EE5801 EMC

Tutorial 6 – Cables and Cabling

1. For two current-carrying infinitely long cables as shown in Fig. 1, show that the magnetic field at a point (x, 0) is inversely proportional to x^2 and is proportional to d, when $x >> d$. Discuss its significance.

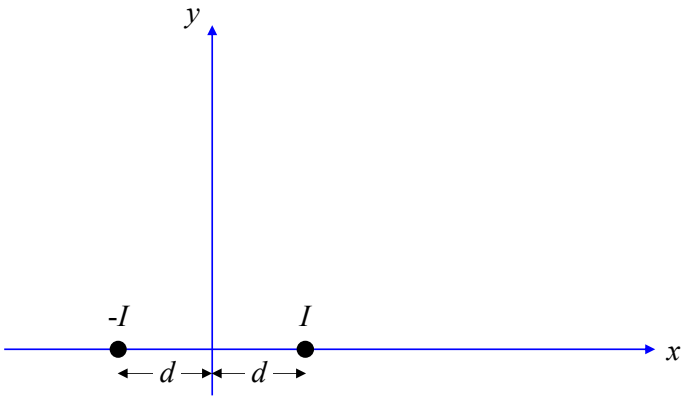

Figure 1. Arrangement of two current-carrying cables.

2. Two infinitely long straight cables are buried in earth, and the earth is of conductivity 10 S/m, relative permeability 4, relative permittivity 1. A ground plane is one skin depth away from the cables.

   The per unit length mutual inductance of two equal-radii cables separated by a distance of d and at the height of h above a ground plane is

$$M = \frac{\mu_0 \mu_r}{4\pi} \ln\left[1 + \left(\frac{2h}{d}\right)^2\right]$$

   when $2h >> d$.

   (i) Find the induced voltage on the second cable (for telecommunication) when a fault occurs at the first cable (50Hz, 230 kV) with a fault current of 63 kA. The lengths of the cables are 300 m, while the cable separation is 1 m.

   (ii) Discuss on how this induced voltage could be reduced.