ECE 320: Homework #1

DUE DATE: By 5:00pm on Friday September 5.

Hand in to my mailbox, my office, or the homework collection box on the second floor of GJL (slot marked EE320).

1. Given a sinusoidal voltage source:

   $vs = 170\cos(377t + 30\text{deg})\ \text{V}$

   Find the following:

   a. Maximum amplitude
   b. RMS magnitude
   c. Phase angle in radians
   d. Phase angle in milliseconds
   e. Period in milliseconds
   f. Frequency in Hertz

2. Express the following sums in Phasor form:

   a. $v1 = 170\cos(377t - 30\text{deg})\ \text{V} + 170\cos(377t + 30\text{deg})\ \text{V}$

   b. $v2 = 170\cos(377t - 30\text{deg})\ \text{V} + 155\cos(377t + 45\text{deg})\ \text{V}$

3. In each of the following, the 60Hz voltage appears across a black box, and the 60Hz current is entering the black box.

   Calculate: P, Q, power factor, and state whether the black box is supplying or sinking real power.

   a. $va = 300\cos(\omega t + 60\text{deg})\ \text{V}$ and $ia = 20\cos(\omega t + 15\text{deg})\ \text{A}$

   b. $va = 75\cos(\omega t - 15\text{deg})\ \text{V}$ and $ia = 75\cos(\omega t + 60\text{deg})\ \text{A}$

   c. $va = 200\cos(\omega t + 240\text{deg})\ \text{V}$ and $ia = 10\cos(\omega t + 40\text{deg})\ \text{A}$

4. A 60Hz voltage source with a RMS magnitude to 500V, and an angle of 0 degrees, supplies 7500W. It is connected to a load that draws 2500W, and supplies 5000VARs through a line with a resistance of 20 Ohm.

   a. Determine the line current.
   b. Determine the inductive reactance X of the line such that the source neither delivers nor absorbs reactive power.

5. A 60Hz voltage source with a RMS magnitude to 7200V, and an angle of 0 degrees is connected to a series RL load with R = 140 Ohm and jX = j500Ohm by a line with R = 2 Ohm and jX = j20 Ohm.
   a. Calculate the voltage across the load
   b. Calculate P and Q drawn by the load
   c. Calculate P and Q supplied by the source
   d. Now we want to connect a capacitor in parallel with the R-L load. Determine the capacitve reactance and the capacitance (in microFarads) such parallel combination has a unity power factor
   e. Calculate the voltage across the load in part d.
   f. Calculate P delivered to the load in part d. (compare this to P in part b).
   g. Calculate P and Q supplied by the source in part d.