Sirindhorn International Institute of Technology

Thammasat University at Rangsit

School of Information, Computer and Communication Technology

ECS 203: Problem Set 10

Semester/Year: **2/2014**
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: April 10

Instructions

i. Solve all problems. (5 pt)
ii. ONE sub-question will be graded (5 pt). Of course, you do not know which part will be selected; so you should work carefully on all of them.
iii. Late submission will be heavily penalized.
iv. ***Write down all the steps*** that you have done to obtain your answers. You may not get full credit even when your answer is correct without showing how you get your answer.
v. All phasor should be answered in polar form where the magnitude is positive and the phase is between -180° and 180°.
vi. All sinusoid should be answered in the cosine form where the amplitude is positive and the phase is between -180° and 180°.

Questions

1) [Alexander and Sadiku, 2009, Q6.73] Show that the circuit in Figure 1 is a noninverting integrator.

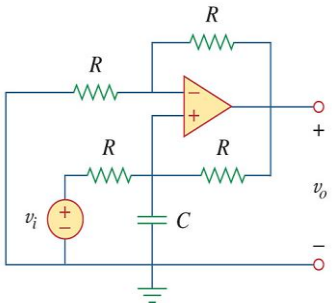

Figure 1

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

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

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

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

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

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

5) 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).

6) Find the phasors (in <u>standard</u> 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

7) (*) Consider the signal x(t) in Figure 2 below. Suppose $x(0) = -3.356$. Find its phasor.

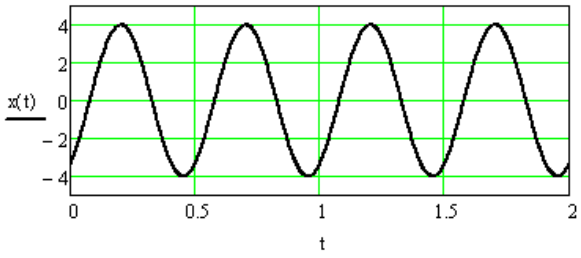

Figure 2

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