

Answer on Question #44694, Physics, Electromagnetism

Task: four identical very long solenoid p,q,r and s. Q,R,S arrange in parallel and P is in series if magnetic field produced at the centre of solenoid P is "B" then magnetic fields at the ends of solenoids Q,R and S?

Solution:

Let magnetic fields at the centre of solenoid P is H; $H = \frac{\chi NI}{l} = B$, where χ is the magnetic constant, N the number of turns, and I the current.

Due to the fact that the two halves of the infinite solenoid at the point of connection make the same contribution to the magnetic field, the magnetic induction is a semi-infinite solenoid at its edge twice smaller than in the bulk. The same can be said of the field at the edges of a finite but sufficiently long solenoid.

$$H_p = \frac{\chi NI}{2l} = \frac{B}{2},$$

$$\text{But } I_p = I_Q + I_R + I_S = 3I \Rightarrow I = \frac{I_p}{3} \Rightarrow H_Q = H_R = H_S = \frac{H_p}{3} = \frac{\chi NI_p}{6l} = \frac{B}{6}.$$

magnetic fields at the ends of solenoids Q,R and S: $H_Q = H_R = H_S = \frac{B}{6}$.