Laboratory Work № 3.30

Measuring resistance using the bridge method

The aim: to explore laws of DC and to measure resistance in a bridge method;

Accessory: model of the gear, source of power supply;

Description of the device and piece of theory

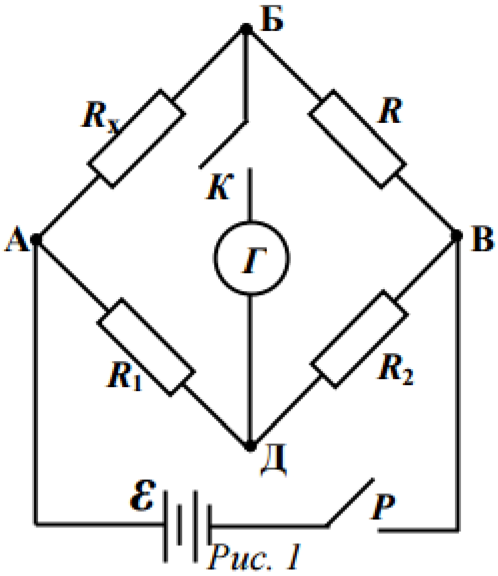

Рис. 1

Scheme of the bridge is a rectangle of resistance. At one diagonal there is a source of supply, at another-galvanometer (current detector).The latter diagonal is called as a bridge. If we know three resistances R, R(1), R(2), it’s easy to define the forth R(x).

If key P and button K are pressed, there is a current in BD. Its direction depends on which point has greater potential. If potentials ’re equal there is no current in the diagonal:

φ(В)- φ(Д)=0;   (1);
In this case current I is divided in two currents I(1-АДВ) and I(2-АБВ).
According to the DC laws, it is obtained:

АД: U= I_1R_1 ***;   (2);***   ***АБ:U=*** I_2R_x ***;   (3);***
It follows, that:

$$I_1R_1 = I_2R_x; \quad (4);$$

For ДВ and БВ:

$$I_1R_2 = I_2R; \quad (5) \Rightarrow$$

$$\frac{R_1}{R_2} = \frac{R_x}{R} \rightarrow R_x = \frac{R_1}{R_2} R.$$

Usually, AD and DC are changed by rheochord (slide-wire)- a kind of homogeneous wire set along AC.

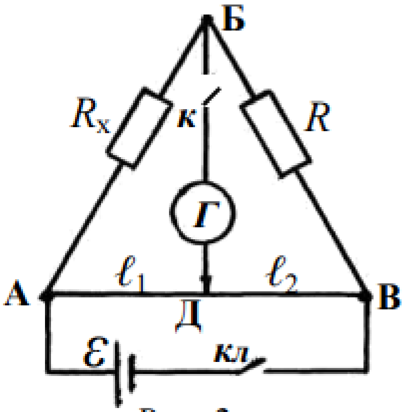

Рис. 2

In this case R(1) is for АД and R(2)- for ДВ. So, we have:

$$R_1 = \rho \frac{\ell_1}{S}; \quad \textbf{(7);} \qquad R_2 = \rho \frac{\ell_2}{S}, ; \quad \textbf{(8);} \rightarrow$$

$$\frac{R_1}{R_2} = \frac{\ell_1}{\ell_2} \quad \textbf{(9);}$$

Using formulas №9 and №6 we obtain:

$$R_x = \frac{\ell_1}{\ell_2} R.$$

№	Опір	Результати вимірів			R_{x_i} Ом	$\langle R_x \rangle$ Ом	ΔR_{x_i} Ом	$\Delta R^2_{x_i}$, Ом	$S\langle R_x \rangle$ Ом	α	$t_{\alpha,n}$	ΔR_x Ом	E, %
		ℓ_1	ℓ_2	R									
1 2 3	R_{x_1}												
1 2 3	R_{x_2}												
1 2 3	Послі-довне з'єд-нання												
1 2 3	Пара-лельне з'єд-нання												

After filling up the table, measured values should be compared with theoretical ones.

R(one by one)=

$$\langle R_1 \rangle + \langle R_2 \rangle$$

;

R(parallel)= $\dfrac{\langle R_1 \rangle \langle R_2 \rangle}{\langle R_1 \rangle + \langle R_2 \rangle}$ ***;***