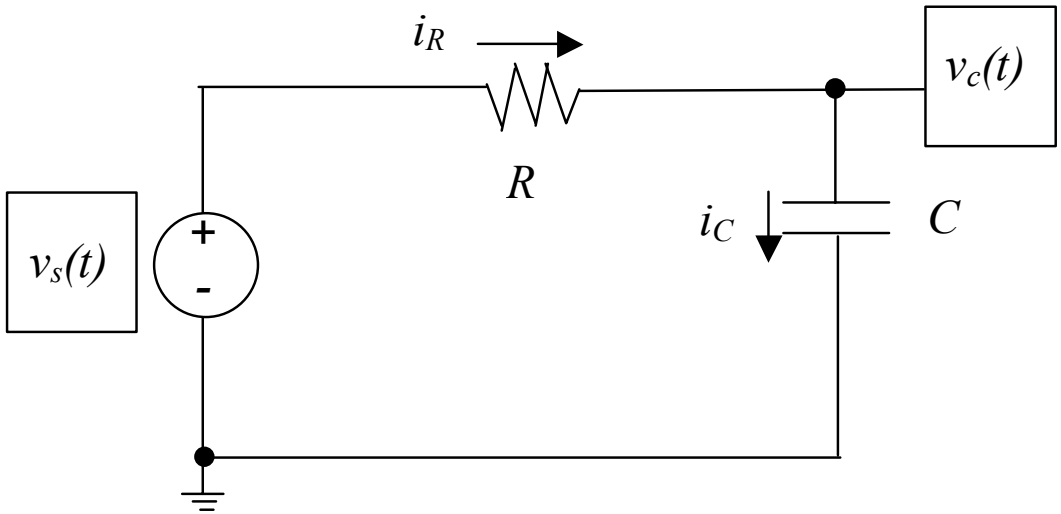
Why are Sinusoids Important?

- *Any* periodic signal $v(t)$ can be expressed as a sum of sinusoidal signals by a Fourier series expansion (EECS 20N, EE 120)
- The response of a linear circuit to a sinusoidal input, as a function of its frequency ω, leads to insights into the behavior of the circuit.

Linear Circuits

- *Theorem*: solutions for voltages and currents in a linear circuit (i.e., one consisting of R, L, C and dependent sources G_m, R_m, A_v, and A_i) with a *sinusoidal* signal as the input are:

RC Circuit with Sinusoidal Input



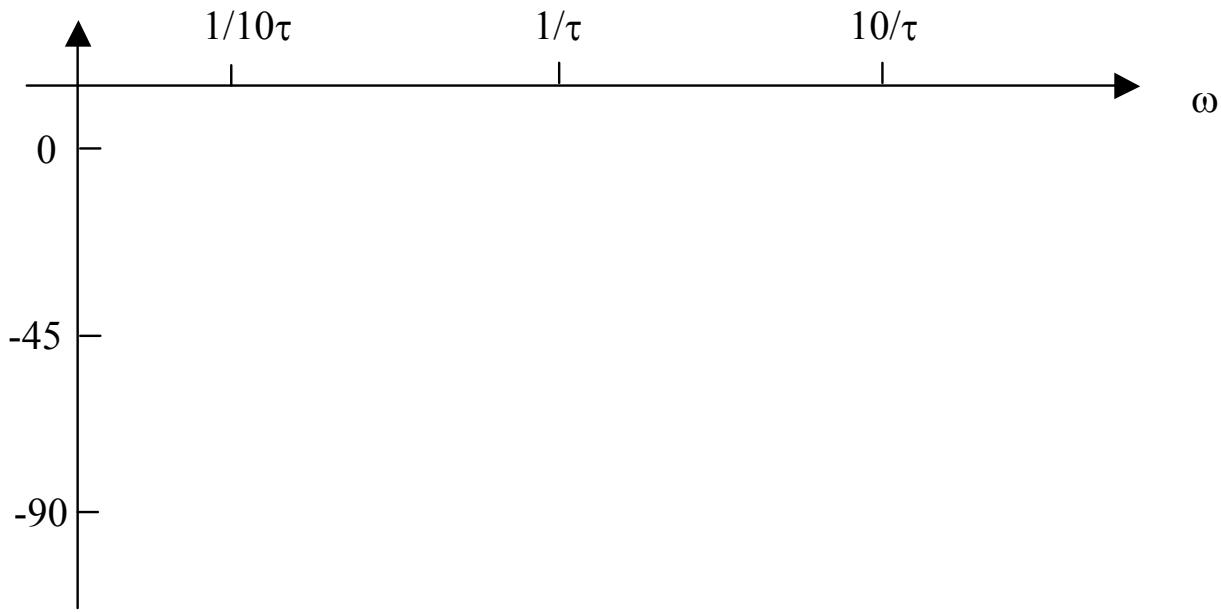
$v_s(t) = V_s \cos(\omega t)$: set phase of source to zero (use as the reference)

$v_c(t) = V_c \cos(\omega t + \phi)$: solution is a sinusoidal signal with the same frequency, but with a different amplitude and phase-shifted with respect to the source

Circuit Analysis

Circuit Analysis (Continued)

Graphical Result for Phase ϕ



Graphical Result for Amplitude Ratio