Wroclaw University of Science and Technology

GENERAL PHYSICS
LABORATORY REPORT

Theme of class: DETERMINATION OF SOLID STATE DENSITY

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2.1 Determination of capacitance C of the capacitor component(RC circuit)

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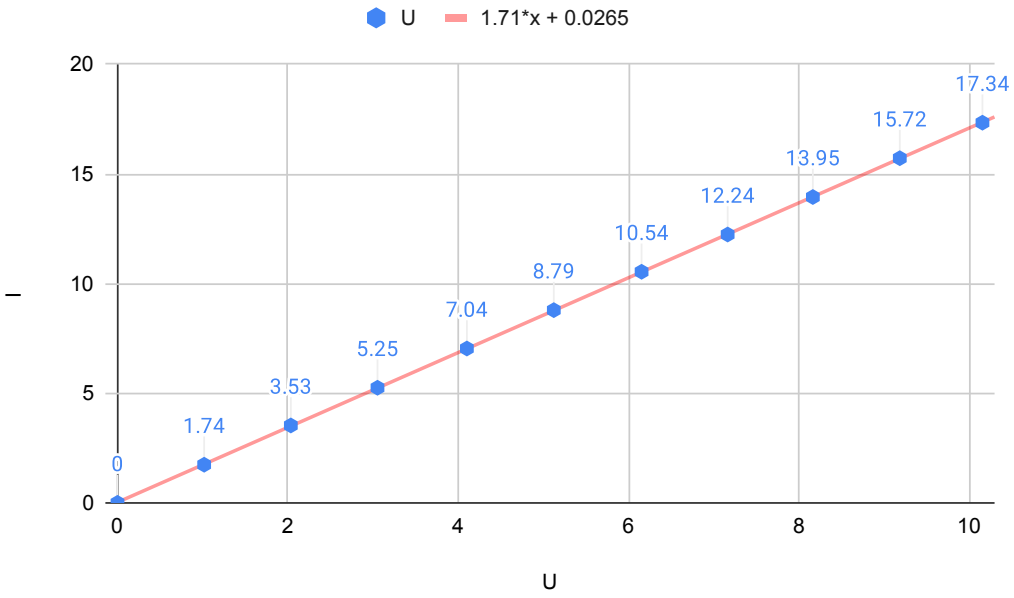

Figure 1: RC circuit measurements

V	UV	ImA
0	0	0
100	1.017	1.74
200	2.034	3.53
300	3.051	5.25
400	4.1	7.04
500	5.12	8.79
600	6.15	10.54
700	7.16	12.24
800	8.16	13.95
900	9.18	15.72
1000	10.15	17.34

Table 1: RC circuit. f = 300 Hz
R = 220 Ω Z_c = 1.71 kΩ

Calculations

$$C = \frac{1}{2\pi f\sqrt{(Z_c^2 - R^2)}} = \frac{1}{2\pi 300\sqrt{(1.71^2 - 220^2)}} = 0.000000411562347 \quad (1)$$

