MATLAB과 PSPICE를 이용한

RLC 회로의

AC Steady-State Analysis

Phasors

$$\vec{V} = \vec{I}Z$$

- ✓ Phasors allow us to manipulate sinusoids in terms of amplitude and phase changes
- ✓ Phasors are based on complex polar coordinates
- ✓ The influence of each component is given by Z, its complex impedance

Magnitude and Phase

$$\vec{V} \equiv A\cos(\omega t + \phi) + jA\sin(\omega t + \phi) = x + jy$$

$$\left|\vec{V}\right| \equiv \sqrt{x^2 + y^2} = A \quad \textit{magnitude of } \vec{V}$$

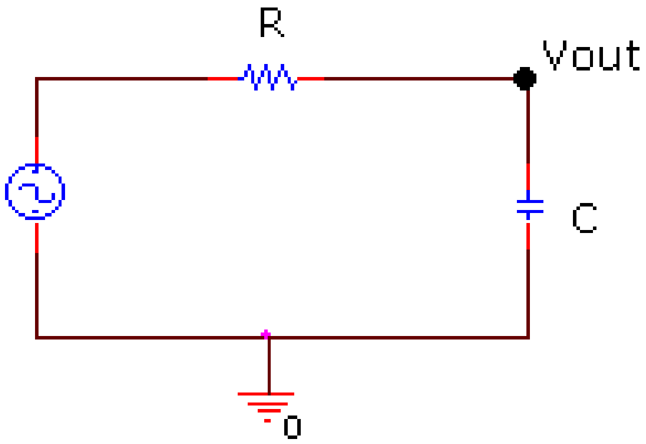
$$\angle\vec{V} = \tan^{-1}\left(\frac{y}{x}\right) = \omega t + \phi \quad \textit{phase of } \vec{V}$$

✓ Phasors have a magnitude and a phase derived from polar coordinates rules.

Complex Impedance Z

- Z defines the influence of a component on the amplitude and phase of a circuit
  - Resistors: $Z_R = R$
    - ✓ change the amplitude by R
  - Capacitors: $Z_C = 1/jwC$
    - ✓ change the amplitude by 1/wC
    - ✓ shift the phase -90 (1/j=-j)
  - Inductors: $Z_L = jwL$
    - ✓ change the amplitude by wL
    - ✓ shift the phase +90 (j)

Simple Example



$$Z_R = R$$

$$Z_C = \frac{1}{j\omega C}$$

$$\frac{\vec{V}_{out}(j\omega)}{\vec{V}_{in}(j\omega)} = \frac{Z_C\vec{I}}{(Z_R + Z_C)\vec{I}} = \frac{Z_C}{(Z_R + Z_C)}$$

$$= \frac{\frac{1}{j\omega C}}{R + \frac{1}{j\omega C}} \cdot \frac{j\omega C}{j\omega C} = \frac{1}{j\omega RC + 1}$$

MATLAB Analysis

$$V = 10\angle 45^{o} = x + j * y$$

where

$$x = 10 * \cos(45 * pi / 180) = 7.07$$

$$y = 10 * \sin(45 * pi / 180) = 7.07$$

$$V = inv(Y) * I$$

AC PSPICE Analysis

- ❖ Defining AC Sources
  - ✓ Attributes Box: ACMAG and ACPHASE
- ❖ Single Frequency AC Simulations
  - ✓ Setup Box → AC Sweep Box
  - ✓ VPRINT and IPRINT
- ❖ Variable Frequency AC Simulations
  - ✓ Probe Setup: Automatically Run Probe After Simulation
- ❖ Creating Plot in Probe
  - ✓ View, Trace and Plot Menu