PROIECT TEHNICI CAD

VU-METRU

STUDENT: VÎTCĂ DIANA-NICOLETA

GRUPA 2127

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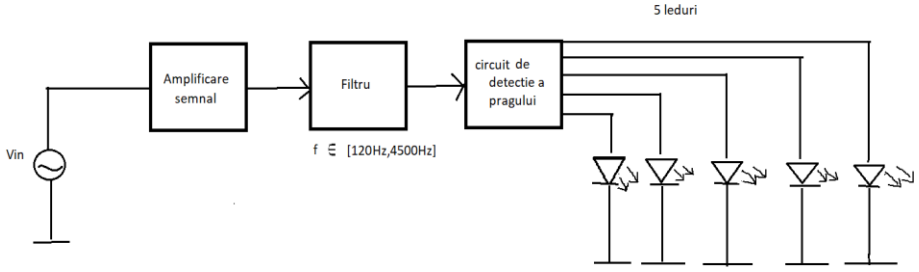
PROIECT VU-METRU

Date de proiectare

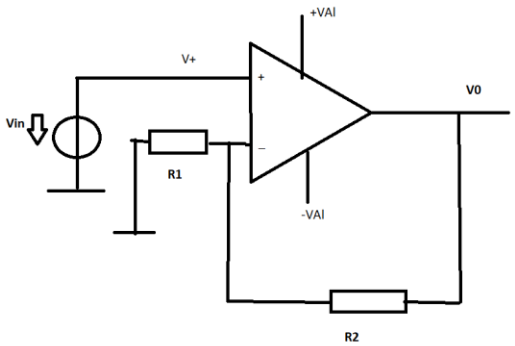
Specificatii proiectare		Amplitudinea semnalului de intrare [uV]	Banda de frecventa [Hz]		VCC	Semnalizari
			fmin	fmax		
29	Vitca Diana-Nicoleta	1800	120	4500	19	5

Schema bloc a circuitului



Amplificarea semnalului

Dimensionarea componentelor



Amplificator neinversor cu reactie negativa

- O să dimensionez rezistentele R1 si R2

AO cu RN => v_D=0

- Un amplificator echipat cu reactie negativa este mai stabil, distorsioneaza mai putin semnalul de intrare si, in general, este capabil de amplificarea unor frecvente mai largi. Dezavantajul este un factor de amplificare mai scazut

$V_D=v^+-v^-$

$v^-=\frac{R1}{R1+R2}$* Vout1

v^+=Vin

=> Vin - $\frac{R1}{R1+R2}$ * Vout1=0

=> Vin = $\frac{R1}{R1+R2}$ * Vout1

$A_v=\frac{Vout1}{Vin}=1+\frac{R2}{R1}$

!!! Amplificarea este data de cele 2 rezistente

Am ales Vout1= 50mV

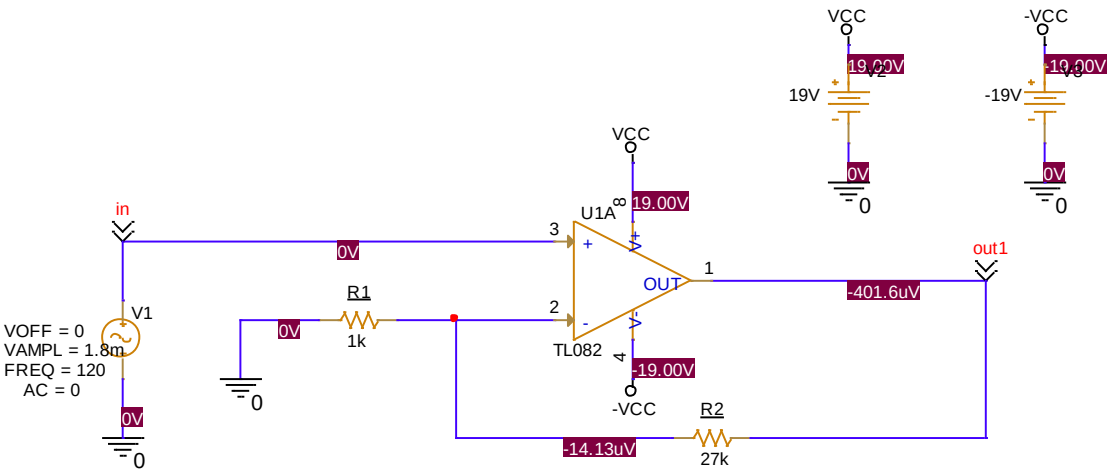
$A_v=\frac{Vout1}{Vin}=\frac{90m}{1.8m}$=27.77 ~28

$A_v=1+\frac{R2}{R1}$

=>$50=1+\frac{R2}{R1}$ => $\frac{R2}{R1}$=49 => R2=49*R1

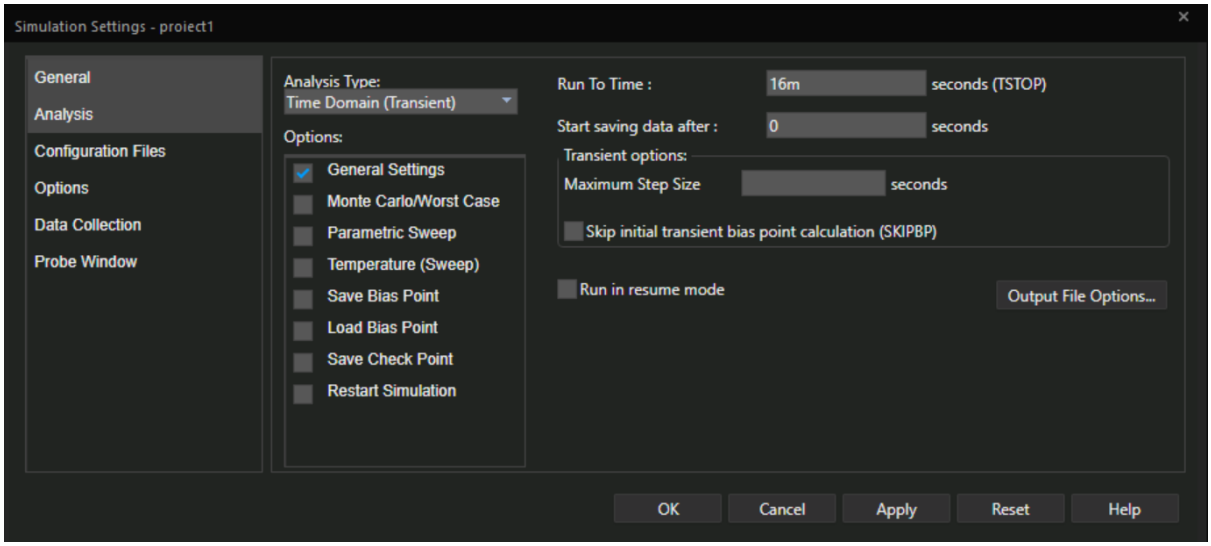
Am ales R1=1kΩ => R2=49kΩ(pentru standardizare voi folosi o rezistenta de 51kΩ)

