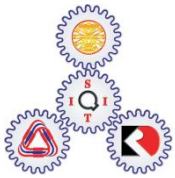

Sirindhorn International Institute of Technology
Thammasat University at Rangsit
School of Information, Computer and Communication Technology

ECS 203: Problem Set and Tutorial 11

Semester/Year: **2/2015**
Course Title: Basic Electrical Engineering
Instructor: Asst. Prof. Dr. Prapun Suksompong (prapun@siit.tu.ac.th)
Course Web Site: http://www2.siit.tu.ac.th/prapun/ecs203/

Due date: Not Due

Instructions

1. All phasor should be answered in polar form where the magnitude is positive and the phase is between -180° and 180°.
2. All sinusoid should be answered in the cosine form where the amplitude is positive and the phase is between -180° and 180°.

Questions

The first three questions are here to give you a warm-up exercise for the computation that you will encounter throughout chapters 7,8 and 9. You will need to be able to work with complex numbers and many of the calculations will require the use of a calculator.

1) Simplify and then express the following complex numbers in polar form. Make sure that the magnitude values are positive and the phase values are between -180° and 180°.
   a) $-6+8j$

   b) $\dfrac{50\angle -30^\circ}{10j+5-2j}$

2) Simplify and then express the following complex numbers in rectangular form.

a) $-10j+\dfrac{(3-2j)\times(8+10j)}{(3-2j)+(8+10j)}$

b) $\left(20\angle -15^\circ\right)\times\dfrac{100j}{60+100j}$

3) Suppose $\mathbf{V}_S = 20\angle 90^\circ$, $\mathbf{I}_S = 5$, $\mathbf{Z}_1 = -2j$, $\mathbf{Z}_2 = 10j$, $\mathbf{Z}_3 = 8$, $\mathbf{Z}_4 = -2j$, and $\mathbf{Z}_5 = 4$.
Furthermore, suppose

$$\mathbf{I}_3 = \mathbf{I}_S,$$
$$-\mathbf{I}_1\mathbf{Z}_3 - (\mathbf{I}_1 - \mathbf{I}_3)\mathbf{Z}_2 - (\mathbf{I}_1 - \mathbf{I}_2)\mathbf{Z}_4 = 0, \text{ and}$$
$$-(\mathbf{I}_2 - \mathbf{I}_1)\mathbf{Z}_4 - (\mathbf{I}_2 - \mathbf{I}_3)\mathbf{Z}_1 - \mathbf{I}_2\mathbf{Z}_5 - \mathbf{V}_S = 0.$$

Find $\mathbf{I}_2$ (in polar form).

4) [Alexander and Sadiku, 2009, Ex 9.1] Find the amplitude, phase, period, and frequency of the sinusoid

$$v(t) = 12\cos\left(50t + 10^\circ\right).$$

5) Find the phasors (in standard form) corresponding to the following signals.
   a) v(t) = 120 sin (10t –50^o) V

   b) i(t) = -60cos(30t +10^o) mA

   c) i(t) = -8 sin(10t+70^o) mA

6) [F2010]
   a) Find the sinusoid $x(t)$ which is represented by a phasor $\mathbf{X} = -7 + 7j$. Assume $\omega = 100$ rad/s. (Your answer should be a time-dependent sinusoid in standard form.)

   b) Simplify $x(t) = 7\cos\left(t - 777^\circ\right) - 7\sin\left(t - 77^\circ\right)$. (Your answer should be a time-dependent sinusoid in standard form.)

7) [Alexander and Sadiku, 2009, Q9.24a] Find $v(t)$ in the following integrodifferential equation using the phasor approach:

$$v(t)+\int v dt = 5\cos\left(t+45^\circ\right).$$

8) (*) Consider the signal x(t) in Figure 1 below. Suppose $x(0) = -3.356$. Find its phasor.

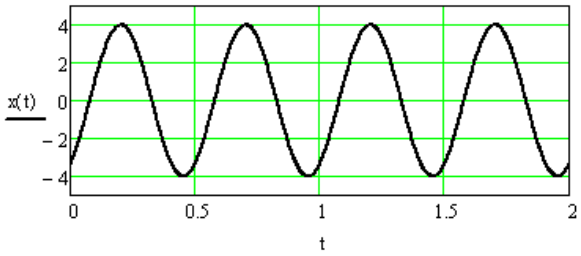

Figure 1

Hint: 1) The amplitude is an integer. Find it first. 2) When t = 0, we also have ωt = 0.