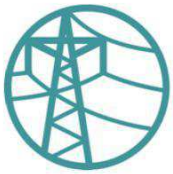


WYDZIAŁ
ELEKTROTECHNIKI
I INFORMATYKI
POLITECHNIKI RZESZOWSKIEJ

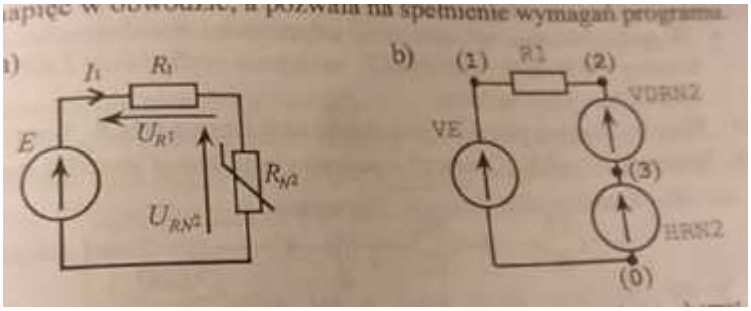
Katedra Elektrotechniki i Podstaw Informatyki

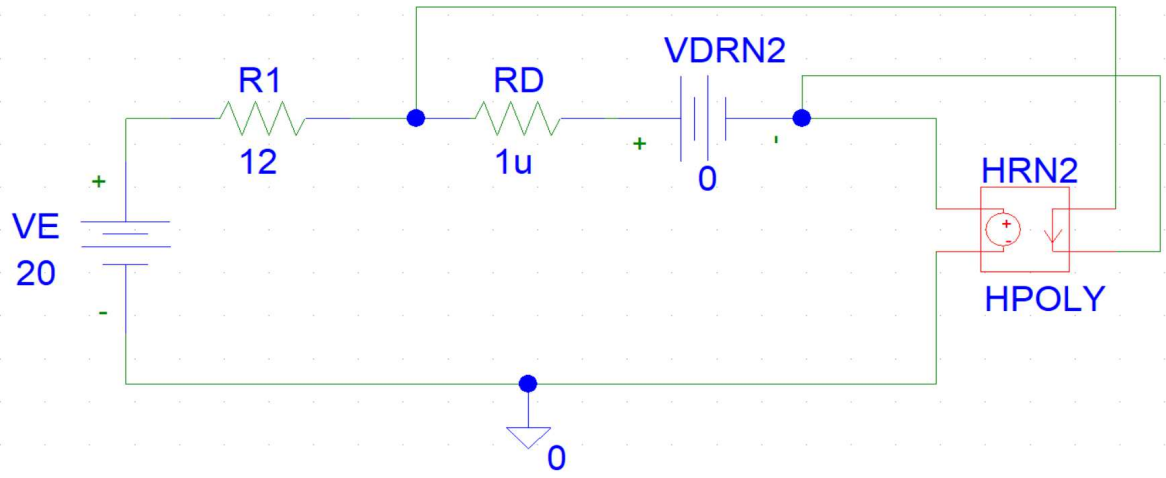
LABORATORIUM OBWODÓW I SYGNAŁÓW

SPRAWOZDANIE

Ćw. nr	Temat		
5	Obwody nieliniowe prądu stałego		
Opracowali		**Rok / gr. lab.**	**Data wyk. ćw**
		1ET-DI /	26.01.2019r.

a) Analiza obwodu zawierającego rezystor nieliniowy opisany wielomianem.





Analiza komputerowa:

**** 01/26/19 18:51:50 ********** Evaluation PSpice (Nov 1999) **********

* C:\Users\Norbert\Desktop\5 ois\lab_6_1.sch

**** CIRCUIT DESCRIPTION

****
****

* Schematics Version 9.1 - Web Update 1
* Sat Jan 26 18:51:46 2019

** Analysis setup **
.OPTIONS NOPAGE
.OP

* From [PSPICE NETLIST] section of pspiceev.ini:
.lib "nom.lib"

.INC "lab_6_1.net"

**** INCLUDING lab_6_1.net ****
* Schematics Netlist *

R_RD $N_0002 $N_0001 1u
V_VE $N_0003 0 20
R_R1 $N_0003 $N_0002 12
V_VDRN2 $N_0001 $N_0004 0
H_HRN2 $N_0004 0 POLY(1) VH_HRN2 4 0 6
VH_HRN2 $N_0002 $N_0004 DC 0V

**** RESUMING lab_6_1.cir ****
.INC "lab_6_1.als"

**** INCLUDING lab_6_1.als ****
* Schematics Aliases *

.ALIASES

```
R_RD           RD(1=$N_0002 2=$N_0001 )
V_VE           VE(+=$N_0003 -=0 )
R_R1           R1(1=$N_0003 2=$N_0002 )
V_VDRN2          VDRN2(+=$N_0001 -=$N_0004 )
H_HRN2         HRN2(3=$N_0004 4=0 )
VH_HRN2         HRN2(1=$N_0002 2=$N_0004 )
.ENDALIASES


**** RESUMING lab_6_1.cir ****
.probe


.END


 ****     SMALL SIGNAL BIAS SOLUTION       TEMPERATURE =
27.000 DEG C


 NODE   VOLTAGE     NODE   VOLTAGE     NODE   VOLTAGE
NODE   VOLTAGE


($N_0001)    9.0217                ($N_0002)    9.0217

($N_0003)   20.0000                ($N_0004)    9.0217


    VOLTAGE SOURCE CURRENTS
    NAME         CURRENT

    V_VE        -9.149E-01
    V_VDRN2      0.000E+00
    VH_HRN2      9.149E-01
```