Schema electrica a circuitului

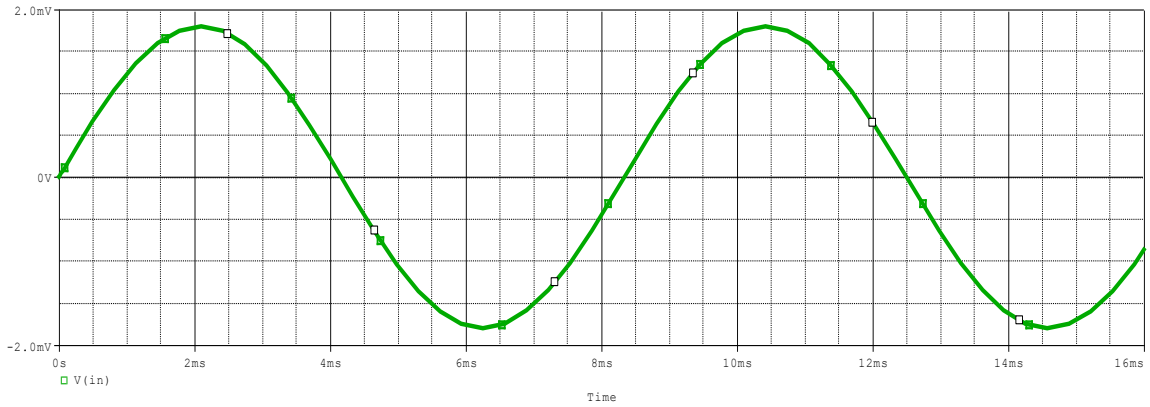


- Am utilizat o sursa de tip Vsin pentru a obtine un semnal sinusoidal
  - ❖ Voff=0 (nu avem componenta continua)
  - ❖ VAmpl=1.8mV(amplitudinea semnalului de intrare => 1800uV=1.8mV)
  - ❖ Freq=120Hz(frecventa minima din banda de frecventa)
- Am utilizat un amplificator TL082

Profilul de simulare pentru vizualizarea formelor de unda a semnalului de intrare si a semnalului de iesire



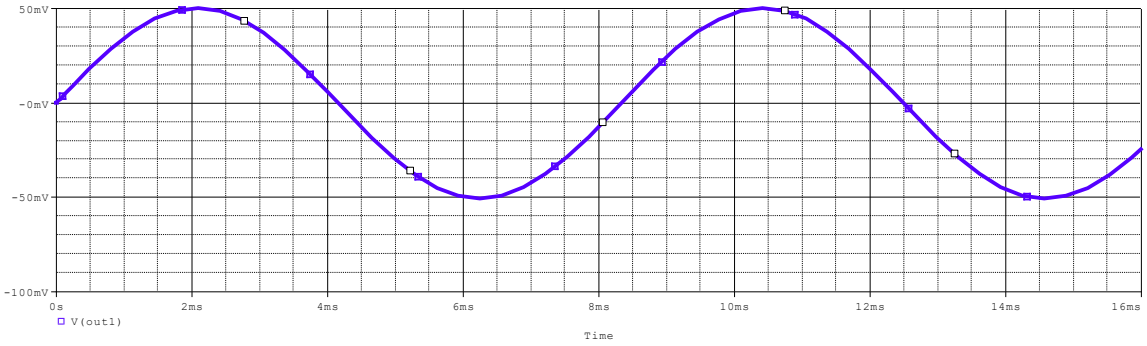
Forma de unda a semnalului de intrare



Trace Color	Trace Name	Y1
	X Values	2.0979m
CURSOR 1,2	V(in)	1.8002m

- La intrare am setat amplitudinea 1.8mV si dupa cum se poate observa am obtinut valoarea in urma masurarii cu ajutorul cursoarelor

Forma de unda a semnalui de iesire dupa prima amplificare



- Am masurat cu ajuturul cursoarelor amplitudinea semnalului de iesire

Trace Color	Trace Name	Y1
	X Values	10.420m
CURSOR 1,2	V(out1)	50.005m

!!! Amplificam a doua oara circuitul

- O să dimensionez rezistentele R3 si R4

AO cu RN => v_D=0

V_D=v^+-v^-
v^-=$\frac{R3}{R3+R4}$* Vout2
v^+=Vout1

=> Vout1 - $\frac{R3}{R3+R4}$ * Vout2=0
=> Vout1 = $\frac{R3}{R3+R4}$ * Vout2

- A_v=$\frac{Vout2}{Vout1}$=1+$\frac{R4}{R3}$

- !!! Amplificarea este data de cele 2 rezistente

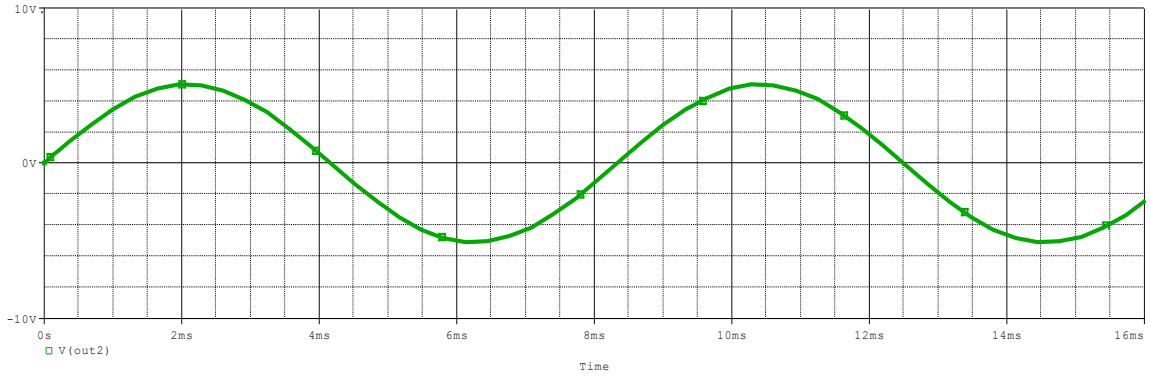
Am ales Vout2= 5V

A_v=$\frac{Vout2}{Vout1}$=$\frac{5}{50*10^{-3}}$=100
A_v=1+$\frac{R4}{R3}$

=>100=1+$\frac{R4}{R3}$ => $\frac{R4}{R3}$= 99 =>R4=99*R3

Am ales R3=1kΩ => R4=99kΩ (am folosit o rezistenta de 100kΩ)

Forma de unda a semnalului de iesire dupa a doua amplificare



- Am masurat cu ajutorul cursoarelor amplitudinea semnalului de iesire si am obtinut valorea aleasa 5V

