

# ECE 476 – Power System Analysis Fall 2012

## Homework 3

**Reading:** For lectures 4-6, read Chapter 4 from textbook. Sections 4.7, and 4.11-4.12 will not be covered in detail.

**Due Date:** Tuesday, September 25, 2012

**Problem 1.** A 60-Hz single-phase, two-wire overhead line has solid cylindrical copper conductors with 1.5 cm diameter. The conductors are arranged in a horizontal configuration with 0.5 m spacing. Calculate in mH/km:

- a) The inductance of each conductor due to internal flux linkages only.
- b) The inductance of each conductor due to both internal and external flux linkages.
- c) The total inductance of the line.

**Problem 2.** Rework Problem 1 if the diameter of each conductor is:

- a) Increased by 20% to 1.8 cm.
- b) Decreased by 20% to 1.2 cm, without changing the phase spacing.

Compare the results with those of Problem 1.

**Problem 3.** Figure 1 shows the conductor configuration of a completely transposed three-phase overhead transmission line with bundled phase conductors. All conductors have a radius of 0.74 cm with a 30 cm bundle spacing. a) Determine the inductance per phase in mH/km and in mH/mi. b) Find the inductive line reactance per phase in  $\Omega/\text{mi}$  at 60 Hz.

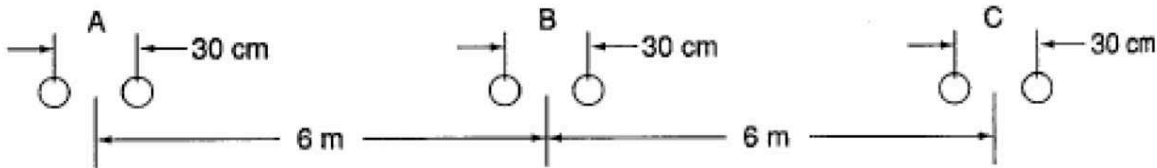


Figure 1: Conductor configuration for problem 3.

**Problem 4.** For the overhead line of configuration shown in Fig. 2, operating at 60 Hz, and a conductor temperature of  $70^\circ\text{C}$ , determine the resistance per phase (of each subconductor in a conductor), inductive reactance in ohms/mile/phase and the current carrying capacity of the overhead line. The resistance of each conductor in the four-subconductor bundle is  $0.12 \Omega/\text{mi}$ .

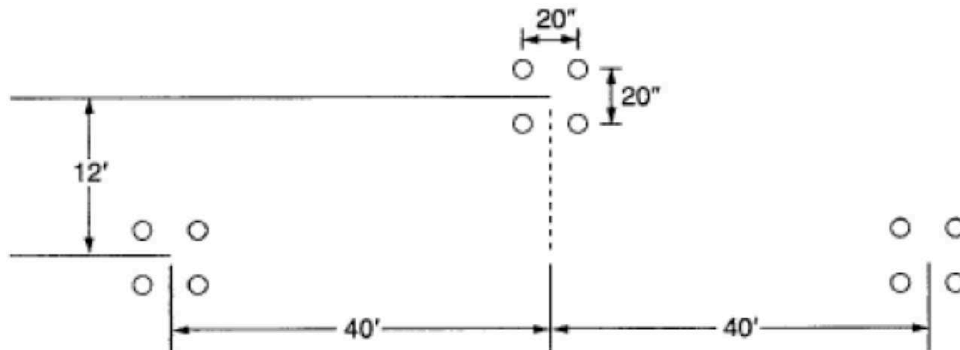


Figure 2: Conductor configuration for problem 4.