

QUESTION:

Bends in a pipe slow down the flow of water through it. Do bends in a wire increase its electrical resistance? Explain.

SOLUTION:

There are two types of hydraulic resistance: friction resistance and local resistance. In the latter case the resistance is caused by dissipation of mechanical energy when the configuration or the direction of flow is sharply changed, by the formation of vortices and secondary flows as a result of the flow breaking away, etc.

Using the hydraulic analogy we can say that since the velocity of electrons (drift velocity) in conductor, due the applied electric field (this electron flow is electric current) is very small ($\sim 10^{-4} \text{ m/s}$), as compared with velocities of water flow, we can assume that bends in a wire don't affect its electrical resistance.

On the other hand, the electrical resistance R of the object of uniform cross section is proportional to its electrical resistivity (electrical resistivity ρ is constant for given material) and length L and inversely proportional to its cross-sectional area S :

$$R = \rho \frac{L}{S}$$

Hence, resistance is independent on the bends of wire.

If we bend a wire, we can alter its inductance.