Trace Color	Trace Name	Y1
	X Values	1.9448m
CURSOR 1,2	V(out2)	5.0051

!!! Amplificam a treia oara circuitul

- O să dimensionez rezistentele R5 si R6

AO cu RN => v_D=0

V_D=v^+-v^-
v^-=$\frac{R5}{R5+R6}$* Vout3
v^+=Vout2

=> Vout2 - $\frac{R5}{R5+R6}$ * Vout3=0
=> Vout2 = $\frac{R5}{R5+R6}$ * Vout3

- A_v=$\frac{Vout3}{Vout2}$=1+$\frac{R6}{R5}$

- !!! Amplificarea este data de cele 2 rezistente

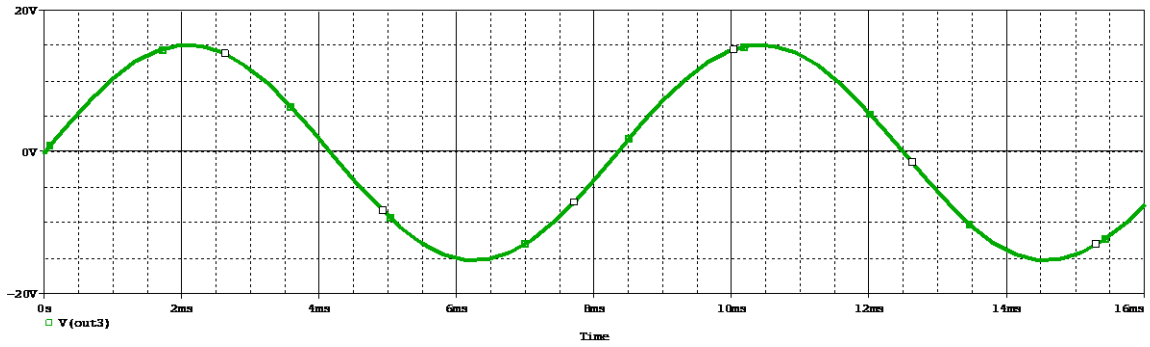
Am ales Vout3= 15V

A_v=$\frac{Vout3}{Vout2}$=$\frac{15}{5}$= 3
A_v=1+$\frac{R6}{R5}$

=>3=1+$\frac{R6}{R5}$ => $\frac{R6}{R5}$= 2 =>R4=2*R3

Am ales R3=1kΩ => R4=2kΩ

Forma de unda a semnalului de iesire dupa a treia amplificare



- Am masurat cu ajutorul cursoarelor amplitudinea semnalului de iesire si am obtinut cat valoarea aleasa de 15V

Trace Color	Trace Name	Y1
	X Values	2.0000m
CURSOR 1,2	V(out3)	15.066

Schema electrica a circuitului -Amplificarea totala

- Am amplificat circuitul de trei ori pentru a avea un echilibru
- Tensiunea de intrare este de 19V ,iar la iesirea circuitului in urma dimensionarii va rezulta o tensiune de 15V

Filtrarea

- Filtrul trece banda

Fmin=120Hz

Fmax=4500Hz

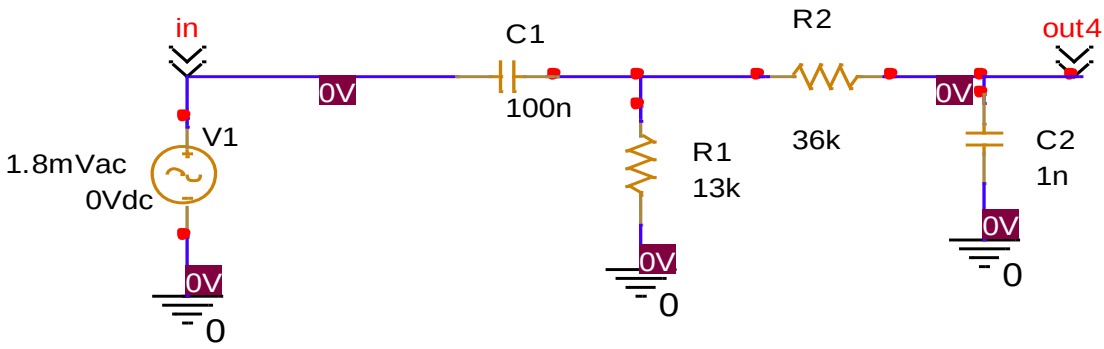
Banda de frecventa= 4500-120=4380HZ

Am ales C1=100nF C2=1nF.

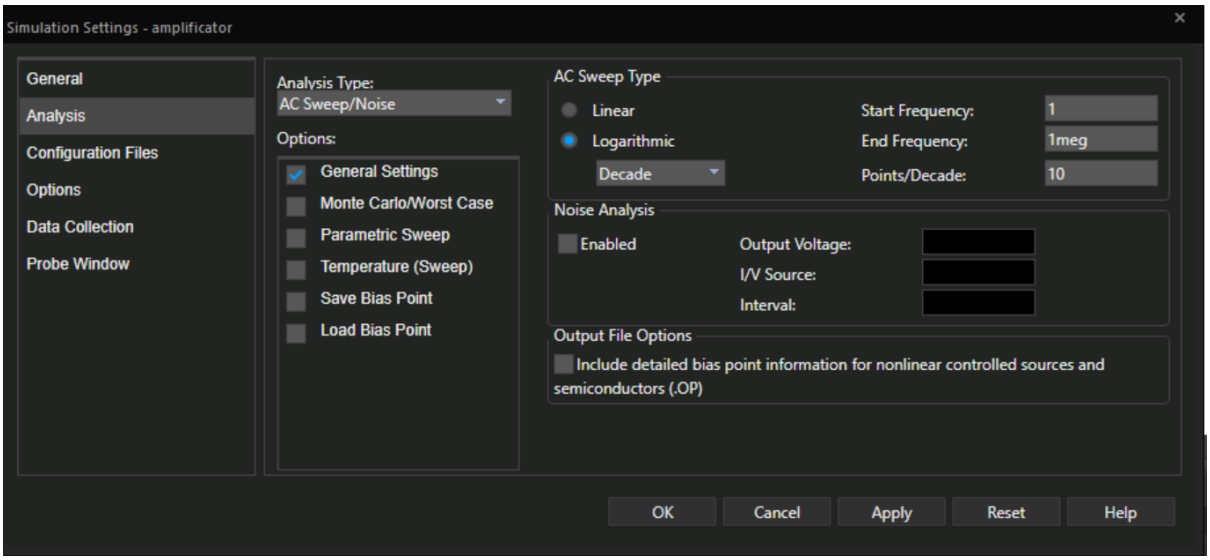
Fmin=$\frac{1}{2*\pi*R1*C1}$=> R1= $\frac{1}{2*\pi*120*100*10^{-9}}$ =13.26k=> 13k

