laba1

September 9, 2023

0.0.1

[169]:

```python
# random fault of the slope
def RR(i, v):
    s1 = s2 = 0
    for index in range(1, len(i) + 1):
        s1+=i[index]*v[index]
        s2+=i[index]**2
    return s1/s2

def random_fault(i, v, n):
    s1 = s2 = 0
    for index in range(1, len(i) + 1):
        s1+=v[index]**2
        s2+=i[index]**2
    return ((1/(n-1))*(s1/s2 - (RR(i, v))**2))**0.5
```

[170]:

```python
def sistematic_fault(i, v, delta_i, delta_v):
    return RR(i, v)*((delta_v/max(v))**2 + (delta_i/max(i))**2)**0.5
```

[178]:

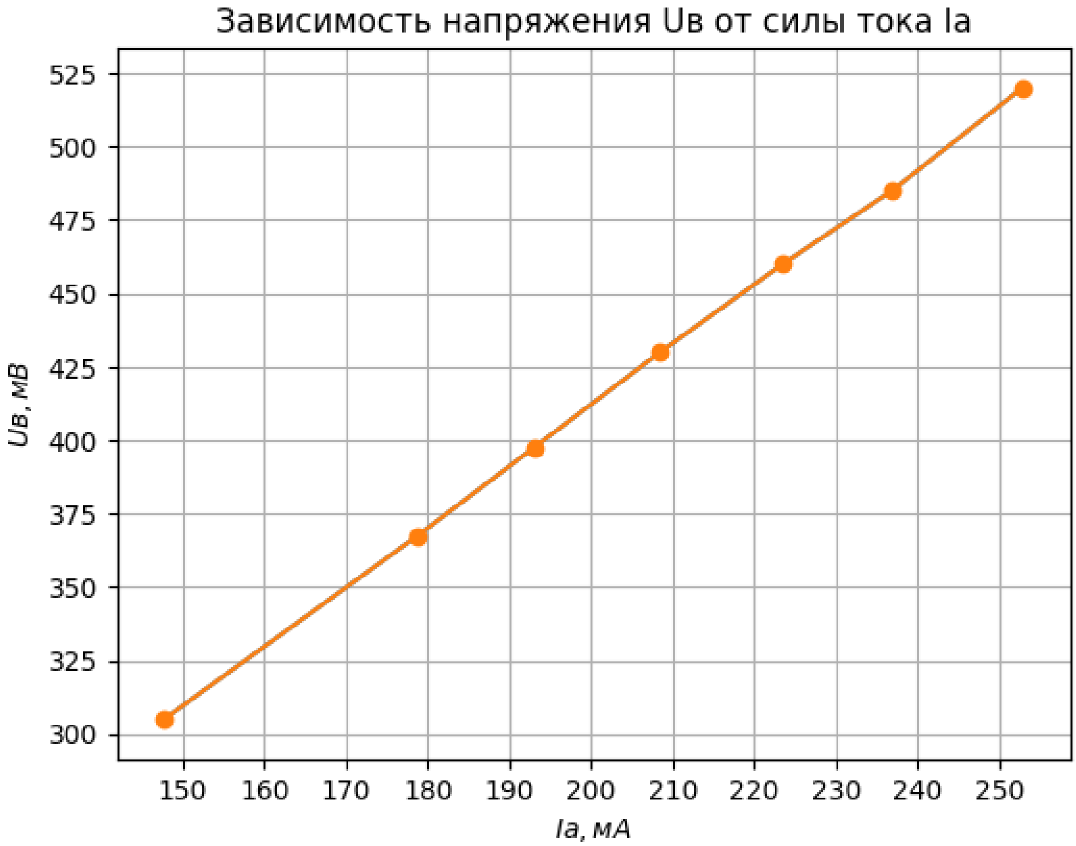
```python
def full_fault(sist_fault, rand_fault):
    return (sist_fault**2 + rand_fault**2)**0.5
```

