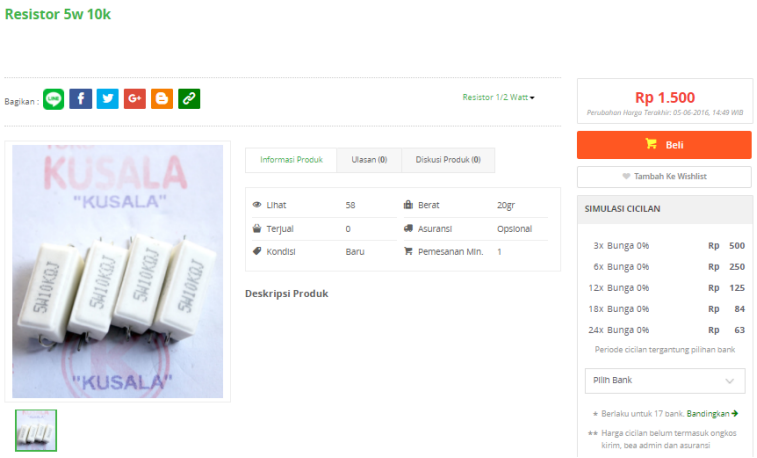
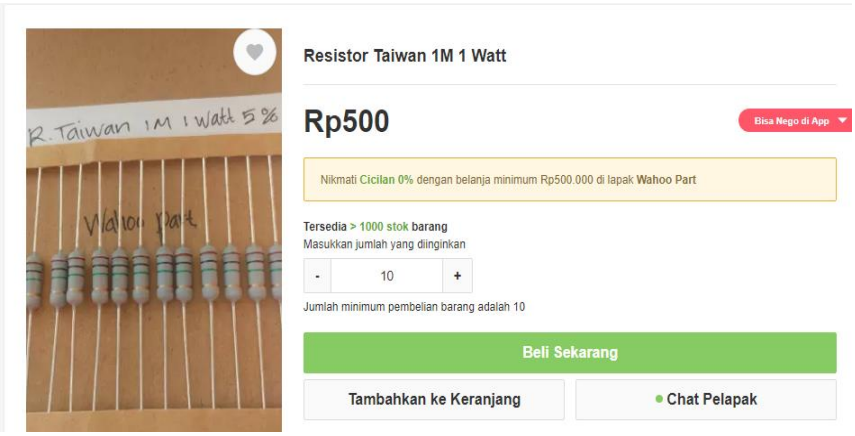
Lampiran 1. Komponen dan Alat yang Digunakan