Fmax= $\frac{1}{2*\pi*R2*C2}$ => R2= $\frac{1}{2*\pi*4500*1*10^{-9}}$ =35.36k => 35k

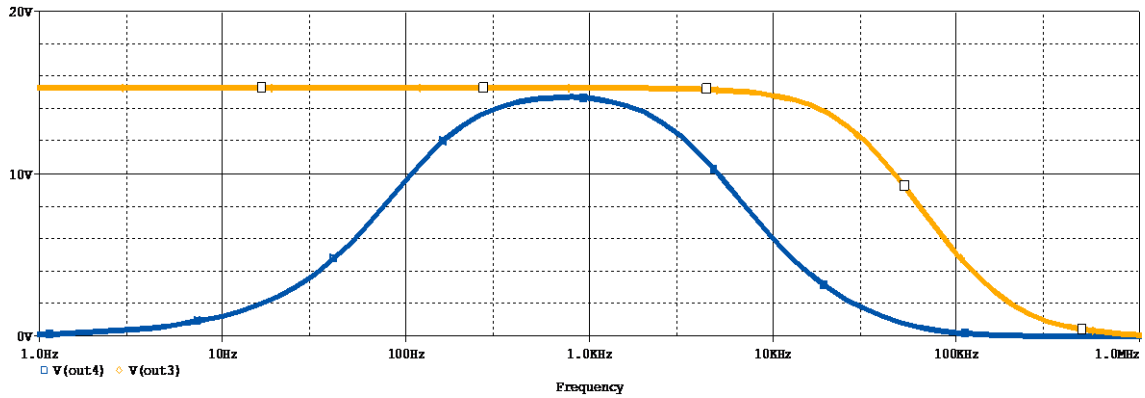
Schema electrica a filtrului trece banda



- Pentru a vizualiza banda de frecventa am folosit o sursa Vac si o analiza de tip AC SWEEP



- in figura de mai jos se poate observa semnalul amplificat nefiltrat-portocaliu si semnalul amplificat filtrat-albastru



Valoarea tensiunilor de iesire inainte si dupa filtrare

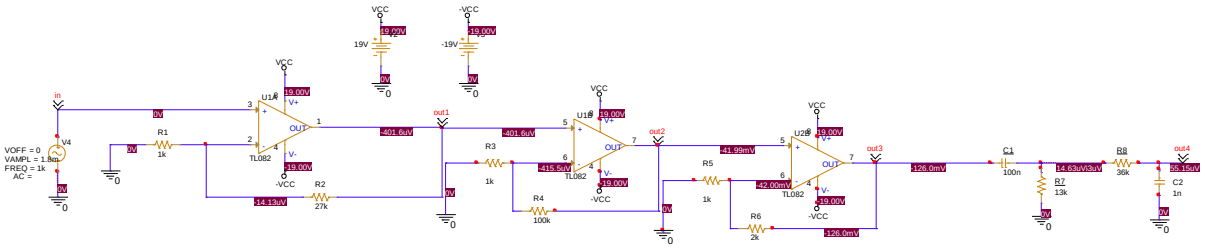
Trace Color	Trace Name	Y1
	X Values	857.696
CURSOR 1,2	V(out4)	14.678
	V(out3)	15.259

- Am masurat cu ajutorul cursoarelor frecventa minima si frecventa maxima

Trace Color	Trace Name	Y1
	X Values	120.796
CURSOR 1,2	DB(V(out4)/V(out3))	-3.1331

Trace Color	Trace Name	Y1
	X Values	4.4275K
CURSOR 1,2	DB(V(out4)/V(out3))	-3.0931

