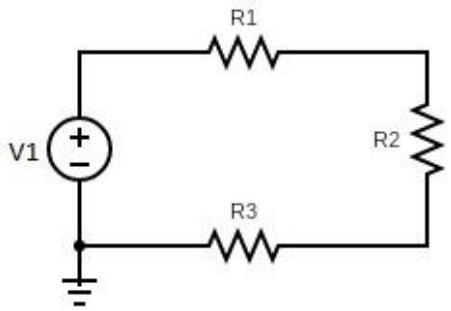
List of examples

Examples

Example 1:

A simple electric circuit with three series-connected resistors will be solved using JuliaCAP.



Step 1.1 Mark all nodes in the circuit starting from 1

Step 1.2 Include JuliaCAP.jl file with using .JuliaCAP not to emphasize that every function call is made from a JuliaCAP.jl file (it is not necessary)

```
include("JuliaCap.jl")
using .JuliaCAP
```

Step 1.3 Create circuit and add elements

```
graf = noviGraf()
dodajGranu(graf, Grana(Vg, "V1", [4], [1], [5.]))
dodajGranu(graf, Grana(R, "R1", [4], [3], [150.]))
dodajGranu(graf, Grana(R, "R2", [3], [2], [50.]))
dodajGranu(graf, (R, "R3", [2], [1], [300.]))
```

Step 1.4 Solve the circuit and result assing to a variable

```
rezultat = resiKolo(graf; omega = "w")
```

Step 1.5 Write solution with some of writing function whose argument will be variable from previous step, e.g.

```
ispisi_rezultate(rezultat)
```

and the result should be

```
U4 = 5.0
U2 = 3.0
U3 = 3.4999999999999996
IV1 = -0.0099999999999998
```

U4 is fourth node voltage (node node to which the number 4 was assigned in the first step), U2 is second node voltage, U3 is third node voltage.

Step 1.6 Additionaly, it is possible to print basic equations based on which we got final solution, some specified parameter (voltage at the node or branch current), circuit specification or to write each of these in Latex.

```
ispisi_jednacine()
ispisi_specifican_rezultat(rezultat, "U2")
ispisi_specifikacije_kola(graf)
ispisi_jednacine_latex()
ispisi_rezultate_latex(rezultat)
ispisi_specifican_rezultat_latex(rezultat, "U2")
```

Note: Step 1.3 Instead of float number element value could be String or an expression :

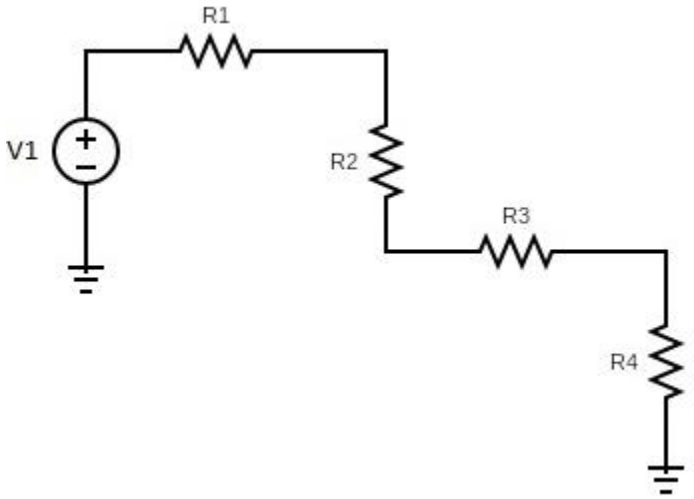
```
dodajGranu(graf, Grana(Vg, "V1", [4], [1], ["V1"]))
dodajGranu(graf, Grana(R, "R1", [4], [3], ["R1"]))
dodajGranu(graf, Grana(R, "R2", [3], [2], ["R2"]))
dodajGranu(graf, Grana(R, "R3", [2], [1], ["R3"]))
```

And final solution would be

```
U4 = V1
U2 = (-((-V1*(1 / R1)*(1 / R2)) / (-1 / R1 + -1 / R2 + (-((1 / R2)^2)) / (-1 / R2 + -1 / R3)))) / (-1 / R2 + -1 / R3)
U3 = (-V1*(1 / R1)) / (-1 / R1 + -1 / R2 + (-((1 / R2)^2)) / (-1 / R2 + -1 / R3))
IV1 = (-V1*((1 / R1)^2)) / (-1 / R1 + -1 / R2 + (-((1 / R2)^2)) / (-1 / R2 + -1 / R3)) - V1*(1 / R1)
```

Example 2:

Electric cirtuit with four serial-connected resistors and one voltage generator.



