PHYF214 PHYSICS LAB REPORT SEM1 2018-2019
Lab 10 Group 7: Magnetic Field in a Current-carrying conductor [MFCC]

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18 th October, 2018

1 Experimental Tasks

Determination of the magnetic field inside a conductor as a function

1. of the current in the conductor.
2. of the distance from the axis of the conductor.

2 Apparatus

Hollow cylinder, Power frequency, LF amplifier, Digital multimeter , plug pair, Meter scale, Tripod base, Connecting cord, Connecting cord, Hydrochloric acid.

3 Theory

The aparatus is arranged such that such that there is no net magnetic field on the outside of the cylinder which contains electrolyte in a cylindrical cavity and the grid on the surface wont produce magnetic field on the inside of the cylinder, the only magnetic field would be due to the electrolyte. The Induce Voltage (U_f) is given by:

$$U - f = 2n\pi AfB_o sin(\omega t + \phi) \tag{1}$$

Here n is the number of turns, A is the cross sectional area f is the sinusoidal current frequency $B_o sin(\omega t + \phi)$ is the magnetic field produced

The magnetic field as thus produced at a distance or $\mathbf{r}$ from the axis can be thus represented as

$$B = \frac{\mu_0}{2\pi}\frac{I_{tot}|\mathbf{r}|}{R^2} \tag{2}$$

Since induced voltage (U) and magnetic field (B) have a linear relationship, one can find B from U.

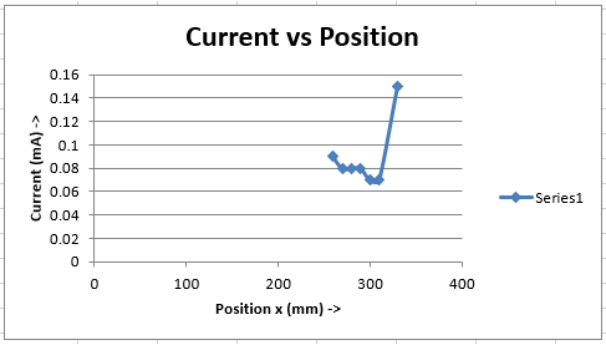
4 Observations

4.1 Trial1: Variation of magnetic field with position

Table 1: Variation with position

Position (in cm)	Magnetic field (in V)
260	0.09
270	0.08
280	0.08
290	0.08
300	0.07
310	0.07
330	0.15
320	0.18

Figure 1: Graph of variation of magnetic field with position



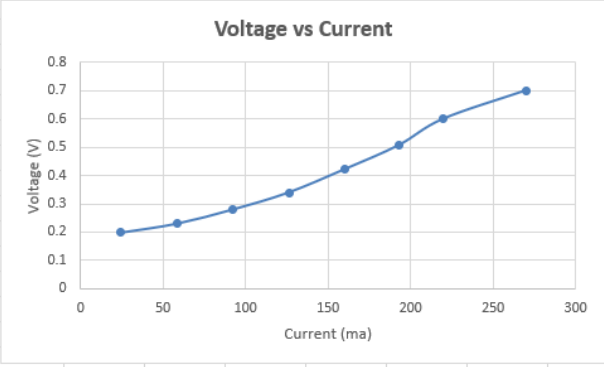
4.2 Trial2: Variation of magnetic field with current through the electrolyte

In order to measure the variation of magnetic field with current through the electrolyte, the function generator was set to 2500Hz and voltage was varied in steps and the resultant voltage in the probe is measured.

Table 2: Variation of current with voltage

Current (in mA)	Magnetic field (in V)
270	0.7
220	0.6
193	0.507
160.5	0.423
126.2	0.34
92.4	0.28
58.5	0.23
24	0.198

Figure 2: Graph of variation of magnetic field with current



5 *Analysis:*

The minima in the first graph corresponds to the center of the cylindrical cavity (30 cm from the ground level). The very high spike in the values for the later part can be attributed to the error due to non-homogeneity of the electrolyte and the fast chemical reaction resulting in Oxygen bubbles accumulating to the top. The second graph shows a linear behaviour as expected from the formulae presented above.

6 Precautions

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