

## Problem Set #4 Transmission line parameters

### 4-1

The Aluminum Electrical Conductor Handbook lists a dc resistance of 0.01558 ohm per 1000 ft at 20°C and a 60-Hz resistance of 0.0956 ohm per mile at 50°C for the all aluminum Marigold conductor, which has 61 strands and whose size is 1113 kcmil. Assuming an increase in resistance of 2% for spiraling, calculate and verify the dc resistance. Then calculate the dc resistance at 50°C, and determine the percentage increase due to skin effect. The resistivity of the conductor at 20°C is 17.00  $\Omega$ -cmil/ft.

### 4-2 (Keyhani Lecture)

One thousand circular mils or 1 kcmil is sometimes designated by the abbreviation MCM. Data for commercial bare aluminum electrical conductors lists a 60-Hz resistance of 0.0880 ohm per kilometer at 75°C for a 795-MCM AAC conductor.

- a) Determine the cross-sectional conducting area of this conductor in square meters.
- b) Find the 60-Hz resistance of this conductor in ohms per kilometer at 50°C.

### 4-3 (Keyhani Lecture)

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 1.2m 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, and (c) the total inductance of the line.

### 4-4 (Keyhani Lecture)

A 60-Hz three-phase, three-wire overhead line has solid cylindrical conductors arranged in the form of an equilateral triangle with 4 ft conductor spacing. Conductor diameter is 0.5 in. Calculate the positive-sequence inductance in H/m and the positive-sequence inductive reactance in  $\Omega$ /km.

### 4-5 (Keyhani Lecture)

Calculate the capacitance-to-neutral in F/m and the admittance-to-neutral in S/km for the single-phase line in Prob. 4-3. Neglect the effect of the earth plane.

### 4-6 (Keyhani Lecture)

Calculate the positive-sequence shunt capacitance in F/m and the positive-sequence shunt admittance in S/km for the three-phase line in Prob. 4-4. Neglect the effect of the earth plane.