ECE 3600 homework # 14 Due: Tue, 11/11/08

Transformers

1. A phase-shifting transformer has a complex turns ratio of $\mathbf{t} := 4 \cdot e^{j \cdot 20 \cdot deg} = 4 \angle 20^{o}$

   It has a series impedance of $\mathbf{Z_S} := (0.05 + j \cdot 0.6) \cdot \Omega$

   Find the admittance matrix of this tranformer (see p 6-16 in the text).

Syncronous Motors and Generators

2. A single-phase generator delivers at its terminals a voltage of $680\ V$ rms at its terminals and a current of $32\ A$ rms. The real power delivered is $15\ kW$.
   Find the reactive power Q. Give both possible answers.

3. A 3-phase synchronous generator operates onto a grid bus of voltage $12\ kV$ (line value). The synchronous reactance is $5\ \Omega$/phase. The magnitude of the generator emf equals the magnitude of the bus voltage. The machine delivers $18\ MW$ to the grid. Find:

   a) The power angle, δ.

   b) The complex phase current, (Assume the bus voltage phase angle is 0^{o}).

   c) The magnitude and direction of reactive power.

Answers

Homework 13 problem 3 (1.22) a) $398 \cdot 4 \cdot V$ $460 \cdot V$ b) $15 \cdot kVA$ $17.3 \cdot kVA$ $32.3 \cdot kVA$ for both

1. $\begin{pmatrix} 0.138 - 1.655 \cdot j & 0.109 + 0.401 \cdot j \\ -0.174 + 0.377 \cdot j & 8.621 \cdot 10^{-3} - 0.103 \cdot j \end{pmatrix} \cdot \frac{1}{\Omega}$

2. $\pm\ 15.8\ kVAR$

3. a) $38.68 \cdot deg$

   b) $918 \cdot A \angle 19.34 \cdot deg$

   c) $-6.32 \cdot MVAR$