2.2 Determination of the inductance L of the inductor component (RL circuit)

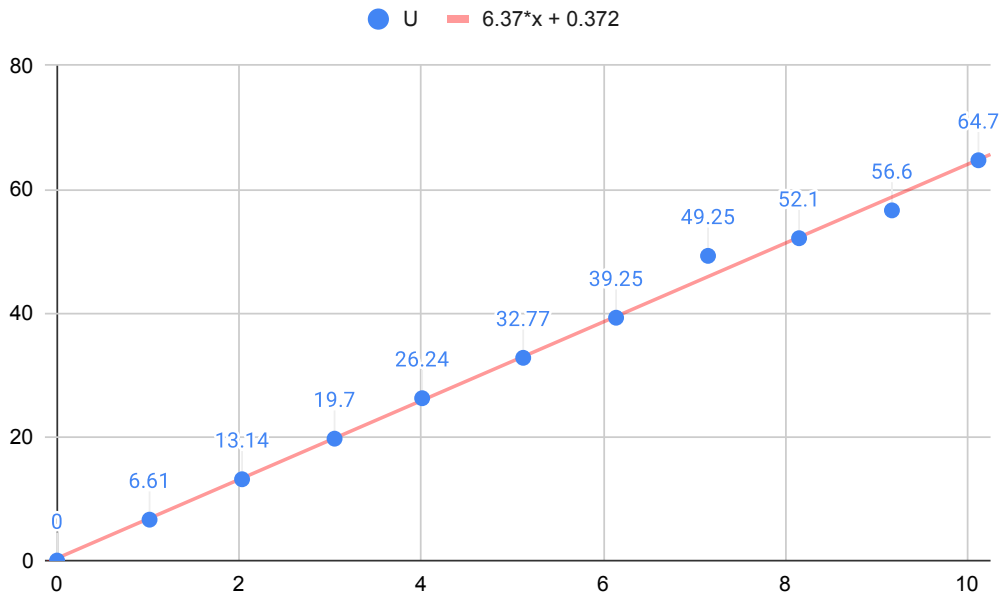

Figure 2: RC circuit measurements

Vrsm	UV	ImA
0	0	0
100	6.61	1.016
200	13.14	2.032
300	19.7	3.048
400	26.24	4.01
500	32.77	5.12
600	39.25	6.14
700	49.25	7.15
800	52.1	8.15
900	56.6	9.17
1000	64.7	10.12

Table 2: RL circuit.f = 300 Hz
R = 220 Ω R_l = 0.6 Ω Z_c = 6.37 kΩ

Calculations

$$L = \frac{\sqrt{Z_L^2 - (R + R_L)^2}}{2\pi f} = \frac{\sqrt{6370^2 - (220 + 0.6)^2}}{2\pi 300} = 1.333838664 \tag{2}$$

2.3 Verification of the Ohm's Law for the alternation current (RLC circuit)

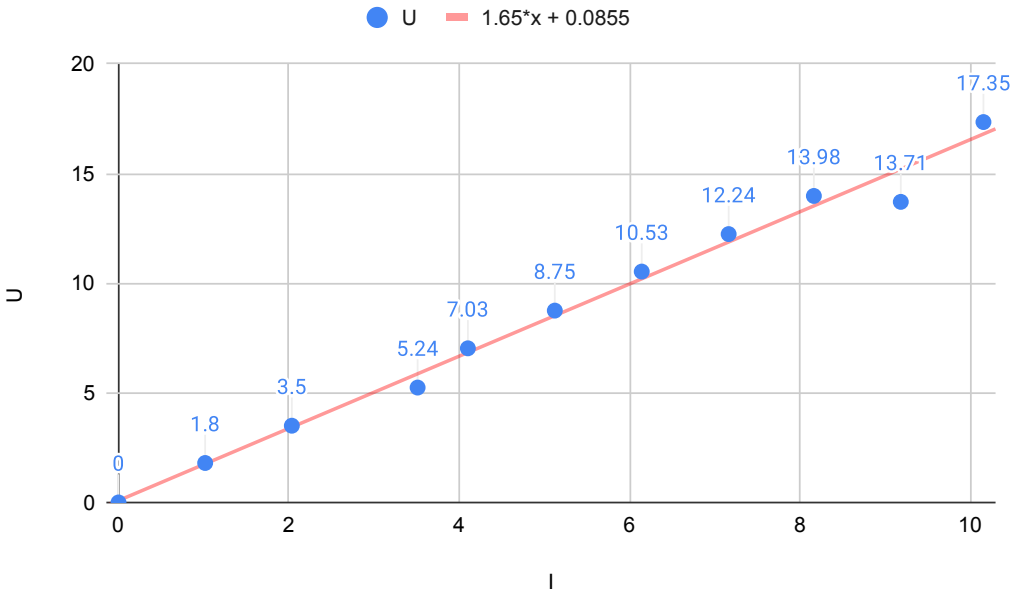

Figure 3: RC circuit measurements

Vrsm	U	I
0	0	0
100	1.8	1.017
200	3.5	2.034
300	5.24	3.51
400	7.03	4.1
500	8.75	5.12
600	10.53	6.14
700	12.24	7.16
800	13.98	8.16
900	13.71	9.18
1000	17.35	10.15

Table 3: RCL circuit.f = 300 Hz
R = 220 Ω R_l = 0.6 Ω Z_{cl} = 1.65 kΩ

Calculations

$$Z_2 = \sqrt{(R + R_L)^2 + \left((2\pi f L) - \left(\frac{1}{2\pi f C}\right)\right)^2} =$$
$$\sqrt{(220 + 0.6)^2 + \left((2\pi 300 \times 1.333838664) - \left(\frac{1}{2\pi 300 \times 0.000000411562347}\right)\right)^2} =$$
$$1244.89743 \quad (3)$$

Formulas used in the calculations

$$C = \frac{1}{2\pi f \sqrt{(Z_c^2 - R^2)}} \quad (4)$$

$$L = \frac{\sqrt{Z_L^2 - (R + R_L)^2}}{2\pi f} \quad (5)$$

$$Z_2 = \sqrt{(R + R_L)^2 + \left((2\pi f L) - \left(\frac{1}{2\pi f C}\right)\right)^2} \quad (6)$$

3 Conclusion