ECE 3364, Dr. Hebert, Fall 2016 HW 2, due Thurs 09/08

Problem 1.
Nilsson, eighth edition
Problem 10.40

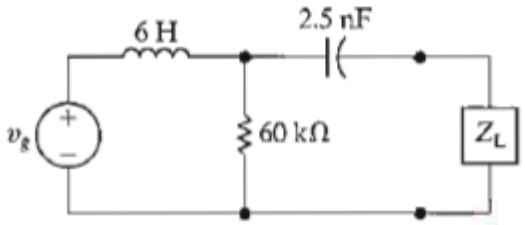
10.40 Prove that if only the magnitude of the load impedance can be varied, most average power is transferred to the load when $|Z_L| = |Z_{Th}|$. (*Hint:* In deriving the expression for the average load power, write the load impedance (Z_L) in the form $Z_L = |Z_L|\cos\theta + j|Z_L|\sin\theta$, and note that only $|Z_L|$ is variable.)

Problem 2.
Nilsson, eighth edition
Problem 10.41

10.41 a) Determine the load impedance for the circuit shown in Fig. P10.41 that will result in maximum average power being transferred to the load if $\omega = 10$ krad/s.

b) Determine the maximum average power delivered to the load from part (a) if $v_g = 90\cos 10{,}000t$ V.

Figure P10.41



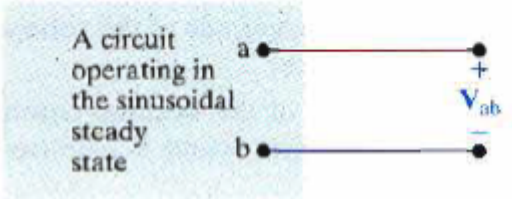
Problem 3.
Nilsson, eighth edition
Problem 10.42

10.42 The phasor voltage $\mathbf{V}_{ab}$ in the circuit shown in Fig. P10.42 is $480\angle 0°$ V (rms) when no external load is connected to the terminals a,b. When a load having an impedance of $100 + j0\ \Omega$ is connected across a,b, the value of $\mathbf{V}_{ab}$ is $240 - j80$ V (rms).

a) Find the impedance that should be connected across a,b for maximum average power transfer.

b) Find the maximum average power transferred to the load of (a).

Figure P10.42



Problem 4.
Nilsson, eighth edition
Problem 10.51

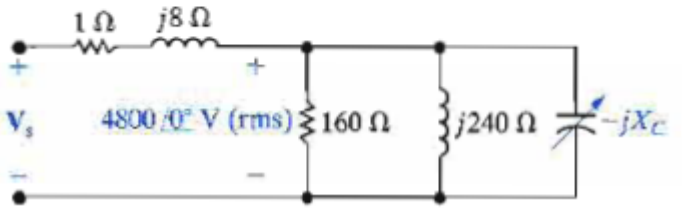
10.51 The sending-end voltage in the circuit seen in Fig. P10.51 is adjusted so that the rms value of the load voltage is always 4800 V. The variable capacitor is adjusted until the average power dissipated in the line resistance is minimum.

a) If the frequency of the sinusoidal source is 60 Hz, what is the value of the capacitance in microfarads?

b) If the capacitor is removed from the circuit, what percentage increase in the magnitude of $\mathbf{V}_s$ is necessary to maintain 4800 V at the load?

c) If the capacitor is removed from the circuit, what is the percentage increase in line loss?

Figure P10.51



Problem 5.
Nilsson, 8th edition
Problem 11.1

11.1 What is the phase sequence of each of the following sets of voltages?

a) $v_a = 120\cos(\omega t + 54^\circ)$ V,

$v_b = 120\cos(\omega t - 66^\circ)$ V,

$v_c = 120\cos(\omega t + 174^\circ)$ V.

b) $v_a = 3240\cos(\omega t - 26^\circ)$ V,

$v_b = 3240\cos(\omega t + 94^\circ)$ V,

$v_c = 3240\cos(\omega t - 146^\circ)$ V.

Problem 6.
Nilsson, 8th edition
Problem 11.5

11.5 PSPICE a) Is the circuit in Fig. P11.5 a balanced or unbalanced three-phase system? Explain.

b) Find $\mathbf{I}_o$.

Figure P11.5