[203]:

```python
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
n = 7

table1 = pd.DataFrame({
                        'Uv, mV': [5*61, 5*73.5, 5*79.5, 5*86, 5*92, 5*97,␣
 ↪5*104],
                        'Ia, mA': [147.7, 178.74, 193, 208.45, 223.45, 236.83,␣
 ↪252.8],},  index= [1, 2, 3, 4, 5, 6, 7])
table1
```

[203]:
```
   Uv, mV  Ia, mA
1   305.0  147.70
2   367.5  178.74
3   397.5  193.00
4   430.0  208.45
5   460.0  223.45
6   485.0  236.83
7   520.0  252.80
```

[207]:
```
x = table1['Ia, mA']
y = table1['Uv, mV']
plt.plot(x, y)
plt.xlabel(r'$I ,  $')
plt.ylabel(r'$U ,  $')
plt.grid(True)
plt.yticks(np.arange(0, 750, 25))
plt.xticks(np.arange(0,  400, 10))

xerr = 0.5
yerr = 2.5
plt.errorbar(x, y, xerr=xerr, yerr=yerr, fmt='o-', ecolor='red')

plt.title(r'             U          I ')
plt.show()
```



[174]:

```
model1 = np.polyfit(x, y, 1)
R1 = model1[0]
```

[183]:

```
print("R1 = ", R1)
print("RR1 = ", RR(x, y))
model1
```

```
R1 =  2.040468365183917
RR1 =  2.0572037989115546
```

[183]:

```
array([2.04046837, 3.53518569])
```

[179]:

```
rand_fault1 = random_fault(x, y, n)
sist_fault1 = sistematic_fault(x, y, xerr, yerr)
full_fault1 = full_fault(sist_fault1, rand_fault1)
```

[181]:

```
print("full_fault1 = ", full_fault1)
```

```
full_fault1 =  0.010895976867924
```