TOTAL POWER DISSIPATION 1.83E+01 WATTS

**** OPERATING POINT INFORMATION TEMPERATURE = 27.000 DEG C

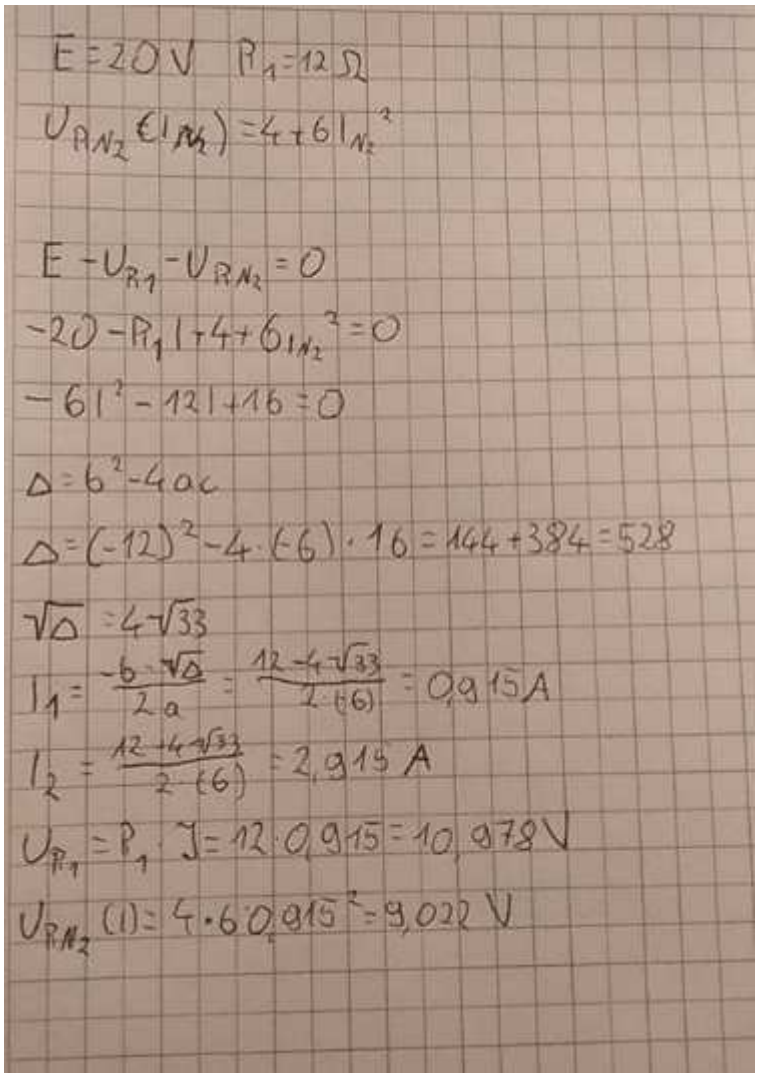
**** CURRENT-CONTROLLED VOLTAGE SOURCES

NAME H_HRN2
V-SOURCE 9.026E+00
I-SOURCE 9.149E-01

JOB CONCLUDED

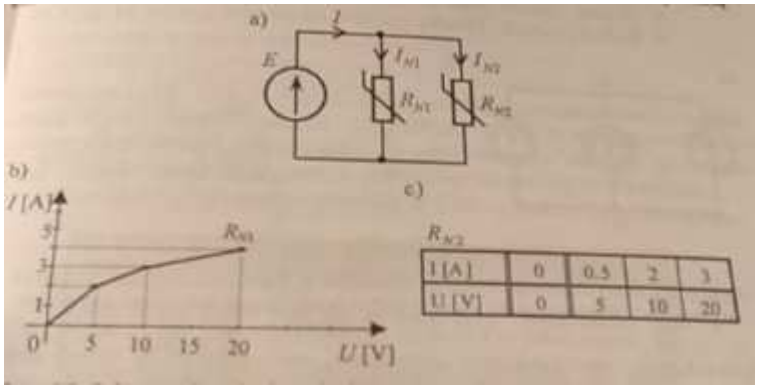
TOTAL JOB TIME .02

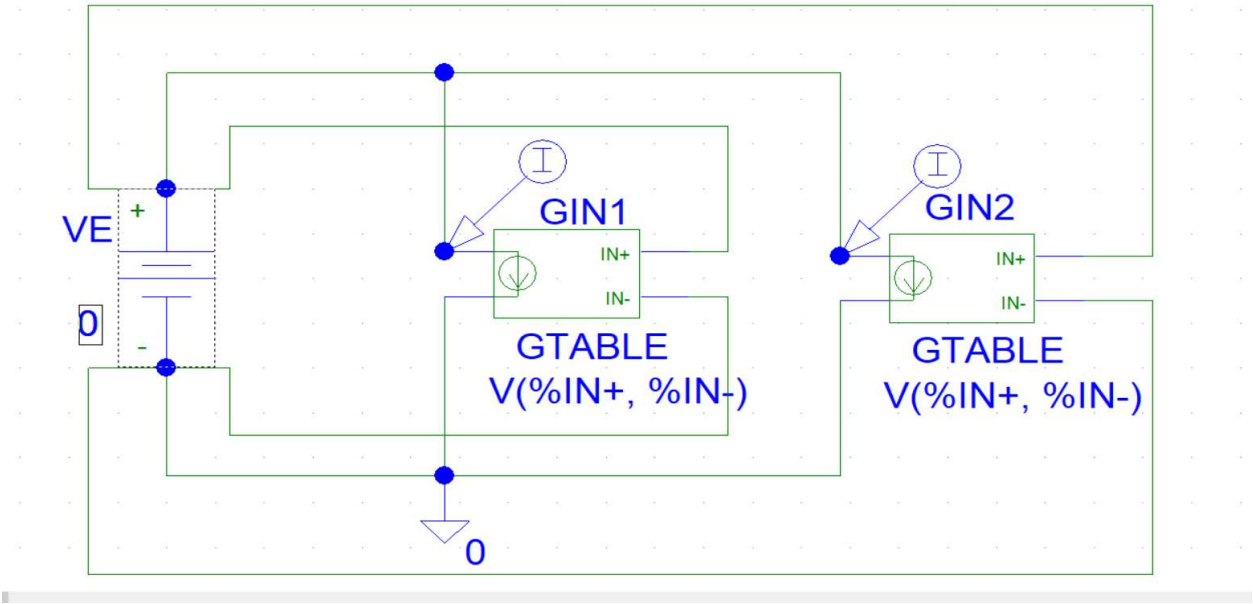
Obliczenia ręczne:



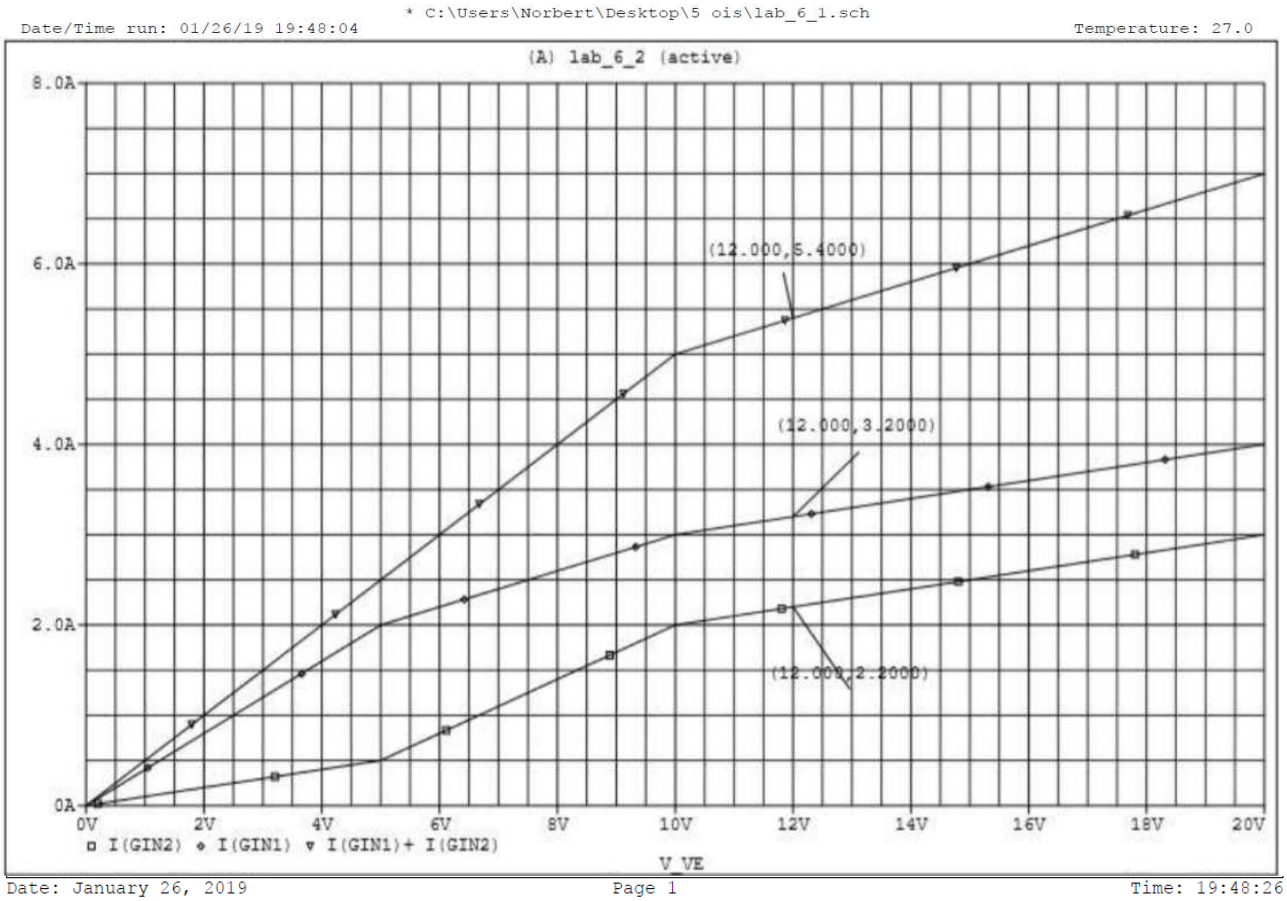
Wielkośc	Wynik komputerowy	Wynik ręczny
U_{R1}	10,978V	10,978V
U_{RN1}	9,021V	9,022V

b)Analiza obwodu zawierającego rezystory nieliniowe opisane charakterystykami prądowo-napięciowymi.