1) Resistor 10kΩ 5W



2) Kapasitor 10 nF 3kV

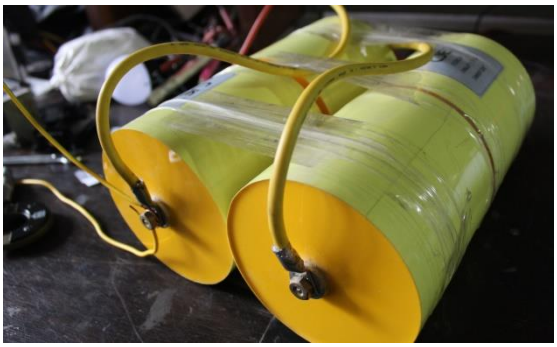
3) Resistor 1 MΩ 1W



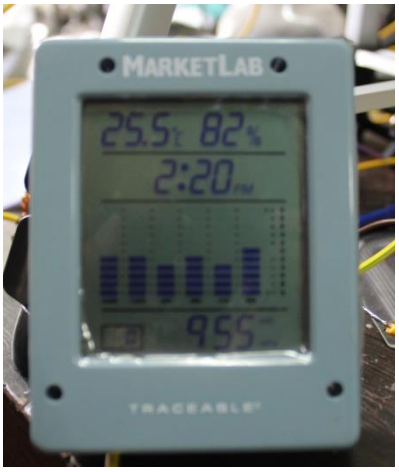
4) Elektroda Tembaga Diameter 0,5mm

5) Baut Diameter 5mm

6) *Storage capacitor* $25\mu F$, 12kV



7) Termometer Digital

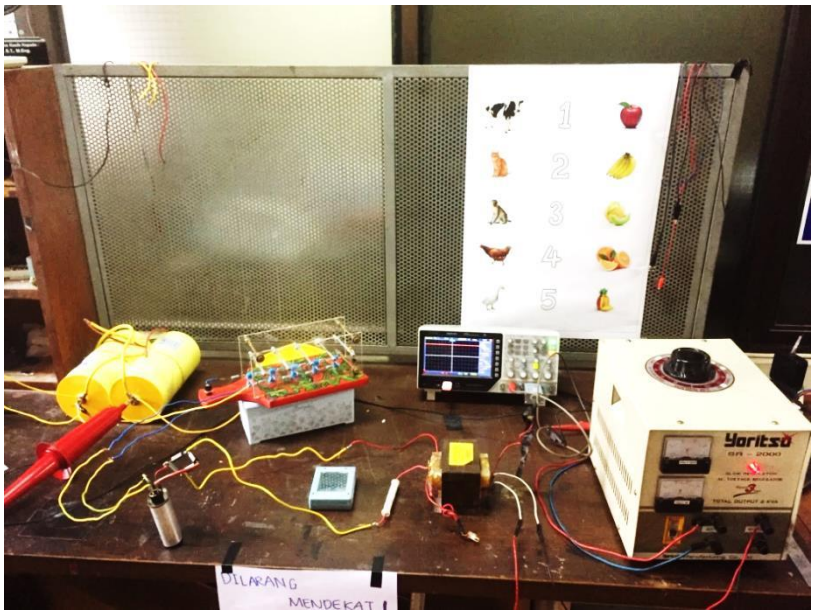


8) Osiloskop Hantek MSO5074FG

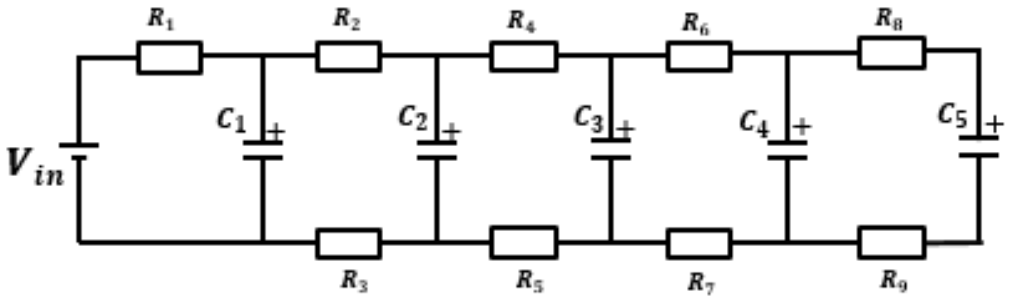
9) Mikrometer Sekrup Ketelitian 0,01mm

10) Probe Tegangan Tinggi

Lampiran 2. Dokumentasi Kegiatan


1
2
3
4
5
Yaritsa
DILARANG
MENDEKAT

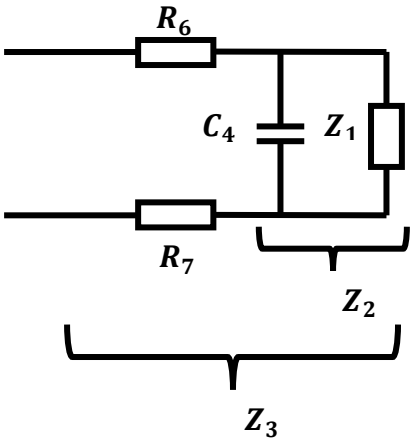
Lampiran 3. Perhitungan *Charging Current Marx Generator*



$$\boldsymbol{R_1 = R_2 = R_3 = R_4 = R_5 = R_6 = R_7 = R_8 = R_9 = 10\ \text{k}\Omega}$$
$$\boldsymbol{C_1 = C_2 = C_3 = C_4 = C = 1\ x\ 10^{-7}\text{F}}$$