Repeat steps 1.1-1.6 from example 1. with changes in step 1.3. Circuit should be made with this equations:

```
dodajGranu(graf, Grana(Vg, "V1", [2], [1], [5.]))
dodajGranu(graf, Grana(R, "R1", [2], [3], [514.]))
dodajGranu(graf, Grana(R, "R2", [3], [4], [123.]))
dodajGranu(graf, Grana(R, "R3", [4], [5], [300.]))
dodajGranu(graf, Grana(R, "R4", [5], [1], [154.]))
```

Solution of this circuit is:

```
U2 = 5.0
U4 = 2.0806599450045815
```

```
U5 = 0.7057745187900983
U3 = 2.644362697525193
IV1 = -0.004582951420714943
```

Example 3.1: CCCS (current controlled current source)

CCCS, current controlled current source electric circuit with resistors. Repeat steps 1.1-1.6 from example 1. with changes in step 1.3. Circuit should be made with this equations:

```
dodajGranu(graf, Grana(Vg, "V1", [5], [1], [5.]))
dodajGranu(graf, Grana(R, "R1", [5], [2], [150.]))
dodajGranu(graf, Grana(R, "R3", [2], [1], [50.]))
dodajGranu(graf, Grana(R, "R4", [2], [3], [200.]))
dodajGranu(graf, Grana(R, "R5", [4], [3], [50.]))
dodajGranu(graf, Grana(R, "R6", [3], [1], [100.]))
dodajGranu(graf, Grana(CCCS, "CCCS1", [2, 1], [4, 1], [1]))
```

Solution:

```
U2 = -0.0
U4 = -2.916666666666647
U5 = 5.0
U3 = -1.666666666666654
IV1 = -0.0333333333333333
ICCCS1 = 0.02500000000000005
```

Example 3.2: VCVS (voltage controlled voltage source)

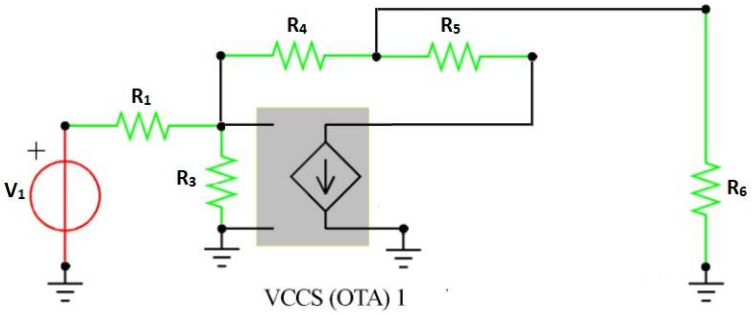
VCVS, voltage controlled voltage source electric circuit with resistors. Repeat steps 1.1-1.6 from example 1. with changes in step 1.3. Circuit should be made with this equations:

```
dodajGranu(graf, Grana(Vg, "V1", [5], [1], [5.]))
dodajGranu(graf, Grana(R, "R1", [5], [2], [150.]))
dodajGranu(graf, Grana(R, "R3", [2], [1], [50.]))
dodajGranu(graf, Grana(R, "R4", [2], [3], [200.]))
dodajGranu(graf, Grana(R, "R5", [4], [3], [50.]))
dodajGranu(graf, Grana(R, "R6", [3], [1], [100.]))
dodajGranu(graf, Grana(VCVS, "VCVS1", [2, 1], [4, 1], [1]))
```

Solution of the circuit:

```
U2 = 1.186440677966101 6
U4 = 1.186440677966101 6
U5 = 5.0
U3 = 0.847457627118644
IV1 = -0.0254237288135593 2
IVCVS1 = -0.00677966101694915
```

Example 3.3: VCCS (voltage controlled current source)