Analiza komputerowa:



**** 01/26/19 19:51:41 ********** Evaluation PSpice (Nov 1999) **********

* C:\Users\Norbert\Desktop\5 ois\lab_6_2.sch

**** CIRCUIT DESCRIPTION

****
****

```
* Schematics Version 9.1 - Web Update 1
* Sat Jan 26 19:45:24 2019



** Analysis setup **
.OPTIONS NOPAGE
.OP
.DC LIN V_VE 0 20 1
.PROBE


* From [PSPICE NETLIST] section of pspiceev.ini:
.lib "nom.lib"

.INC "lab_6_2.net"

**** INCLUDING lab_6_2.net ****
* Schematics Netlist *



G_GIN1         $N_0001 0 TABLE { V($N_0001, 0) }
+ ( (0,0) (5,2) (10,3) (20,4) )
G_GIN2         $N_0001 0 TABLE { V($N_0001, 0) }
+ ( (0,0) (5,0.5) (10,2) (20,3) )
V_VE         $N_0001 0 2

**** RESUMING lab_6_2.cir ****
.INC "lab_6_2.als"



**** INCLUDING lab_6_2.als ****
* Schematics Aliases *

.ALIASES
G_GIN1         GIN1(OUT+=$N_0001 OUT-=0 IN+=$N_0001 IN-=0 )
```

```
G_GIN2          GIN2(OUT+=$N_0001 OUT-=0 IN+=$N_0001 IN-=0 )
V_VE            VE(+=$N_0001 -=0 )
.ENDALIASES


**** RESUMING lab_6_2.cir ****
.probe


.END
```