✓ $Z_1 = R_8 + R_9 + \frac{1}{C_5 s}$

$$\boldsymbol{Z_1 = 2R + \frac{1}{Cs}}$$



✓ $Z_2 = C_4 // Z_1$

$$\frac{1}{Z_2} = \frac{1}{Z_1} + C_4 s$$

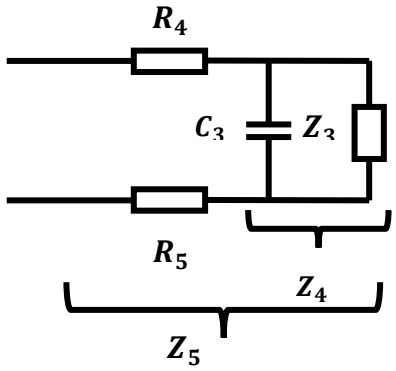
$$= \frac{1}{2R + \frac{1}{Cs}} + Cs$$

$$\boldsymbol{Z_2 = \frac{2RCs + 1}{2RC^2s^2 + 2Cs}}$$

✓ $Z_3 = R_6 + R_7 + Z_2$

$$= 2R + \frac{2RCs + 1}{2RC^2s^2 + 2Cs}$$

$$\boldsymbol{Z_3 = \frac{6RCs + 4R^2C^2s^2 + 1}{2Cs + 2RC^2s^2}}$$



✓ $Z_4 = Z_3 // C_3$

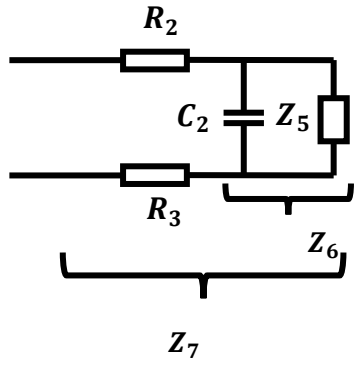
$$\frac{1}{Z_4} = \frac{1}{Z_3} + C_3 s$$

$$\boldsymbol{Z_4 = \frac{4R^2C^2s^2 + 6RCs + 1}{4R^2C^3s^3 + 3Cs + 8RC^2s^2}}$$

✓ $Z_5 = R_4 + R_5 + Z_4$

$$= 2R + \frac{4R^2C^2s^2 + 6RCs + 1}{4R^2C^3s^3 + 3Cs + 8RC^2s^2}$$

$$\boldsymbol{Z_5 = \frac{12RCs + 20R^2C^2s^2 + 8R^3C^3s^3 + 1}{3Cs + 8RC^2s^2 + 4R^2C^3s^3}}$$



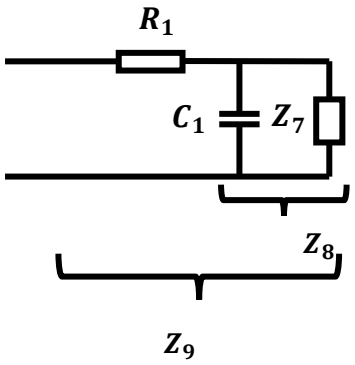
✓ $Z_6 = Z_5 // C_2$

$$\frac{1}{Z_6} = \frac{1}{Z_5} + C_2 s$$

$$\boldsymbol{Z_6 = \frac{12RCs + 20R^2C^2s^2 + 8R^3C^3s^3 + 1}{3Cs + 8RC^2s^2 + 4R^2C^3s^3}}$$

✓ $Z_7 = R_2 + R_3 + Z_6$

$$\boldsymbol{Z_7 = \frac{s^4(16R^4C^4) + s^3(56R^3C^3) + s^2(60R^2C^2) + s(20RC) + 1}{s^4(8R^3C^4) + s^3(24R^2C^3) + s^2(20RC^2) + 4Cs}}$$