VCCS, voltage controlled current source electric circuit with resistors. Repeat steps 1.1-1.6 from example 1. with changes in step 1.3. Circuit should be made with this equations:

```
dodajGranu(graf, Grana(Vg, "V1", [5], [1], [5.]))
dodajGranu(graf, Grana(R, "R1", [5], [2], [150.]))
dodajGranu(graf, Grana(R, "R3", [2], [1], [50.]))
dodajGranu(graf, Grana(R, "R4", [2], [3], [200.]))
dodajGranu(graf, Grana(R, "R5", [4], [3], [50.]))
dodajGranu(graf, Grana(R, "R6", [3], [1], [100.]))
dodajGranu(graf, Grana(VCCS, "VCCS1", [2, 1], [4, 1], [1]))
```

Solution of the circuit:

```
U2 = 0.0917431192660550 1
U4 = -10.672782874617734
U5 = 5.0
U3 = -6.085626911314985
IV1 = -0.032721712538226 3
```

Example 3.4: CCVS (current controlled voltage source)

CCVS, current controlled voltage source electric circuit with resistors.

Repeat steps 1.1-1.6 from example 1. with changes in step 1.3. Circuit should be made with this equations:

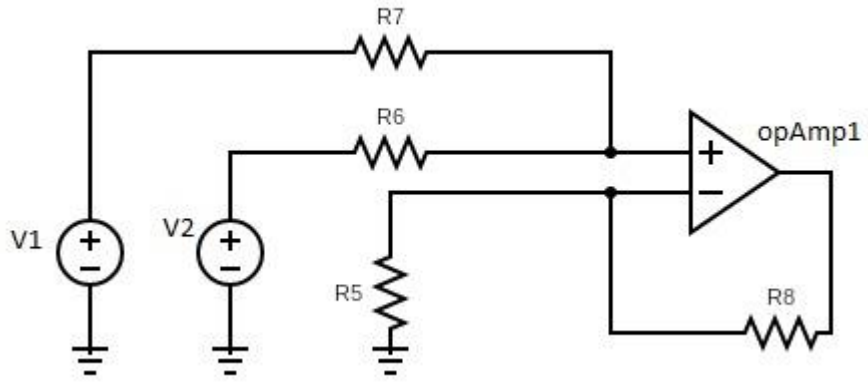
```
dodajGranu(graf, Grana(Vg, "V1", [5], [1], [5.]))
dodajGranu(graf, Grana(R, "R1", [5], [2], [150.]))
dodajGranu(graf, Grana(R, "R3", [2], [1], [50.]))
dodajGranu(graf, Grana(R, "R4", [2], [3], [200.]))
dodajGranu(graf, Grana(R, "R5", [4], [3], [50.]))
dodajGranu(graf, Grana(R, "R6", [3], [1], [100.]))
dodajGranu(graf, Grana(CCVS, "CCVS1", [2, 1], [4, 1], [1]))
```

Solution of the circuit:

```
U2 = -0.0
U4 = 0.033428844317096466
U5 = 5.0
U3 = 0.019102196752626 55
IV1 = -0.0333333333333333
ICCVS1 = -0.0002865329512893 9826
```

Example 4:

Electric cirucit with operational amplifier and resistors.



Repeat steps 1.1-1.6 from example 1. with changes in step 1.3. Circuit should be made with this equations:

```
dodajGranu(graf, Grana(Vg, "V1", [6], [1], [2.5]))
```

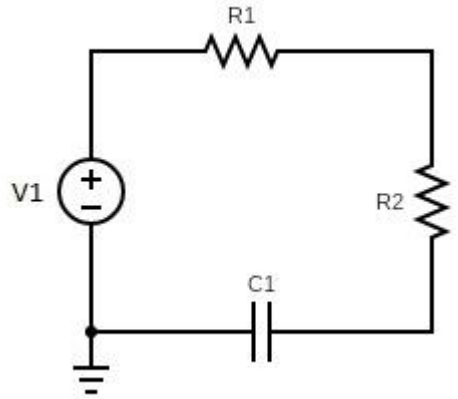
```
dodajGranu(graf, Grana(Vg, "V2", [2], [1], [2]))
dodajGranu(graf, Grana(R, "R5", [1], [4], [10000]))
dodajGranu(graf, Grana(R, "R6", [2], [3], [10000]))
dodajGranu(graf, Grana(R, "R7", [3], [6], [2780]))
dodajGranu(graf, Grana(R, "R8", [4], [5], [2780]))
dodajGranu(graf, Grana(opAmp, "opAmp1", [3, 4], [5]))
```

Solution of the circuit:

```
U2 = 2.0
U4 = 2.391236306729265
U5 = 3.056000000000005
U3 = 2.391236306729265
U6 = 2.5
IV1 = -3.912363067292649e-5
IV2 = 3.912363067292646 5e-5
IopAmp1 = -0.0002391236306729264 7
```

Example 5:

Electric cirucit with serial-conected resistors and capacitor.