**** SMALL SIGNAL BIAS SOLUTION TEMPERATURE = 27.000 DEG C

NODE VOLTAGE NODE VOLTAGE NODE VOLTAGE NODE VOLTAGE

($N_0001) 2.0000

VOLTAGE SOURCE CURRENTS
NAME CURRENT

V_VE -1.000E+00

TOTAL POWER DISSIPATION 2.00E+00 WATTS

**** OPERATING POINT INFORMATION TEMPERATURE = 27.000 DEG C

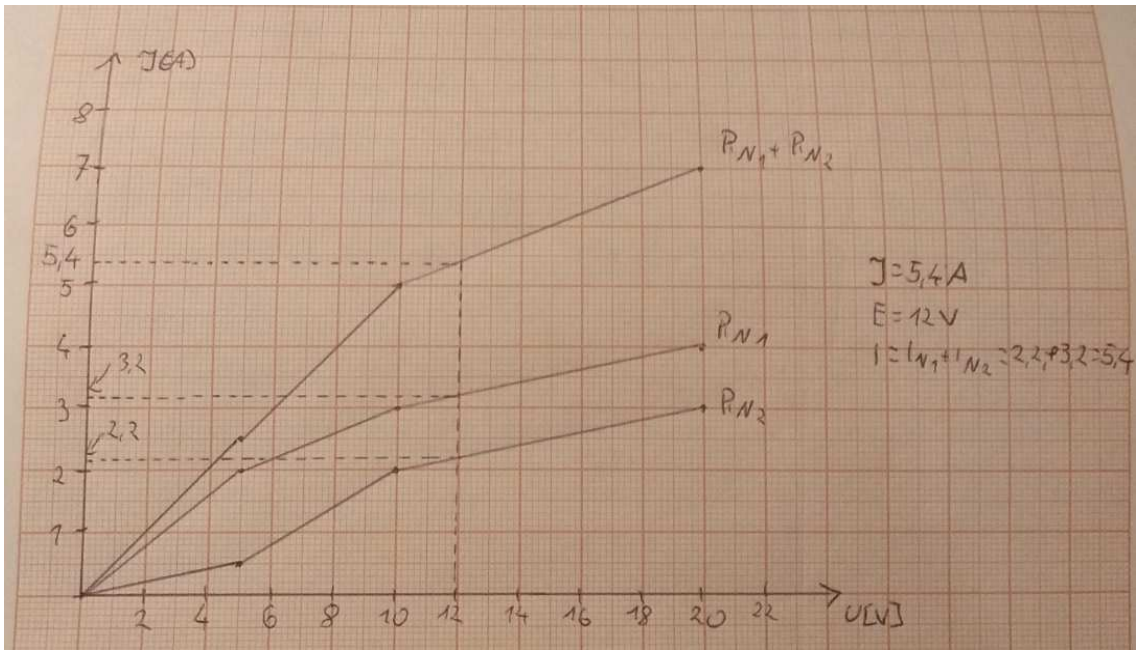
**** VOLTAGE-CONTROLLED CURRENT SOURCES

NAME G_GIN1 G_GIN2
I-SOURCE 8.000E-01 2.000E-01

JOB CONCLUDED

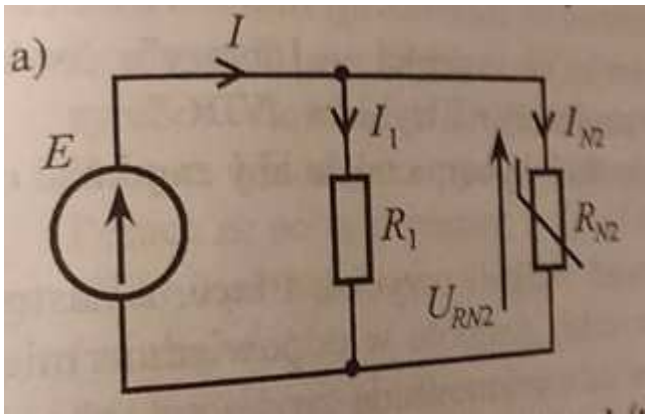
TOTAL JOB TIME 0.00

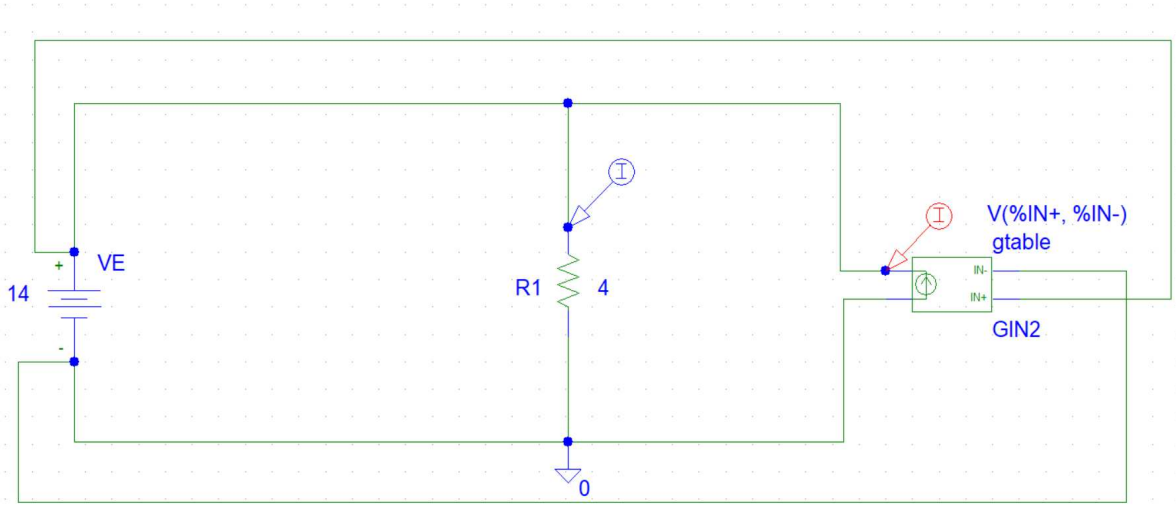
Obliczenia ręczne:



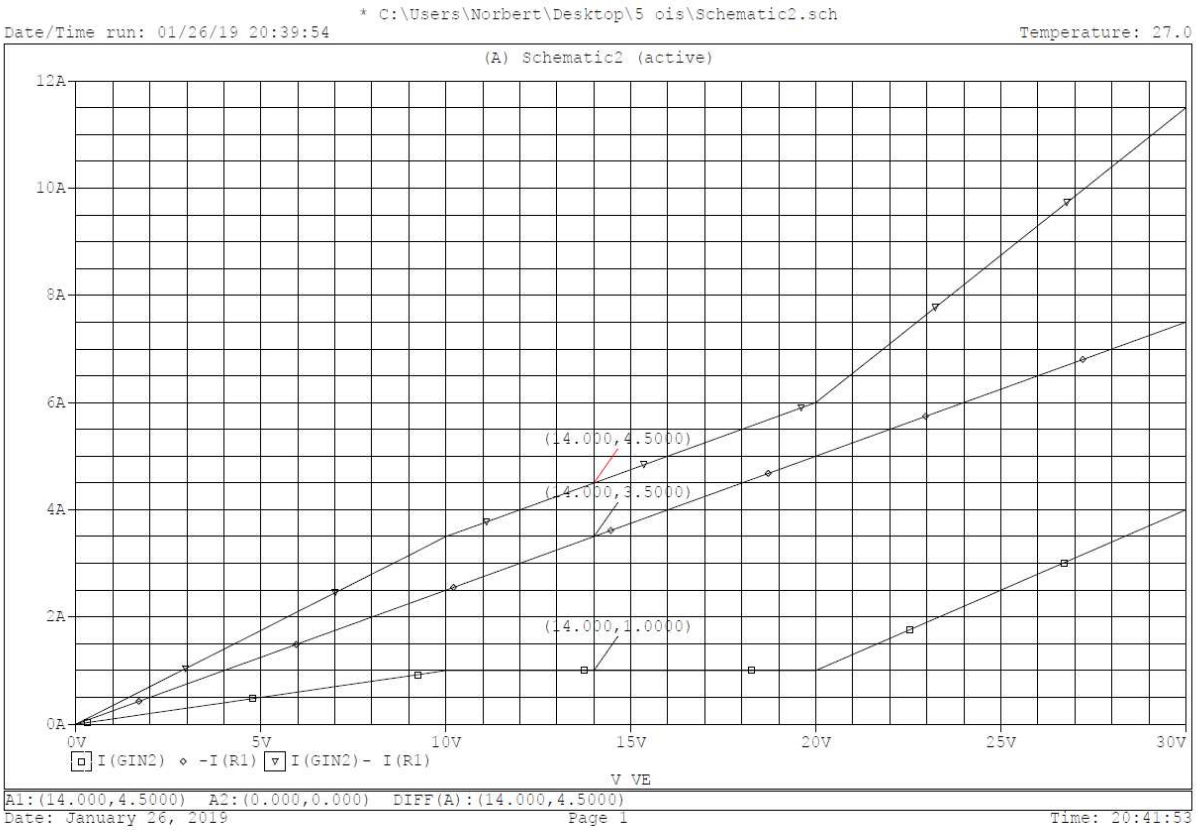
Wartość	Obliczenia komputerowe	Obliczenia ręczne
E[V]	12	12
I1	3,2	3,2
I2	2,2	2,2

c)Analiza równoległego obwodu zawierającego rezystor nieliniowy opisany charakterystyką prądowo-napieciową.