✓ $Z_8 = Z_7 // C_1$

$$\frac{1}{Z_8} = \frac{1}{Z_7} + C_1 s$$

$$\boldsymbol{Z_8 = \frac{s^4(16R^4C^4) + s^3(56R^3C^3) + s^2(60R^2C^2) + s(20RC^2) + 1}{s^5(16R^4C^5) + s^4(64R^3C^4) + s^3(84R^2C^3) + s^2(40RC^2) + 5Cs}}$$

✓ $Z_9 = R_1 + Z_9$

$$\boldsymbol{Z_9 = \frac{s^5(16R^5C^5) + s^4(80R^4C^4) + s^3(140R^3C^3) + s^2(100R^2C^2) + s(20RC^2 + 5RC) + 1}{s^5(16R^4C^5) + s^4(64R^3C^4) + s^3(84R^2C^3) + s^2(40RC^2) + 5Cs}}$$

Substitusi nilai C dan R

Sehingga,

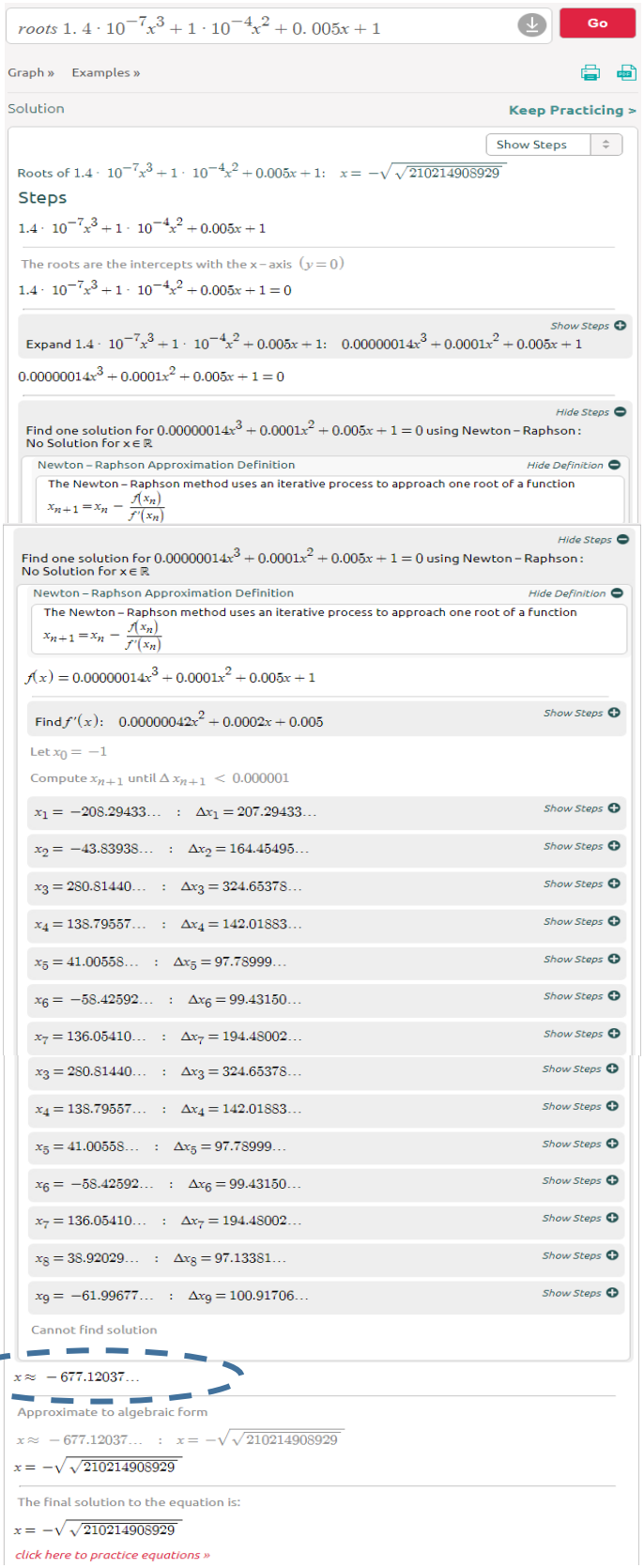
$$Z_9 = \frac{1{,}6x10^{-14}s^5 + 8x10^{-11}s^4 + 1{,}4x10^{-7}s^3 + 1x10^{-4}s^2 + 0{,}005s + 1}{1{,}6x10^{-18}s^5 + 6{,}4x10^{-15}s^4 + 8{,}4x10^{-12}s^3 + 4x10^{-9}s^2 + 5x10^{-7}s}$$