Repeat steps 1.1-1.6 from example 1. with changes in step 1.3. Circuit should be made with this equations:

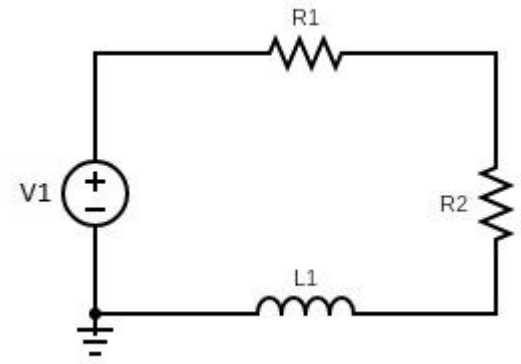
```
dodajGranu(graf, Grana(Vg, "V1", [2], [1], [3.]))
dodajGranu(graf, Grana(R, "R1", [2], [3], [50.]))
dodajGranu(graf, Grana(R, "R2", [3], [4], [100.]))
dodajGranu(graf, Grana(C, "C1", [4], [1], [5.], [2.]))
```

Solution of the circuit:

```
 U2 = 3.0
 U4 = ((0.03(0.06 + ((0.06(-0.01 - 5.0jw)) / 0.01 + (-
0.09(-0.01 - 5.0jw)) / 0.01 - 10.03) / (-(((-0.03(-0.01
- 5.0jw)) / 0.01 - 0.01) / 0.02)))) / 0.02 - 0.06) /
0.01
 U3 = (0.06 + ((0.06(-0.01 - 5.0jw)) / 0.01 + (-0.09(-
0.01 - 5.0jw)) / 0.01 - 10.03) / (-(((-0.03(-0.01 -
5.0jw)) / 0.01 - 0.01) / 0.02))) / 0.02
 IV1 = ((0.06(-0.01 - 5.0jw)) / 0.01 + (-0.09(-0.01 -
5.0jw)) / 0.01 - 10.03) / (-(((-0.03(-0.01 - 5.0jw)) /
0.01 - 0.01) / 0.02))
```

Example 6:

Electric cirucit with serial-conected resistors and inductor.



Repeat steps 1.1-1.6 from example 1. with changes in step 1.3. Circuit should be made with this equations:

```
dodajGranu(graf, Grana(Vg, "V1", [2], [1], [3.]))
```

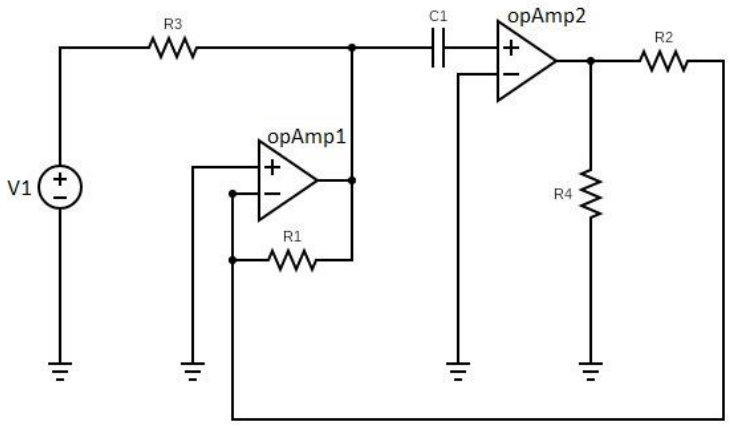
```
dodajGranu(graf, Grana(R, "R1", [2], [3], [50.]))
dodajGranu(graf, Grana(R, "R2", [3], [4], [100.]))
dodajGranu(graf, Grana(L, "L1", [4], [1], [5.], [2.]))
```

