

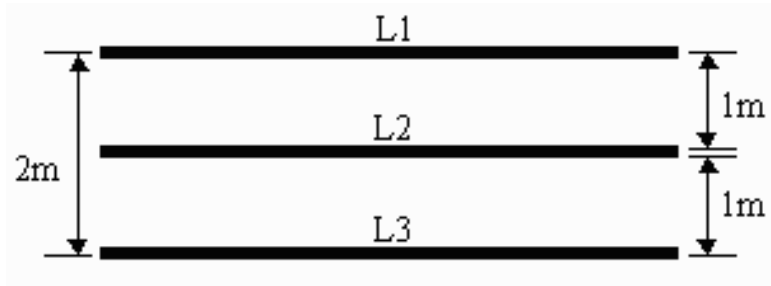


Aalto-yliopisto
Teknillinen korkeakoulu

Exercise 10

Power systems

Question 1



A three-phase power line consists of three parallel conductors in the same horizontal plane. The two outer conductors are each 1 m from the center conductor. If the conductor diameter is 6 mm, **calculate the average inductance per phase of a 1 km length of the line.** Assume the expression for the inductance per meter of length.

Question 2

In a three-core cable, the capacitance between the three cores short-circuited together and the sheath is $0.87 \mu\text{F}/\text{km}$, and that between two cores connected together to with the sheath and the third core is $0.84 \mu\text{F}/\text{km}$. **Determine the MVA required to keep 16 km of this cable charged when the supply is 33 kV, three phase, 50 Hz.**

Question 3

An AAC is composed of 37 strands, each having a diameter of 0.333 cm. **Compute the dc resistance in ohms per kilometer at 75°C.** Assume that the increase in resistance due to spiraling is 2%.

Use

resistivity for aluminum:

0.0283 $\Omega\text{mm}^2/\text{m}$ at 20°C

temperature dependence:

0.00403 /°C

Question 4

A three-phase 60-Hz line has flat horizontal spacing. The conductors have an outside diameter of 3.28 cm with 12 m between conductors. **Determine the capacitive reactance to neutral in ohm-meters and the capacitive reactance of the line in ohms if its length is 200 km.** Presume that the distance to ground is much larger than the distance between conductors.