$$\boldsymbol{I(s) = \frac{V(s)}{Z(s)}, dimana\ V(s) = 1500}$$

$$I(s) = 1500\ x\ \frac{1{,}6x10^{-18}s^5 + 6{,}4x10^{-15}s^4 + 8{,}4x10^{-12}s^3 + 4x10^{-9}s^2 + 5x10^{-7}s}{1{,}6x10^{-14}s^5 + 8x10^{-11}s^4 + 1{,}4x10^{-7}s^3 + 1x10^{-4}s^2 + 0{,}005s + 1}$$

$$= \frac{2{,}4x10^{-15}s^5 + 9{,}6x10^{-12}s^4 + 1{,}26x10^{-8}s^3 + 6x10^{-6}s^2 + 7{,}5x10^{-4}s}{1{,}6x10^{-14}s^5 + 8x10^{-11}s^4 + 1{,}4x10^{-7}s^3 + 1x10^{-4}s^2 + 0{,}005s + 1}$$

Mencari akar-akar dari nilai penyebut $I(s)$ menggunakan kalkulator *online*



$$Laplace(I_{(s)}) = \frac{2{,}4x10^{-15}s^5 + 9{,}6x10^{-12}s^4 + 1{,}26x10^{-8}s^3 + 6x10^{-6}s^2 + 7{,}5x10^{-4}s}{(s + 677{,}12037)}$$

$$A = \frac{2{,}4x10^{-15}s^5 + 9{,}6x10^{-12}s^4 + 1{,}26x10^{-8}s^3 + 6x10^{-6}s^2 + 7{,}5x10^{-4}s}{(s + 677{,}12037)}; s = -677{,}12037$$

$$\boldsymbol{A = 0{,}007833}$$

Maka ;

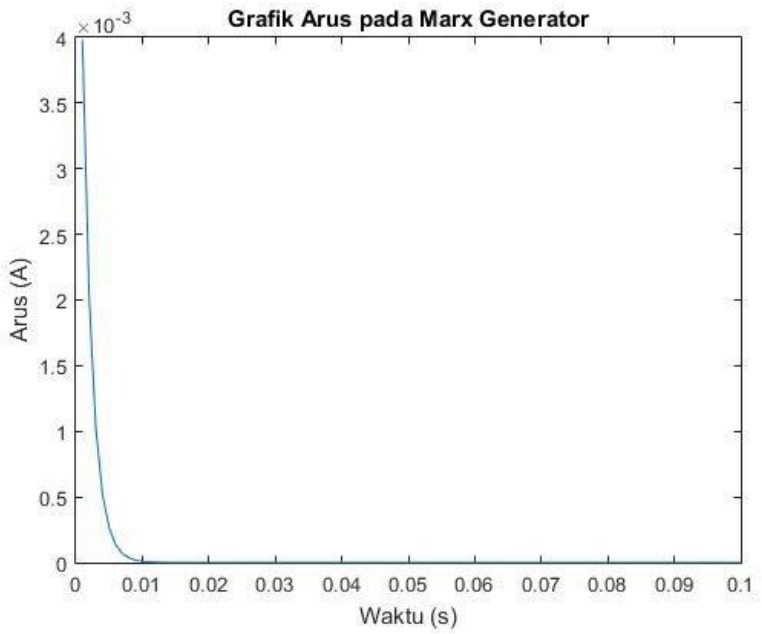
$$I(t) = \frac{0{,}007833}{s + 677{,}12037}$$