Schema electrica cu amplificarea si filtrarea



Detectia pragurilor

- Am 5 semnalizari asadar voi avea 5 praguri

Aplitudinea semnalului amplificat este 15V

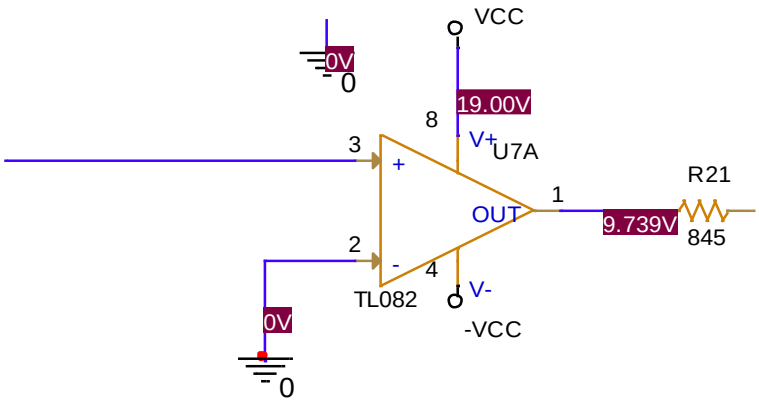
15/5=3V

1)0-3V

V_D=v^+-v^-

v^- = 0

v^+=Vcc=19V



Comparator neiversor pentru primul prag

2) 3-6V

v^+=Vcc=19V

v^- = 3V

v^-= $\frac{R20}{R18+R20}$*Vcc

=> 3= $\frac{R20}{R18+R20}$*19

=>$\frac{R20}{R18+R20}$* 6.3=1

6.3*R20=R18+R20

5.3*R20=R18

$aleg\ R20 = 1K$ => R18=5.3K

3) 6-9V

v^+=Vcc=19V

v^- = 6V

v^-= $\frac{R10}{R9+R10}$*Vcc

=> 6= $\frac{R10}{R9+R10}$*19

=>$\frac{R10}{R9+R10}$* 3.16=1

3.16*R10=R9+R10

3.16*R10=R9

$aleg\ R10 = 1K$ => R9=2.16K

4) 9-12V

v^+=Vcc=19V

v^- = 9V

v^-= $\frac{R13}{R12+R13}$*Vcc

=> 9= $\frac{R13}{R2+R13}$*19

=>$\frac{R13}{R2+R13}$* 2.11=1

2.11*R13=R12+R13

1.11*R13=R12

$aleg\ R13 = 1K$ => R12=1.11K

5) 12-15V

v^+=Vcc=19V

v^- = 12V

v^-= $\frac{R16}{R15+R16}$*Vcc

=> 12= $\frac{R16}{R15+R16}$*19

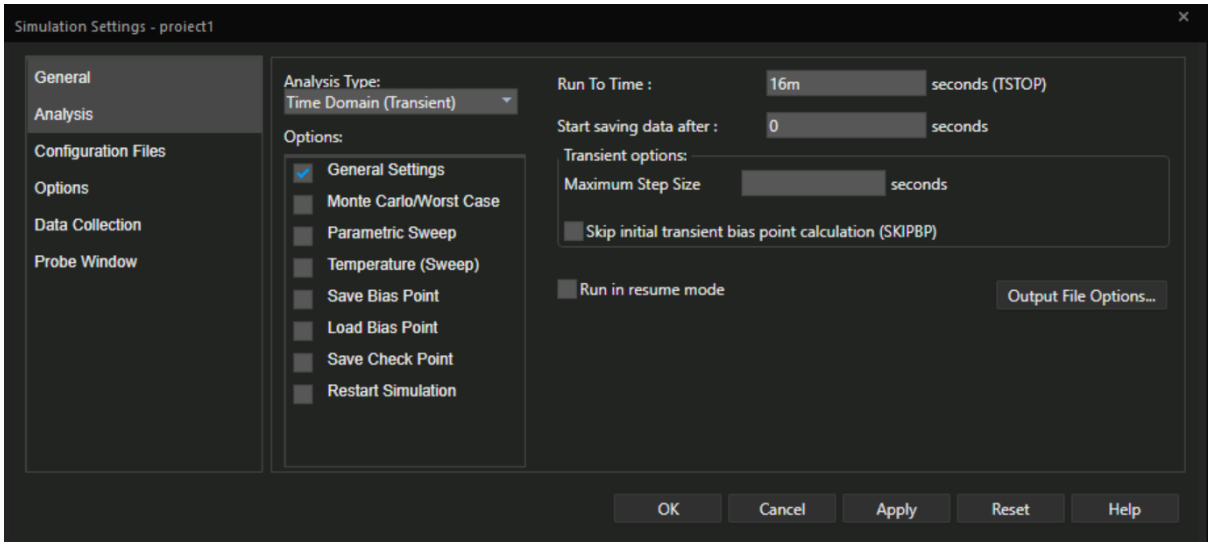
=>$\frac{R16}{R15+R16}$* 1.58=1

1.58*R16=R15+R16

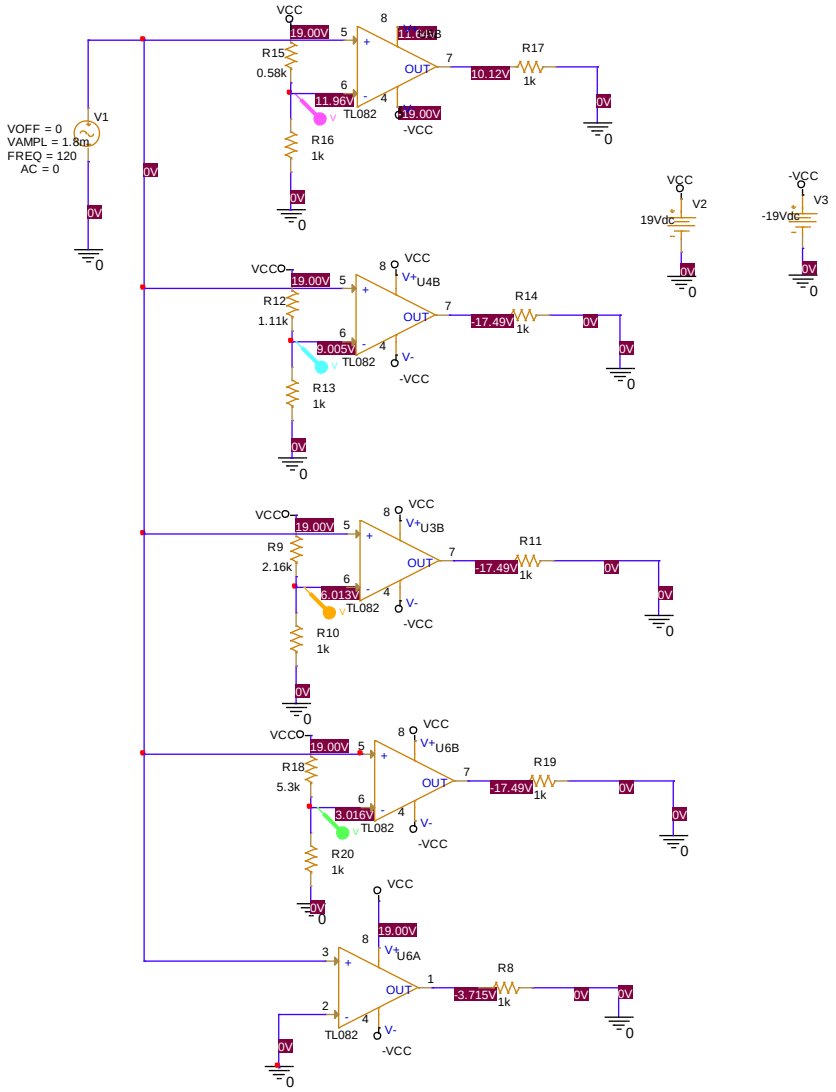
0.58*R16=R15

$aleg\ R16 = 1K$ => R15=0.58K

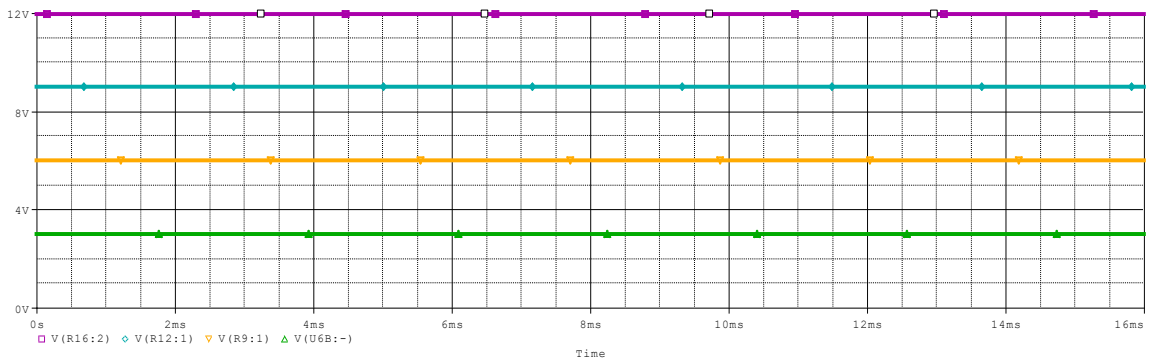
- Am folosit o sursa Vsin si o analiza Time domain pentru a verifica pragurile de tensiune



