

ECE 476 – Power System Analysis Fall 2012

Homework 5

Reading: Chapters 3 and 5.

Due Date: Thursday October 11, 2012

Problem 1. A 500-km, 500-kV, 60-Hz uncompensated three-phase line has a positive-sequence series impedance $z=0.03+j0.35 \Omega/\text{km}$ and a positive-sequence shunt admittance $y=j4.4 \times 10^{-6} \text{ S}/\text{km}$. Calculate:

- Z_c
- (γl)
- The exact ABCD parameters for this line.

Problem 2. A 320-km 500-kV, 60-Hz three-phase uncompensated line has a positive-sequence series reactance $x=0.34 \Omega/\text{km}$ and a positive-sequence shunt admittance $y=j4.5 \times 10^{-6} \text{ S}/\text{km}$. Neglecting losses, calculate:

- Z_c
- (γl)
- The exact ABCD parameters for this line.
- The wavelength λ of the line, in kilometers.
- The surge impedance loading in MW.

Problem 3. The following data are obtained when open-circuit and short-circuit tests are performed on a single-phase, 50-kVA, 2400/240-volt, 60-Hz distribution transformer

- **Measurement on low-voltage side with high-voltage winding open.**
Voltage: 240 V. Current: 5.97 A. Power: 213 W.
- **Measurements on high-voltage side with low-voltage winding shorted.**
Voltage: 60 V. Current: 20.8 A. Power: 750 W.

- Neglecting the series impedance, determine the exciting admittance referred to the high-voltage side.
- Neglecting the exciting admittance, determine the equivalent series impedance referred to the high-voltage side.
- Assuming equal series impedances for the primary and referred secondary, obtain an equivalent T-circuit referred to the high-voltage side.

Problem 4. A single-phase 50-kVA, 2400/240-volt, 60-Hz distribution transformer is used as a step-down transformer at the load end of a 2400-volt feeder whose series impedance is $(1.0 + j2.0) \Omega$. The equivalent series impedance of the transformer is $(1.0 + j2.5) \Omega$ referred to the high-voltage (primary) side. The transformer is delivering rated load at 0.8 power factor lagging and at rated secondary voltage. Neglecting the transformer exciting current, determine:

- The voltage at the transformer primary terminals.
- The voltage at the sending end of the feeder.
- The real and reactive power delivered to the sending end of the feeder.