Helmholtz Coils

Group 12

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Aim:

1. To measure the magnetic flux density along the z-axis of the flat coils when the distance between them a = R (R = radius of the coils) and when it is greater and less than this.

2. To measure the spatial distribution of the magnetic flux density when the distance between coils a = R, using the rotational symmetry of the set-up: a) measurement of the axial component Bz b) measurement of radial component Br.

3. To measure the radial components B r and B r of the two individual coils in the plane midway between them and to demonstrate the overlapping of the two fields at Br = 0.

Apparatus:

Pair of Helmholtz coils Power supply, Digital multimeter , Teslameter, Hall probe, Meter scale, Barrel base, Right angle clamp, Connecting wire.

Procedure:

1. The electric circuit was set up and the teslameter was connected appropriately.
2. The circuit was switched on and the teslameter was moved along the axis of the coils to measure the magnetic field along the axis keeping the radius as zero. [B(z, r=0)]
3. Then the teslameter was moved in radial direction to measure magnetic field along the axis keeping the probe in the middle of the two coils. [B(z=0, r)]
4. Then the teslameter was moved along the z direction such that the probe pointed in the radial direction. This measured the field in the radial direction as a function of z. [B(z,r)]
5. All the readings were taken in intervals of 1cm.
6. In the final part of the experiment a compass was kept in the magnetic field of the Helmholtz coil.
7. Initially the north south of the compass was noted and then in the magnetic field its deflection from north south direction was noted.

Observation:

|  |  |
| --- | --- |
| moved along z axis | |
| distance | magnetic field |
| 0 | 0.83 |
| 1 | 0.85 |
| 2 | 0.86 |
| 3 | 0.86 |
| 4 | 0.87 |
| 5 | 0.88 |
| 6 | 0.88 |
| 7 | 0.89 |
| 8 | 0.89 |
| 9 | 0.89 |
| 10 | 0.91 |
| 11 | 0.9 |
| 12 | 0.89 |
| 13 | 0.88 |
| 14 | 0.88 |
| 15 | 0.86 |
| 16 | 0.85 |
| 17 | 0.83 |
| 18 | 0.82 |
| 19 | 0.81 |
| 20 | 0.8 |

Experiment part 2-

|  |  |  |
| --- | --- | --- |
| moved radially | |  |
| radius | magnetic field | |
| -14 | 0.46 |  |
| -13 | 0.57 |  |
| -12 | 0.63 |  |
| -11 | 0.71 |  |
| -10 | 0.74 |  |
| -9 | 0.8 |  |
| -8 | 0.84 |  |
| -7 | 0.87 |  |
| -6 | 0.88 |  |
| -5 | 0.88 |  |
| -4 | 0.89 |  |
| -3 | 0.9 |  |
| -2 | 0.9 |  |
| -1 | 0.9 |  |
| 0 | 0.91 | center |
| 1 | 0.9 |  |
| 2 | 0.89 |  |
| 3 | 0.88 |  |
| 4 | 0.88 |  |
| 5 | 0.87 |  |
| 6 | 0.86 |  |
| 7 | 0.84 |  |
| 8 | 0.83 |  |
| 9 | 0.82 |  |
| 10 | 0.79 |  |
| 11 | 0.75 |  |
| 12 | 0.7 |  |
| 13 | 0.61 |  |
| 14 | 0.4 |  |

Experiment part 3-

|  |  |
| --- | --- |
| distance | magnetic field |
| 1 | -0.12 |
| 2 | -0.13 |
| 3 | -0.14 |
| 4 | -0.15 |
| 5 | -0.15 |
| 6 | -0.16 |
| 7 | -0.14 |
| 8 | -0.16 |
| 9 | -0.17 |
| 10 | -0.16 |
| 11 | -0.15 |
| 12 | -0.16 |
| 13 | -0.17 |
| 14 | -0.16 |
| 15 | -0.14 |
| 16 | -0.16 |
| 17 | -0.15 |
| 18 | -0.16 |

Experiment part4-

Magnetic needle rotated by 87degrees.

Graphs:

Experiment part 1-

Experiment part 2-

Experiment part 3-

Dotted line is best fit line.

Precautions:

1. Always push the barrel base bearing the Hall probe along the rule in the same direction.
2. Check if the connections are correct and if the current in both coils is in the same direction.
3. Connect the probe correctly.