Obliczenia komputerowe:



**** 01/26/19 20:39:54 ********** Evaluation PSpice (Nov 1999) **********

* C:\Users\Norbert\Desktop\5 ois\Schematic2.sch

**** CIRCUIT DESCRIPTION

****
****

```
* Schematics Version 9.1 - Web Update 1
* Sat Jan 26 20:23:41 2019



** Analysis setup **
.OP
.DC LIN V_VE 0 30 1
.PROBE


* From [PSPICE NETLIST] section of pspiceev.ini:
.lib "nom.lib"

.INC "Schematic2.net"

**** INCLUDING Schematic2.net ****
* Schematics Netlist *



R_R1         0 $N_0001  4
V_VE         $N_0001 0 14
G_GIN2         0 $N_0001 TABLE { V($N_0001, 0) }
+ ( (0,0) (10,1) (20,1) (30,4) )

**** RESUMING Schematic2.cir ****
.INC "Schematic2.als"

**** INCLUDING Schematic2.als ****
* Schematics Aliases *

.ALIASES
R_R1            R1(1=0 2=$N_0001 )
V_VE            VE(+=$N_0001 -=0 )
```

G_GIN2 GIN2(OUT+=0 OUT-=$N_0001 IN+=$N_0001 IN-=0)
.ENDALIASES

**** RESUMING Schematic2.cir ****
.probe

.END

**** 01/26/19 20:39:54 ********** Evaluation PSpice (Nov 1999) **********

* C:\Users\Norbert\Desktop\5 ois\Schematic2.sch