Solution of the circuit:

```
 U2 = 3.0
 U4 = ((0.03(0.06 + (2.0 / jw + (0.06(-0.2 / jw - 0.01)) / 0.01 + (-0.09(-0.2 / jw - 0.01)) / 0.01 - 0.03) / (-(((-0.03(-0.2 / jw - 0.01)) / 0.01 - 0.01) / 0.02)))) / 0.02 - 0.06) / 0.01
 U3 = (0.06 + (2.0 / jw + (0.06(-0.2 / jw - 0.01)) / 0.01 + (-0.09(-0.2 / jw - 0.01)) / 0.01 - 0.03) / (-(((-0.03(-0.2 / jw - 0.01)) / 0.01 - 0.01) / 0.02))) / 0.02
 IV1 = (2.0 / jw + (0.06(-0.2 / jw - 0.01)) / 0.01 + (-0.09(-0.2 / jw - 0.01)) / 0.01 - 0.03) / (-(((-0.03(-0.2 / jw - 0.01)) / 0.01 - 0.01) / 0.02))
```

Example 7:

Electric cirucit with resistors, capacitor and two operational amplifiers.



Repeat steps 1.1-1.6 from example 1. with changes in step 1.3. Circuit should be made with this equations:

```
dodajGranu(graf, Grana(Vg, "V1", [2], [1], ["V1"]))
dodajGranu(graf, Grana(R, "R1", [4], [5], ["R1"]))
```

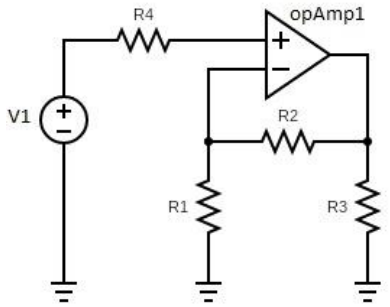
```
dodajGranu(graf, Grana(R, "R2", [5], [6], ["R2"]))
dodajGranu(graf, Grana(R, "R3", [2], [3], ["R3"]))
dodajGranu(graf, Grana(C, "C1", [3], [4], ["C1"], ["Uo"]))
dodajGranu(graf, Grana(opAmp, "opAmp1", [3, 1], [6]))
dodajGranu(graf, Grana(opAmp, "opAmp2", [1, 5], [4]))
dodajGranu(graf, Grana(R, "R4", [6], [1], ["R4"]))
```

Solution of the circuit:

```
U2 = V1
U4 = (-C1*Uo - V1*(1 / R3)) / (C1*jw)
U5 = 0.0
IopAmp2 = ((-1 / R1 - C1*jw)*(-C1*Uo - V1*(1 / R3))) /
(C1*jw) - C1*Uo
U3 = -0.0
IV1 = -V1*(1 / R3)
U6 = -R2*(((1 / R1)*(-C1*Uo - V1*(1 / R3))) / (C1*jw))
IopAmp1 = -R2*(-1 / R2 + -1 / R4)*(((1 / R1)*(-C1*Uo -
V1*(1 / R3))) / (C1*jw))
```

Example 8:

Electric cirucit with resistors and operational amplifier.



Repeat steps 1.1-1.6 from example 1. with changes in step 1.3. Circuit should be made with this equations:

```
dodajGranu(graf, Grana(Vg, "V1", [2], [1], [5]))
dodajGranu(graf, Grana(R, "R1", [4], [1], [10000]))
```

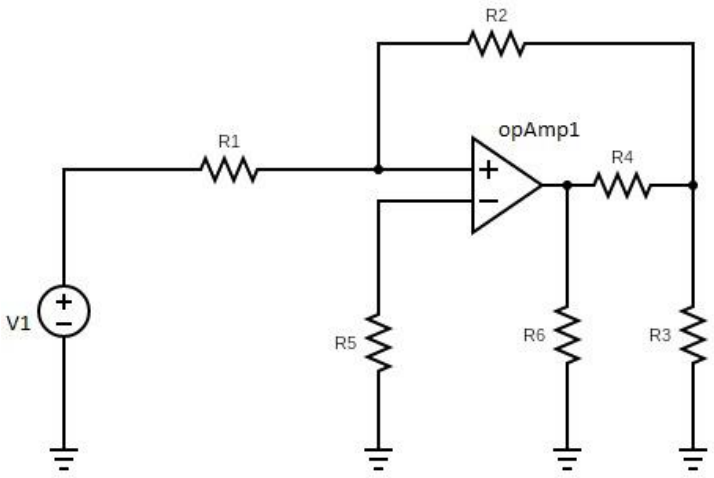
```
dodajGranu(graf, Grana(R, "R2", [4], [5], [10000]))
dodajGranu(graf, Grana(R, "R3", [5], [1], [10000]))
dodajGranu(graf, Grana(R, "R4", [2], [3], [10000]))
dodajGranu(graf, Grana(opAmp, "opAmp1", [3, 4], [5]))
```

