

Answer on Question #74648 Physics / Electromagnetism

Two parallel long wire carry I_1 and I_2 with $I_1 > I_2$. When the current are in the same direction, the magnetic field at a point midway between the wires is $10 \mu\text{T}$. If the direction of I_2 is reversed, the field becomes $30 \mu\text{T}$. The ratio of I_1/I_2 is:

(1)4.

(2)3

(3)2.

(4)1.

Solution:

The magnetic field at the distance r from the long wire with current I is as follow

$$B = \frac{\mu_0 I}{2\pi r}.$$

When the current are in the same direction, net magnetic field

$$B = B_1 - B_2 = \frac{\mu_0 I_1}{2\pi d} - \frac{\mu_0 I_2}{2\pi d} = 10 \mu\text{T}$$

When the current are in the opposite direction, net magnetic field

$$B = B_1 + B_2 = \frac{\mu_0 I_1}{2\pi d} + \frac{\mu_0 I_2}{2\pi d} = 30 \mu\text{T}$$

So

$$\frac{I_1 - I_2}{I_1 + I_2} = \frac{10}{30}$$

$$30I_1 - 30I_2 = 10I_1 + 10I_2$$

$$20I_1 = 40I_2$$

$$\frac{I_1}{I_2} = 2$$

Answer: (3) 2

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