**** SMALL SIGNAL BIAS SOLUTION TEMPERATURE = 27.000 DEG C

****

NODE VOLTAGE NODE VOLTAGE NODE VOLTAGE NODE VOLTAGE

($N_0001) 14.0000

VOLTAGE SOURCE CURRENTS
NAME CURRENT

V_VE -2.500E+00

TOTAL POWER DISSIPATION 3.50E+01 WATTS

**** 01/26/19 20:39:54 ********** Evaluation PSpice (Nov 1999) **********

* C:\Users\Norbert\Desktop\5 ois\Schematic2.sch

**** OPERATING POINT INFORMATION TEMPERATURE = 27.000 DEG C

****

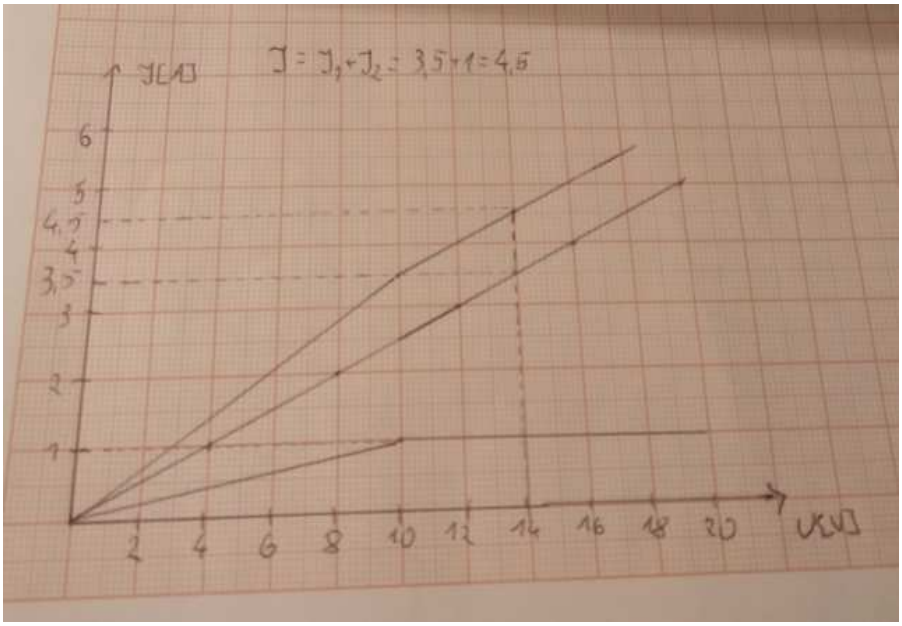
**** VOLTAGE-CONTROLLED CURRENT SOURCES

NAME G_GIN2
I-SOURCE 1.000E+00

JOB CONCLUDED

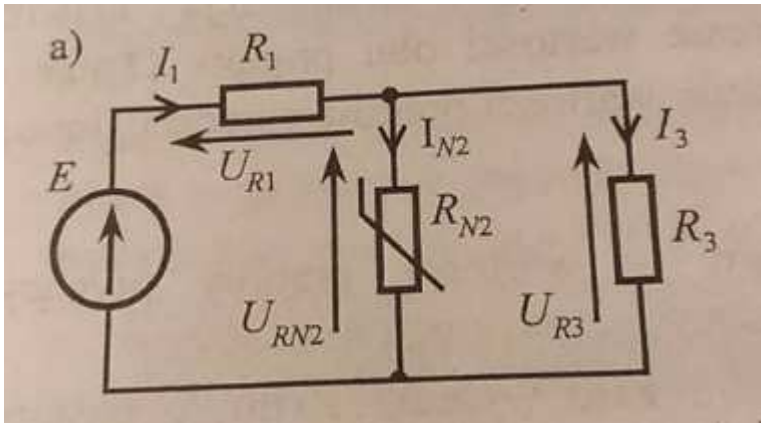
TOTAL JOB TIME 0.00

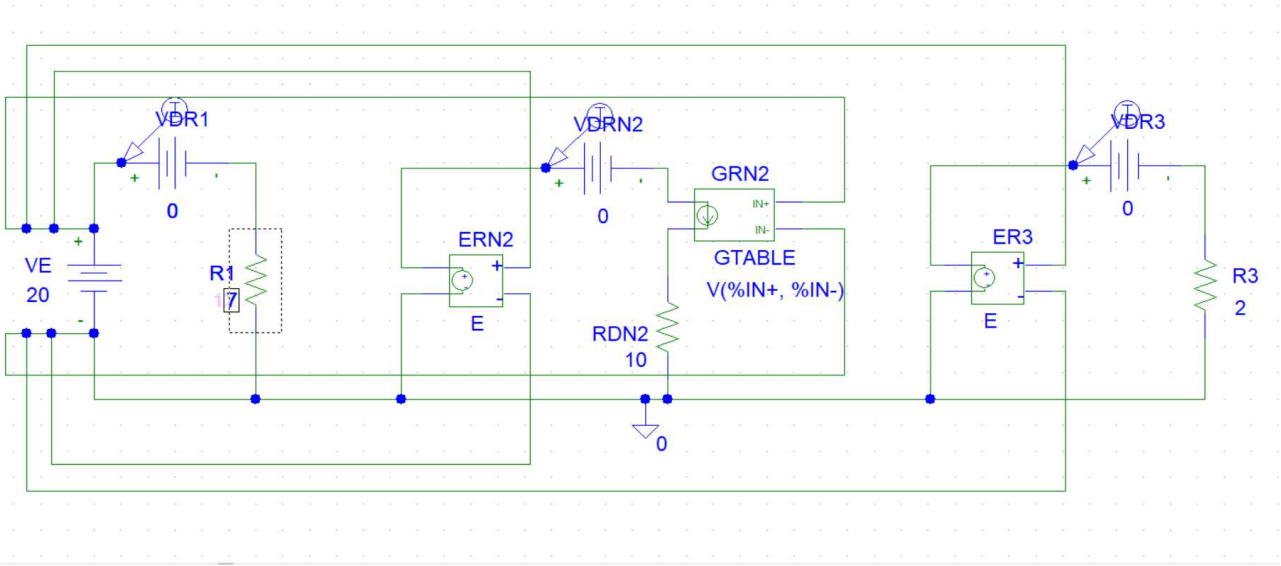
Obliczenia ręczne:



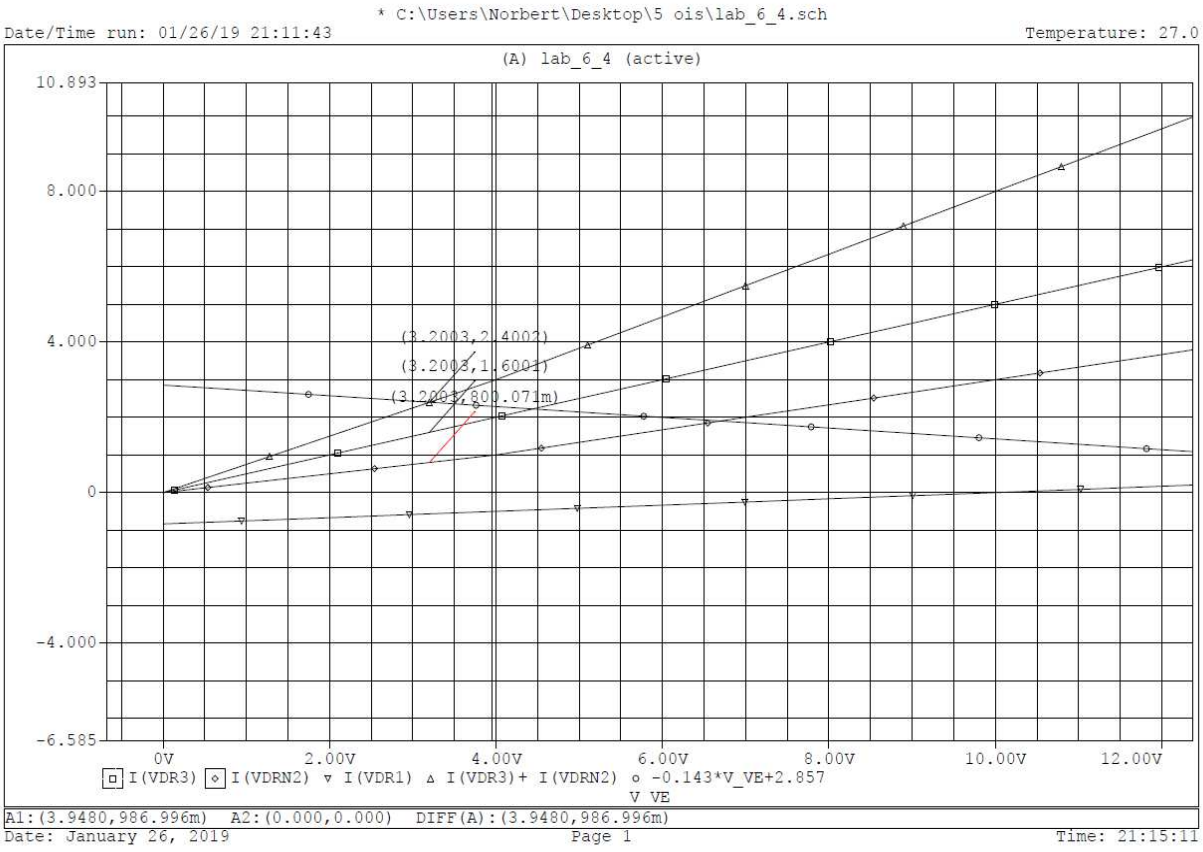
Wielkośc	Wynik komputerowy	Wynik ręczny
I[A]	4,5	4,5
I1[A]	3,5	3,5
I2[A]	1	1

d)Analiza szeregowo-równoległego obwodu zawierającego rezystor nieliniowy opisany charakterystyką prądowo-napięciową.