$$= \boldsymbol{0{,}007833e^{-677{,}12307t}}$$

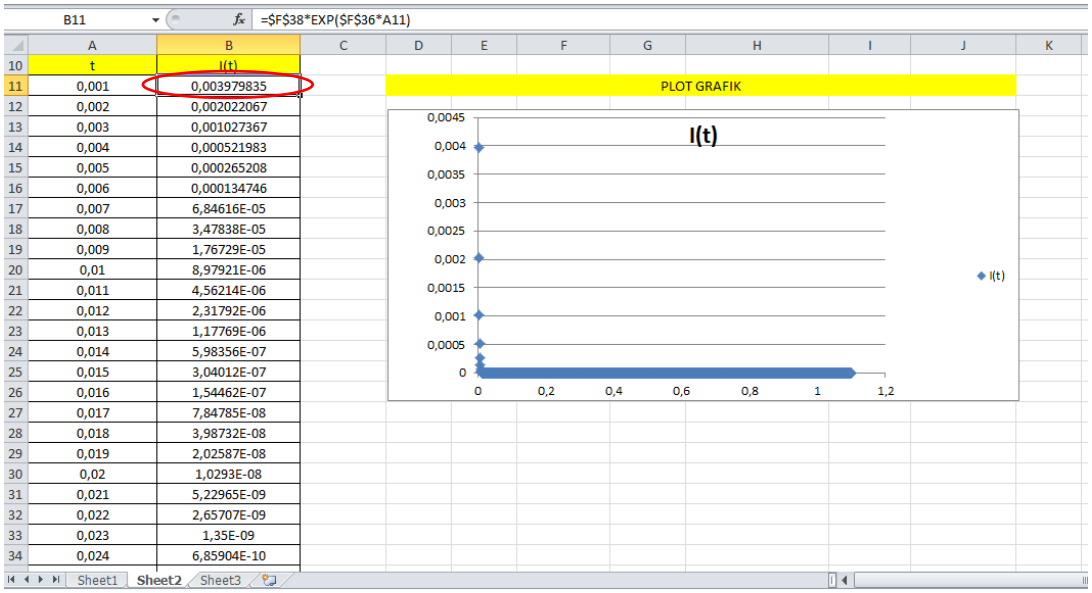
Setelah melakukan plot nilai t pada Matlab dan Microsoft Excel, diperoleh nilai $I(t)$maksimum pada saat $\frac{di(t)}{dt} = 0$, yaitu:

```
r=10000;
c=0.0000001;


A=(16*r^5*c^5)
B=(80*r^4*c^4)
C=(140*r^3*c^3)
D=(100*r^2*c^2)
E=(20*r*c^2)+(5*r*c)
F=1
G=(16*r^4*c^5)
H=(64*r^3*c^4)
I=(84*r^2*c^3)
J=(40*r*c^2)
K=(5*c)

x1=-677.12037;

X=1500*((G*x1^5)+(H*x1^4)+(I*x1^3)+(J*x1^2)+(K*x1))

t=0.001:0.001:0.1;
it=(X*exp(-677.12037*t))

plot(t,it)
```

Listing program mencari nilai I(t) maksimum saat $\frac{di(t)}{dt} = 0$ pada Matlab



Plot nilai I(t) pada Microsoft Excel:



Berdasarkan perhitungan dan grafik tersebut nilai $\boldsymbol{I(t)maks = 0.003979835\ Ampere}$

Maka, daya maksimum yang diserap R_1 adalah:

$$Pmaks = I^2 x\ R_1$$

$$= (0{,}003979835)^2\ x\ 10.000$$

$$= \boldsymbol{0,15839\ Watt}$$