Solution of the circuit:

```
U2 = 5.0
U4 = 5.0
U5 = 10.0
U3 = 5//1
IV1 = -0.0
IopAmp1 = -0.0014999999999999998
```

Example 9: T-scheme

Electric cirucit with resistors and operational amplifier.



Repeat steps 1.1-1.6 from example 1. with changes in step 1.3. Circuit should be made with this equations:

```
dodajGranu(graf, Grana(Vg, "V1", [2], [1], [5]))
dodajGranu(graf, Grana(R, "R1", [2], [3], [10000]))
dodajGranu(graf, Grana(R, "R2", [3], [6], [10000]))
dodajGranu(graf, Grana(R, "R3", [6], [1], [10000]))
```

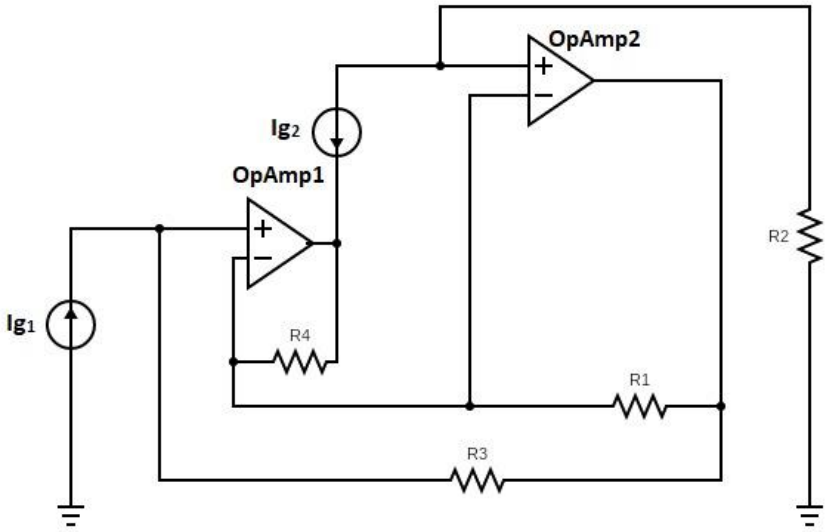
```
dodajGranu(graf, Grana(R, "R4", [6], [5], [10000])
dodajGranu(graf, Grana(R, "R5", [4], [1], [10000]))
dodajGranu(graf, Grana(R, "R6", [5], [1], [10000]))
dodajGranu(graf, Grana(opAmp, "opAmp1", [3, 4], [5]))
```

Solution of the circuit:

```
U2 = 5.0
U4 = 0.0
U5 = -15.000000000000002
U3 = 0
IV1 = -0.0005
U6 = -5.000000000000001
IopAmp1 = 0.0025000000000000005
```

Example 10:

Electric cirucit with resistors and two operational amplifiers.



Repeat steps 1.1-1.6 from example 1. with changes in step 1.3. Circuit should be made with this equations:

```
dodajGranu(graf, Grana(Ig, "Ig1", [1], [2], [5.]))
dodajGranu(graf, Grana(Ig, "Ig2", [4], [3], [5.]))
dodajGranu(graf, Grana(R, "R1", [5], [6], [10000.]))
```

```
dodajGranu(graf, Grana(R, "R2", [4], [1], [10000.]))
dodajGranu(graf, Grana(R, "R3", [2], [5], [10000.]))
dodajGranu(graf, Grana(R, "R4", [6], [3], [10000.]))
dodajGranu(graf, Grana(opAmp, "opAmp1", [2, 6], [3]))
dodajGranu(graf, Grana(opAmp, "opAmp2", [4, 6], [5]))
```

Solution of the circuit:

```
U2 = -50000.0
U4 = -50000.0
U5 = -100000.0
IopAmp2 = 10.0
U3 = -0.0
U6 = -50000.0
IopAmp1 = 0.0
```