Obliczenia komputerowe:



**** 01/26/19 21:11:43 ********** Evaluation PSpice (Nov 1999) **********

* C:\Users\Norbert\Desktop\5 ois\lab_6_4.sch

**** CIRCUIT DESCRIPTION

****
****

* Schematics Version 9.1 - Web Update 1
* Sat Jan 26 21:02:16 2019

** Analysis setup **
.OPTIONS NOBIAS
.OPTIONS NOPAGE
.OP
.DC LIN V_VE 0 100 1
.PROBE

* From [PSPICE NETLIST] section of pspiceev.ini:
.lib "nom.lib"

.INC "lab_6_4.net"

**** INCLUDING lab_6_4.net ****
* Schematics Netlist *

E_ERN2 $N_0002 0 $N_0001 0 1
G_GRN2 $N_0003 $N_0004 TABLE { V($N_0001, 0) }
+ ((0,0) (4,1) (13,4) (30,5))
E_ER3 $N_0005 0 $N_0001 0 1
V_VDR1 $N_0001 $N_0006 10
V_VDRN2 $N_0002 $N_0003 0
R_RDN2 0 $N_0004 10
V_VE $N_0001 0 20

```
R_R1          0 $N_0006  12
R_R3          0 $N_0007  2
V_VDR3          $N_0005 $N_0007 0

**** RESUMING lab_6_4.cir ****
.INC "lab_6_4.als"



**** INCLUDING lab_6_4.als ****
* Schematics Aliases *

.ALIASES
E_ERN2          ERN2(3=$N_0002 4=0 1=$N_0001 2=0 )
G_GRN2          GRN2(OUT+=$N_0003 OUT-=$N_0004 IN+=$N_0001
IN-=0 )
E_ER3           ER3(3=$N_0005 4=0 1=$N_0001 2=0 )
V_VDR1          VDR1(+=$N_0001 -=$N_0006 )
V_VDRN2           VDRN2(+=$N_0002 -=$N_0003 )
R_RDN2          RDN2(1=0 2=$N_0004 )
V_VE            VE(+=$N_0001 -=0 )
R_R1           R1(1=0 2=$N_0006 )
R_R3           R3(1=0 2=$N_0007 )
V_VDR3          VDR3(+=$N_0005 -=$N_0007 )
.ENDALIASES


**** RESUMING lab_6_4.cir ****
.probe


.END


 ****     OPERATING POINT INFORMATION      TEMPERATURE =
27.000 DEG C
```

**** VOLTAGE-CONTROLLED CURRENT SOURCES

NAME G_GRN2
I-SOURCE 4.412E+00

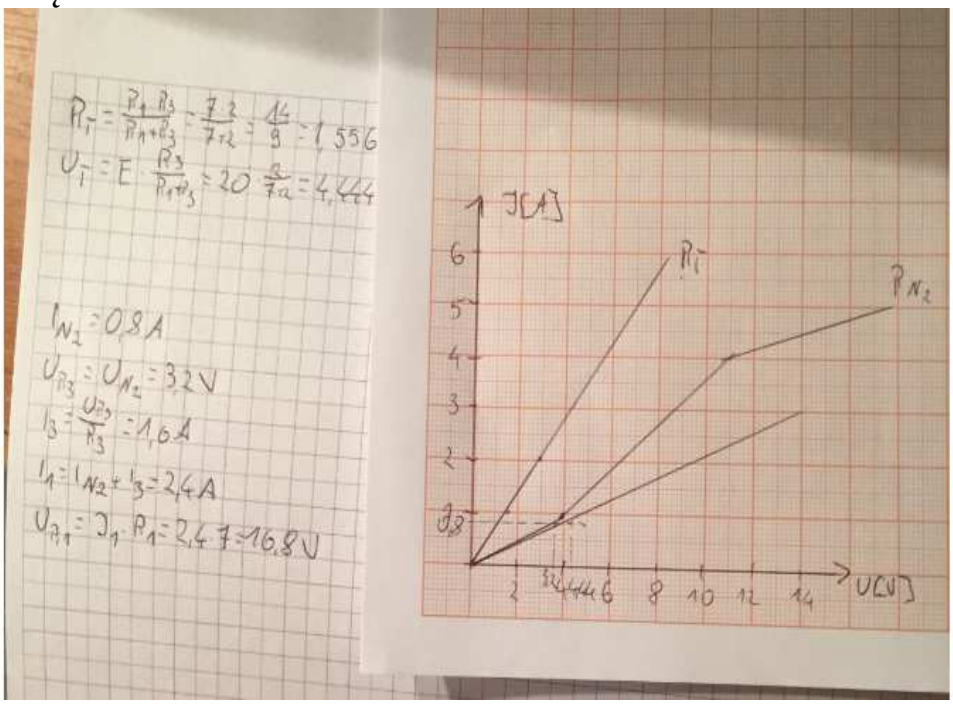
**** VOLTAGE-CONTROLLED VOLTAGE SOURCES

NAME E_ERN2 E_ER3
V-SOURCE 2.000E+01 2.000E+01
I-SOURCE -4.412E+00 -1.000E+01

JOB CONCLUDED

TOTAL JOB TIME 0.00

Obliczenia ręczne:



Wartość	Wyniki komputerowe	Wyniki ręczne
UR1[V]	16,797	16,8
UR3[V]	3,203	3,2
I1[A]	2,402	2,4
IN2[A]	0,801	0,8
I3[A]	1,602	1,6

Wnioski

W tym ćwiczeniu badaliśmy obwody nieliniowe prądu stałego. W większości wyniki pomiarów zgadzały się z wynikami liczonymi ręcznie. Wszystkie nieścisłości są spowodowane przybliżeniami które zastosowaliśmy w obliczeniach ręcznych. Obliczenia komputerowe pozwalają na dużo szybsze obliczenie danych wielkości niż obliczanie ręczne.