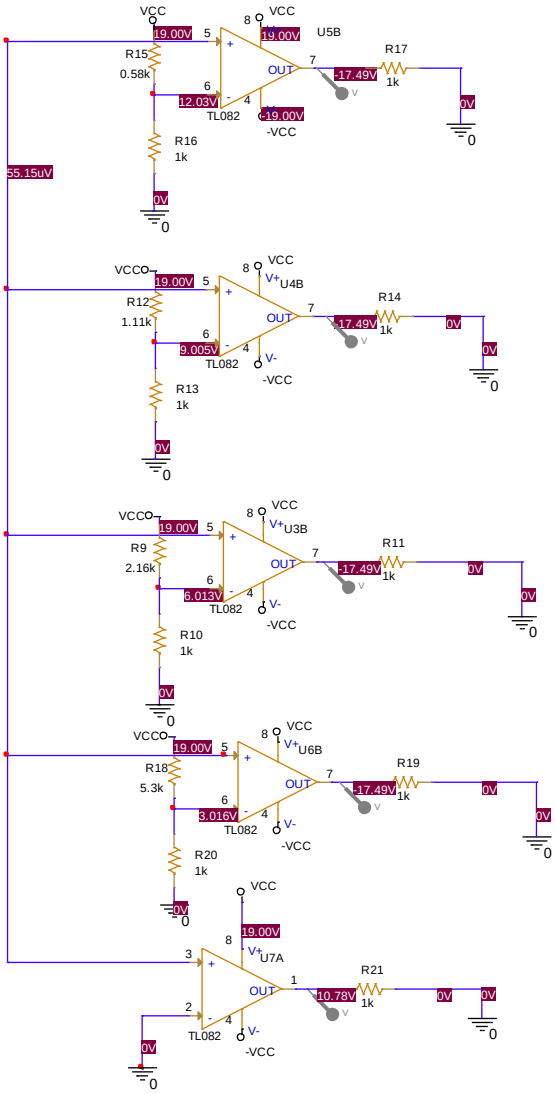
Schema cu toate comporatoarele pentru detectia de praguri

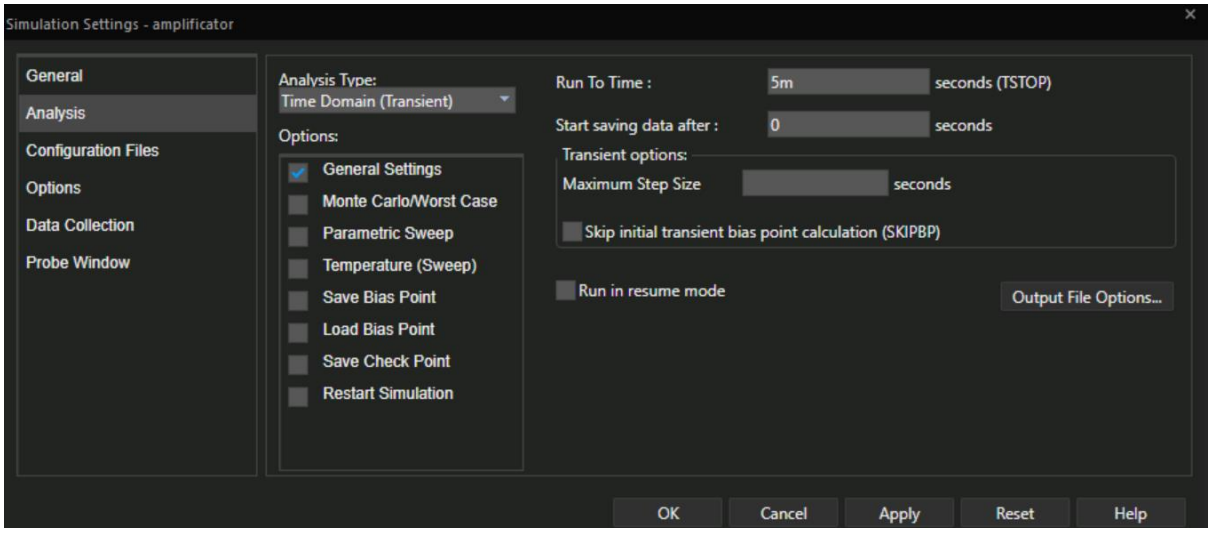


Vizualizarea domeniilor de tensiune

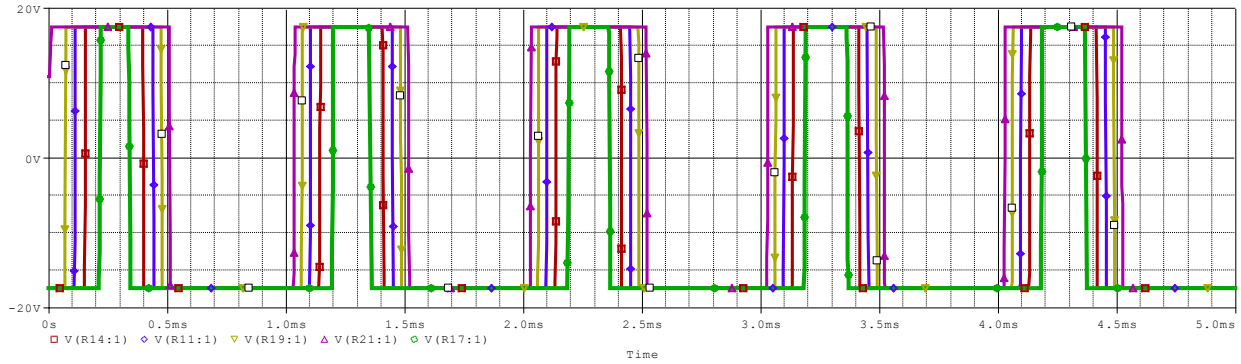


Amplificare+filtrare+detectie de praguri





Semnalele de iesire ale pragurilor



CREAREA LEDURILOR

- In Model Editor am facut 5 leduri

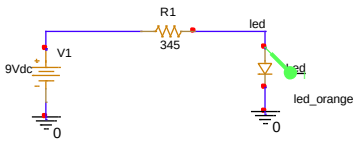
LED PORTOCALIU

V1=9V

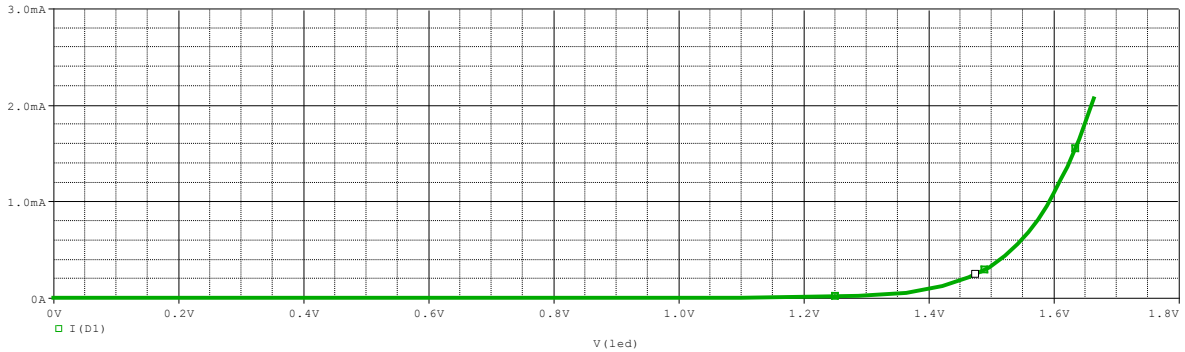
Vd=2.1V

I(LED)=20mA

R=$\frac{V_R}{I_{LED}}$=$\frac{9V-2.1V}{20mA}$=345Ω



Caracteristica I(LED)=f(Vled) pentru ledul portocaliu



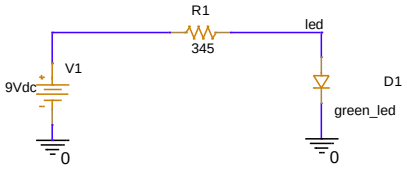
LED VERDE

V1=9V

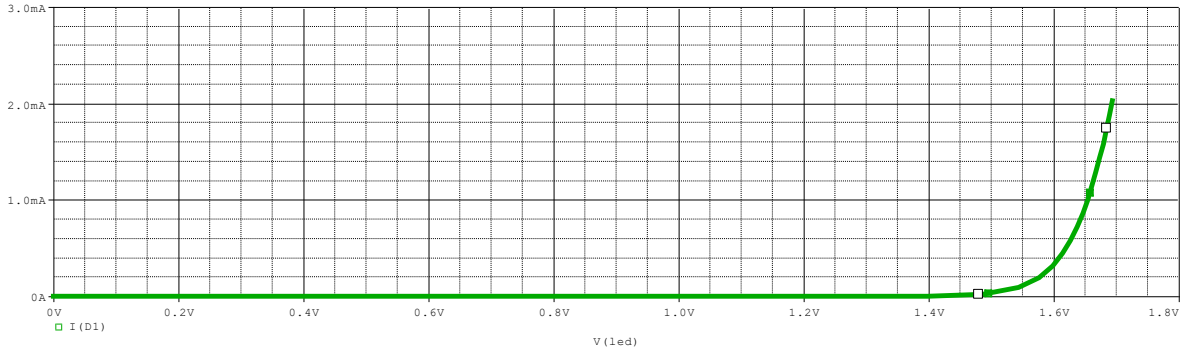
Vd=2.1V

I(LED)=20mA

R=$\frac{V_R}{I_{LED}}$=$\frac{9V-2.1V}{20mA}$=345Ω



Caracteristica I(LED)=f(Vled) pentru ledul verde



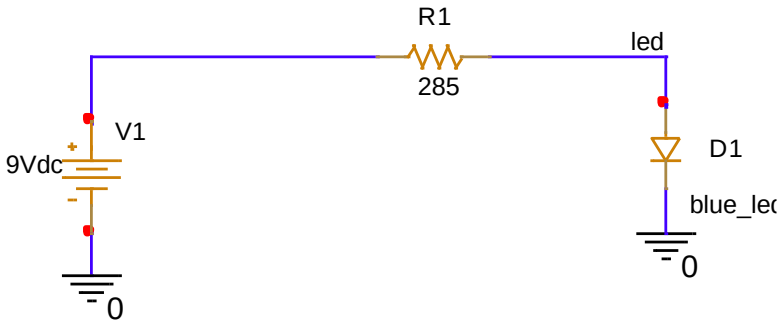
LED ALBASTRU

V1=9V

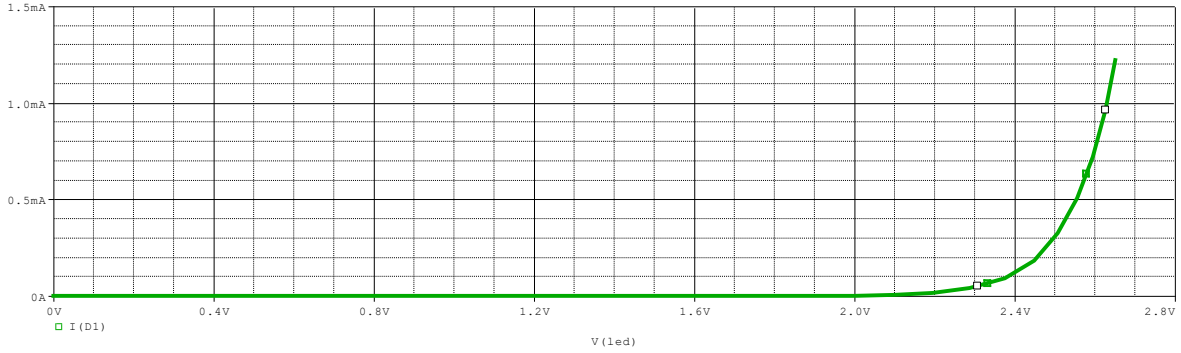
Vd=3.3V

I(LED)=20mA

R=$\frac{V_R}{I_{LED}}$=$\frac{9V-3.3V}{20mA}$=285Ω



Caracteristica I(LED)=f(Vled) pentru ledul albastru



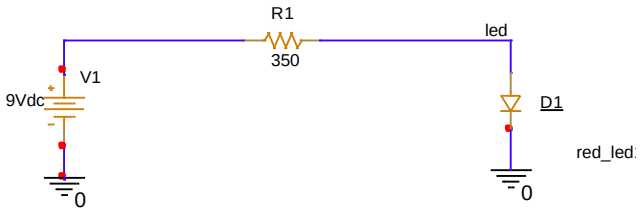
LED ROSU

V1=9V

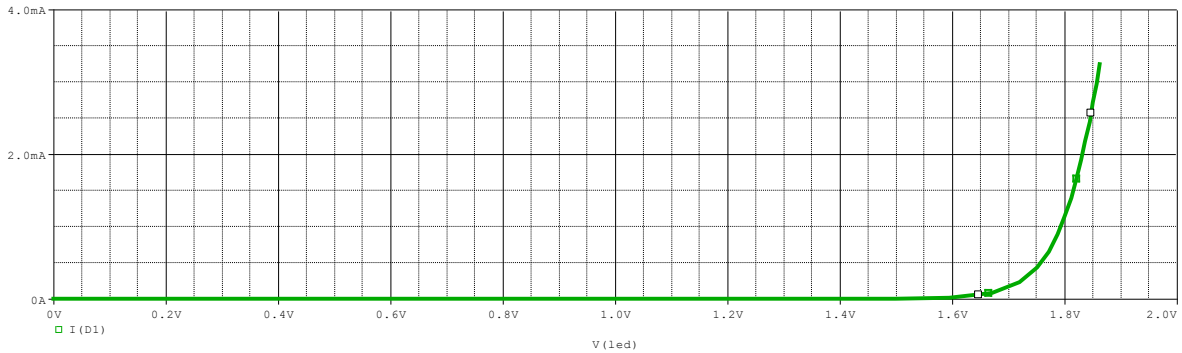
Vd=2V

I(LED)=20mA

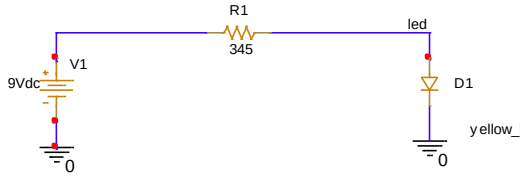
R=$\frac{V_R}{I_{LED}}$=$\frac{9V-2V}{20mA}$=350Ω



Caracteristica I(LED)=f(Vled) pentru ledul rosu



LED GALBEN



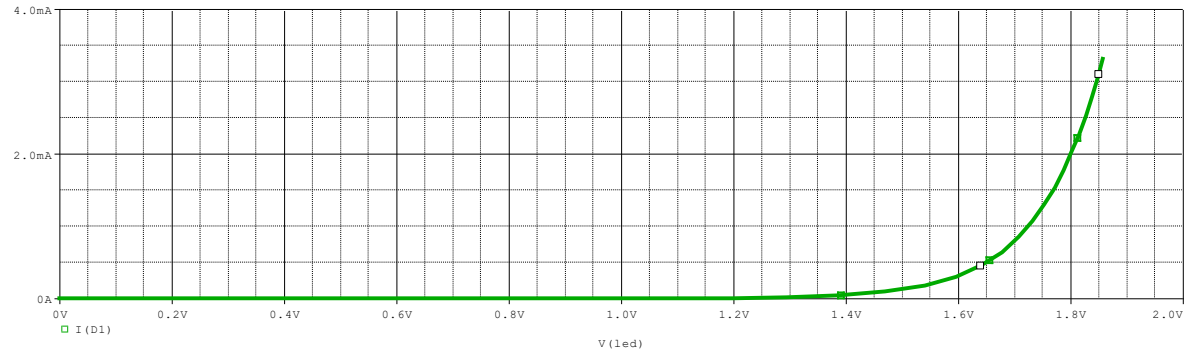
V1=9V

Vd=2.1V

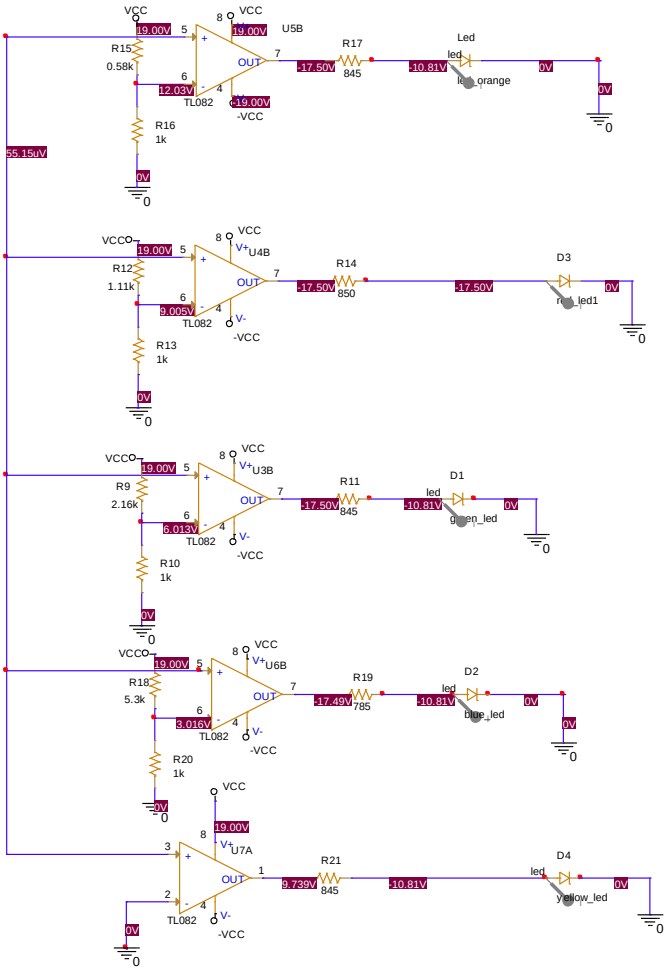
I(LED)=20mA

R=$\frac{V_R}{I_{LED}}$=$\frac{9V-2.1V}{20mA}$=395Ω

Caracteristica I(LED)=f(Vled) pentru ledul galben



Ledurile in circuitul final



R21=(Vcc-VD_galben)/ID_galben=(19V-2.1V)/

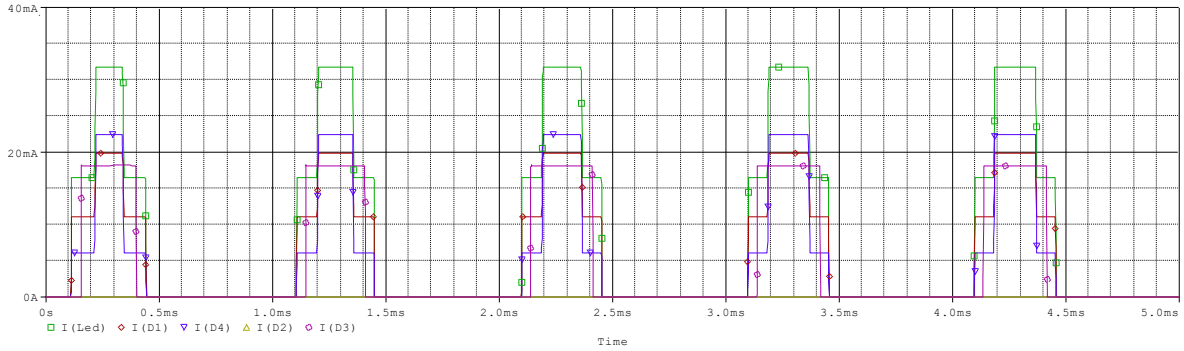
20mA=845 Ω

R19=(Vcc-VD_albastru)/ID_albastru=(19V-3.3V)/20mA=785 Ω

R11=(Vcc-VD_verde/ID_verde=(19V-2.1V)/20mA=845 Ω

R14=(Vcc-VD_rosu)/ID_rosu==(19V-2V)/20mA=850 Ω

R17=(Vcc-VD_portocaliu)/ID_portocaliu=(19V-2.1V)/20mA=845 Ω



Bibliografie

http://www.bel.utcluj.ro/dce/didactic/cef/

http://www.bel.utcluj.ro/dce/didactic/de/de.htm

https://sites.google.com/site/bazeleelectronicii/home/filtre/4-passive-band-pass-filter

https://www.farnell.com/datasheets/1671521.pdf

https://www.farnell.com/datasheets/1671521.pdf

https://www.farnell.com/datasheets/1519875.pdf

https://www.farnell.com/datasheets/1660998.pdf

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