EE 137A Homework #5

due Thursday, Oct 4, 2018

1. Resistance (Problem 4.7 in GOS)

If the per-phase line loss in a 70-km long transmission line is not to exceed 65 kW while it is delivering 100A per phase, compute the required conductor diameter, if the resistivity of the conductor material is 1.72×10^{-8} ohm-meters.

2. Inductance & Reactance (Problem 4.12 in GOS)

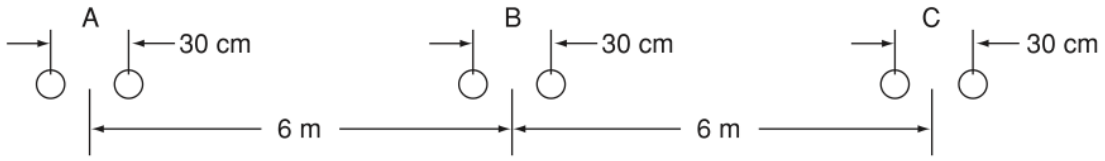
Find the inductance and inductive reactance per mile of a single-phase overhead transmission line operating at 60 Hz, given that the *Partridge* conductors have GMR = 0.0217 ft and are spaced at 30 ft.

3. Stranded Conductor

(a) Find the geometric mean radius (GMR) of a conductor composed of two immediately adjacent strands, each with radius r (like in Fig 4.30 for Problem 4.17 but only two strands).
(b) State briefly what the GMR means and why it should be greater or less than r.
(c) Suppose you separate the strands, turning your stranded into a bundled conductor. What happens to GMR as the distance is increased, and how does this affect the inductance?
(d) What can you say about the ratio of resistance to reactance (R/X) for the stranded vs. bundled conductor?

4. Transmission Line Reactance (Problem 4.23 in GOS)

The bundled conductors in the diagram have a radius of 0.74 cm. The line is completely transposed. Find the inductance per phase in mH/km and the inductive reactance per phase in ohms per mile at 60 Hz.



5. ABCD Parameters

A 25-km, 34.5-kV, 60-Hz three-phase line has a per-phase series impedance z = 0.19 + j0.34 ohms/km. The load at the receiving end absorbs 10 MVA at 33 kV.
Using the short line approximation, find:
(a) the ABCD parameters,
(b) the sending end voltage for a load power factor of 0.9 lagging,
(c) the sending-end voltage for a load power factor of 0.9 leading.
(d) Draw a phasor diagram to illustrate your results above and discuss the significance of the load power factor for voltage drop.

6. Long Line (based on Problem 5.14 in GOS)

A 500-km, 500-kV, 60-Hz line has [per-phase] series impedance z = 0.03 +j0.35 ohms/km and shunt admittance $y = j4.4 \times 10^{-6}$ S/km. Calculate
(a) the characteristic impedance Z_C
(b) the product of propagation constant and length
(c) the exact ABCD parameters for this line.
(d) Suppose you had made the medium-line approximation. How different would the ABCD parameters be?