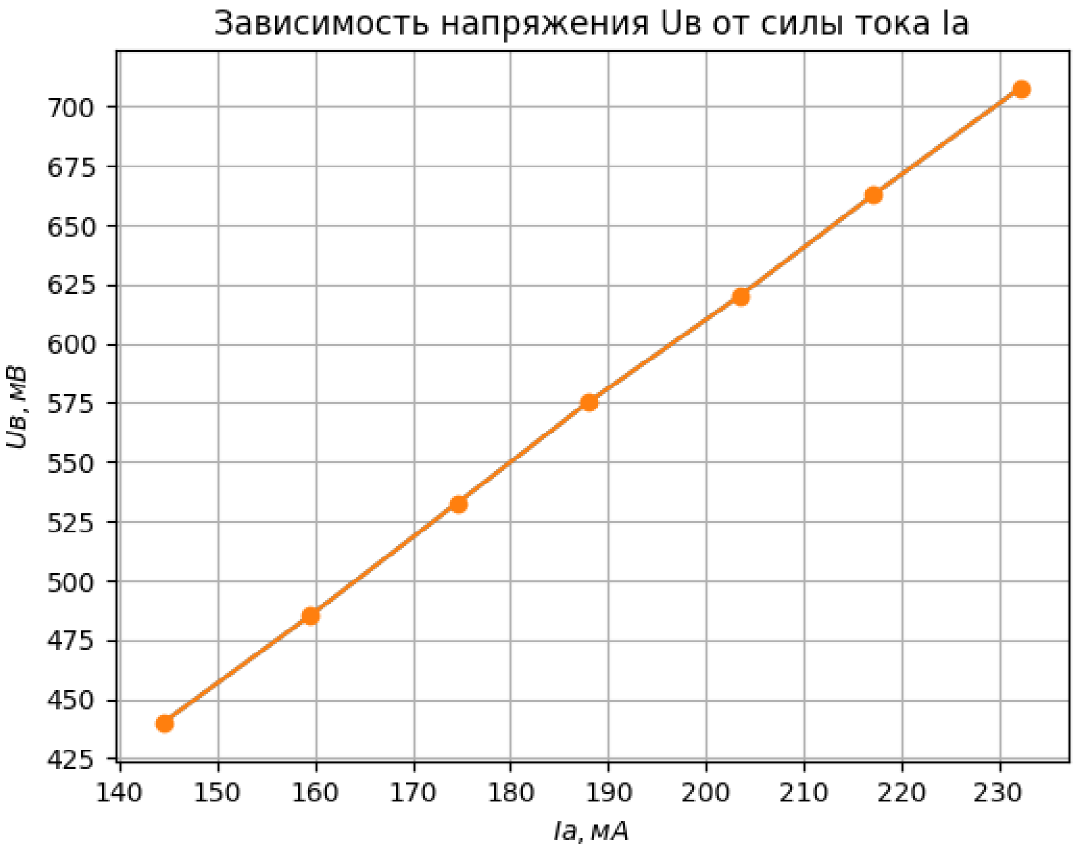
0.0.2 №2

l = 30cm

[199]:
```
table2 = pd.DataFrame({
                        'Uv, mV': [88, 97, 106.5, 115, 124, 132.5, 141.5],
                        'Ia, mA': [144.47, 159.48, 174.55, 187.95, 203.5, 217.
 ↪13, 232.17],},  index= [1, 2, 3, 4, 5, 6, 7])

for i in range(1, n + 1):
    table2['Uv, mV'][i] =table2['Uv, mV'][i]*5
table2
```

[199]:
```
   Uv, mV  Ia, mA
1   440.0  144.47
2   485.0  159.48
3   532.5  174.55
4   575.0  187.95
5   620.0  203.50
6   662.5  217.13
7   707.5  232.17
```

[201]:
```
x2 = table2['Ia, mA']
y2 = table2['Uv, mV']

plt.plot(x2, y2)
plt.xlabel(r'$I ,  $')
plt.ylabel(r'$U ,  $')
plt.grid(True)

plt.yticks(np.arange(0, 750, 25))
plt.xticks(np.arange(0, 400, 10))

xerr = 0.5
yerr = 2.5
plt.errorbar(x2, y2, xerr=xerr, yerr=yerr, fmt='o-', ecolor='red')

plt.title(r'             U          I ')
plt.show()
```



```
[145]: model2 = np.polyfit(x2, y2, 1)
```

```
[186]: print("R2 = ", model2[0])
       print("RR2 = ", RR(x2, y2))
       model2
```

```
R2 =  3.0561298000466217
RR2 =  3.0492450514766243
```

```
[186]: array([ 3.0561298 , -1.32846267])
```

```
[187]: rand_fault2 = random_fault(x2, y2, n)
       sist_fault2 = sistematic_fault(x2, y2, xerr, yerr)
       full_fault2 = full_fault(sist_fault2, rand_fault2)
       print("full_fault2 = ", full_fault2)
```

```
full_fault2 =  0.012779131955527148
```

0.0.3 3

$$\mathbf{l = 50cm}$$

[148]:

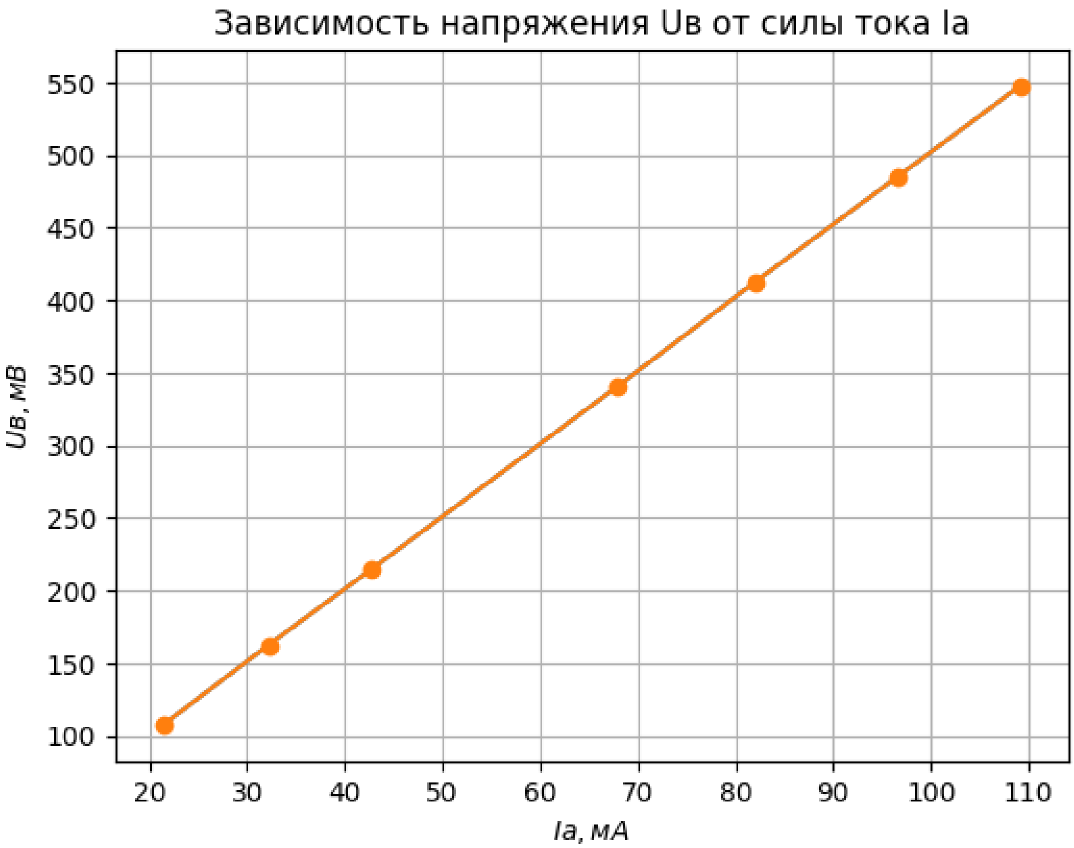
```
table3 = pd.DataFrame({
                        'Uv, mV': [21.5, 32.5, 43, 68, 82.5, 97, 109.5],
                        'Ia, mA': [21.42, 32.2, 42.8, 67.8, 82, 96.58, 109.
 ↪12],},  index= [1, 2, 3, 4, 5, 6, 7])

for i in range(1, n + 1):
    table3['Uv, mV'][i] =table3['Uv, mV'][i]*5

table3
```

[148]:

```
   Uv, mV   Ia, mA
1   107.5    21.42
2   162.5    32.20
3   215.0    42.80
4   340.0    67.80
5   412.5    82.00
6   485.0    96.58
7   547.5   109.12
```

[195]:

```
x3 = table3['Ia, mA']
y3 = table3['Uv, mV']
plt.plot(x3, y3)
plt.xlabel(r'$I ,  $')
plt.ylabel(r'$U ,  $')
plt.grid(True)
plt.yticks(np.arange(0, 750, 50))
plt.xticks(np.arange(0, 200, 10))

xerr = 0.5
yerr = 2.5
plt.errorbar(x3, y3, xerr=xerr, yerr=yerr, fmt='o-', ecolor='red')

plt.title(r'             U          I ')
plt.show()
```



[152]:

```
model3 = np.polyfit(x3, y3, 1)
```

[188]:

```
print("R3 = ", model3[0])
print("RR3 = ", RR(x3, y3))
model3
```

```
R3 =  5.016577579014476
RR3 =  5.021810034862212
```

[188]:

```
array([5.01657758, 0.41546578])
```

[189]:

```
rand_fault3 = random_fault(x3, y3, n)
sist_fault3 = sistematic_fault(x3, y3, xerr, yerr)
full_fault3 = full_fault(sist_fault3, rand_fault3)
print("full_fault3 = ", full_fault3)
```

```
full_fault3 =  0.03260031257470782
```

[ ]: