Computer Studies

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Contents

Chapter 1

Theoretical part

1.1 Circuit calculation

Calculate the voltages on the resistors shown in the diagram 1. For voltage source V1 use DC voltage that is the last three digits of your student ID divided by 10. For example. 101REB123 means V1 = 12.3 (Volts).
R1 is the second digit of the last 3 digits of the student ID + 1. R2 is the last digit of the student ID number +1. For example, if your student ID number is 101REB123 then R1 = 3, R2 = 4. Take a picture of the calculation. The calculation process will be required at work P02. Additionally, the calculation will have to be added to the report you will complete at the end of the semester[1]

1.2 Check modeling with gEDA

- Get into the students work area by using ssh on a training host with an IP address 213.175.92.37. For example: ssh -X x111REB ... @ 213.175.92.37
- Create a folder work and go to it. Create a folder P01 and go to it
- Launch the program gschem . Create the schematics shown in the ***1.*** Select the voltage source and resistor values according to the theoretical calculation made at point ***1.1.*** Save the schematics in file called 01.sch. Do not forget to add the value parameter to all elements. In addition, there must be a defined grounding point. This is done by assigning parameter netname = 0 to one of the connections (nets). See the lecture slides for the usage of the program. [1]

  generate the netlist file. For this purpose, run from the command line: gnetlist -g spice 01.sch -o 01.net .
- Using cat check whether the netlist file has been generated correctly.

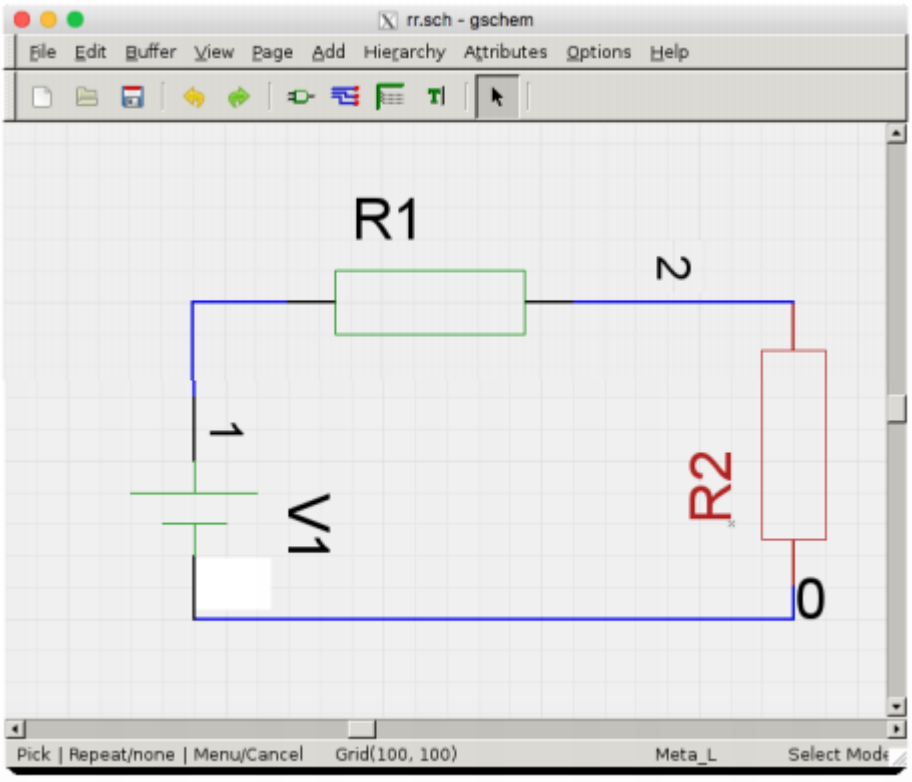

Figure 1.1: Shape gschem medium

- Make a simulation of the circuit 01.net using the program ngspice. For this purpose, run ngspice from the command line.
- Load the created netlist file using the command into ngspice: source 01.net
- Perform a simulation of the transient process (tran) from 0 to 5 seconds in 1 second step.
- Use plot to display the signal on the ***1*** connection. Using ***hardcopy*** button save the resulting image to 011.png or make screenshot.
- Using plot display the signal in the connection 2. Save the resulting image to ***012.png*** or make screenshot. All this will have to be used at work P02

Bold, Italic, Underline Some of the **greatest** discoveries in science were made by ***accident***

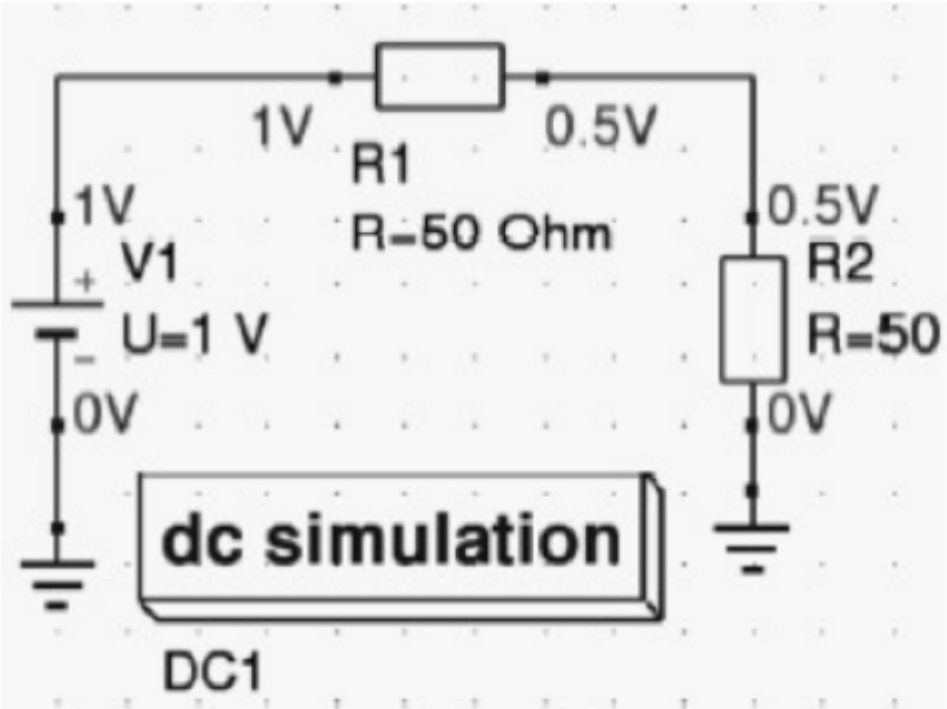

Figure 1.2: The QUCS schematics environment

1.3 Advanced task: Modeling with QUCS

Start simulator QUCS. Locate the Project menu, then select Open Project point to the directory P01.

- Choose the tab Components on the left. From the palette, select the two components Resistor and the source of the component DC Voltage Source from the Sources menu. Put it all on the work surface as shown in the 2 image. Select the voltage source and resistor values according to the theoretical calculation at point 1.1. Make sure the visible component parameters (R1, R2, V1, etc.) are not overlapped and legible.
- Use CTRL + E to turn on wiring or connection mode and 0connect the components. Do not forget to add Ground to the scheme.
- From the menu, open the category simulations and add the DC simulation block to your schema. Without this block, QUCS will not know what needs to be done.

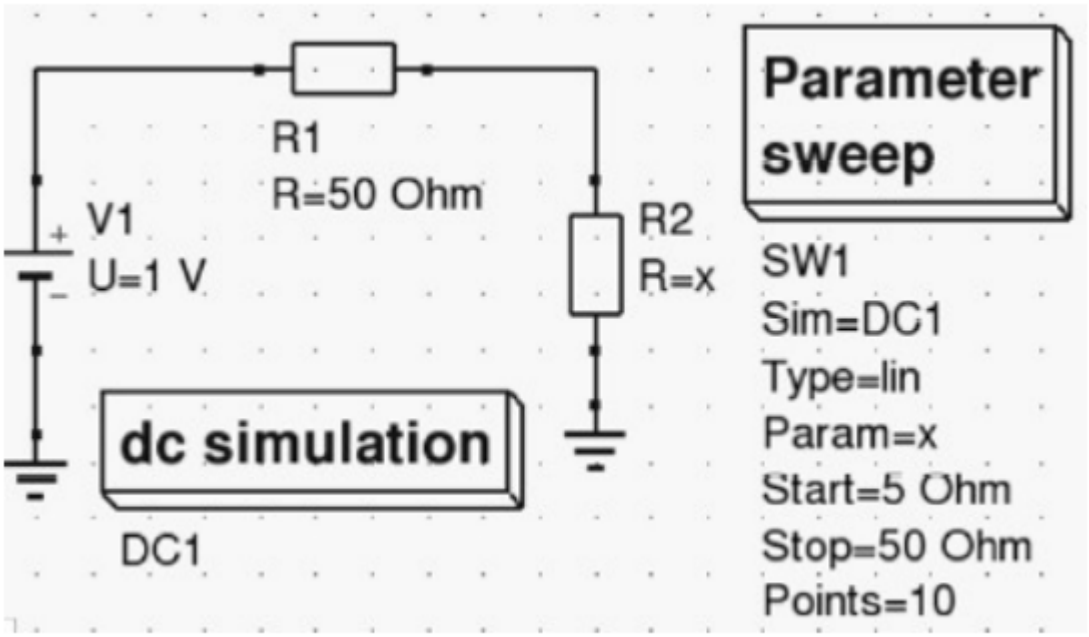

Figure 1.3: Parameter sweep mode

- Save the created scheme with the command sequence File-Save. Name the newly created file as 02. Qucs will add the extension (.sch) to the file itself. This will give you the file 02.sch.
- Perform elementary DC mode simulation with the F8 key, which results in calculations and determines the voltage on the resistor R2. The simulator variable that derives this value is designated R2.V.
- Add the schema to the simulation component Parameter sweep, which is selected from the category simulations (see Fig. 3). Evaluate the Sweep simulation attributes and their parameters displayed on the screen. [1, 3]
- Change the value of resistor R2 to the symbol x, which will serve as the argument for the current circuit calculation. This symbol: x must also be written in the Param field of the component parameter sweep attribute field.
- Change number of points to 10. Now, simulating parameter x will be changed linearly from value 5 to 50 at eleven points, where all the pa-

rameters of the circuit (current and voltages) will be calculated corresponding number of times because they depend of resistor R2 value.

- Press F8. In the resulting parameter selection form, change them, obtain and estimate the calculated voltage value on the resistor R2-UR2, which can be seen in the simulator as R2.V.
- Enhance the chain by introducing the label for wire connecting R1 to R2. Sometimes it says: ... the node connecting R1 to R2. Highlight the wire and call it the exit (see Fig. 4). [1]

1.4 Tabula creation:

I have created simple table which is required in practical work:
After that you can use the environment wrapfig, it takes two parameters that are passed inside braces: the alignement that can be l, r, c, i or o; this letters stand for left, right, centre, inner and outer (the last two intended for two-sided documents). The second parameter is the width of the figure, in the example is 0.25 the width of the text. See the reference guide for a list of possible length units.
Then you can use the environment wraptable which takes two parameters: The first one is the alignment that can be l, r, c, i or o for left, right, centre, inner and outer respectively. The second one is the width of the table container, keep in mind that this latter parameter must be the same as the width of the table, otherwise things may not be properly aligned. [1]
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col1	col2
R1	
R2	
V1	
UR1	
UR2	

Figure 1.4: Table

1.5 Circuitikz - for adding the electrical circuit diagram

The symbols can also be used along a path, using the transistor-path-syntax(T in front of the shape name, see section 6.6). Dont forget to use parameter n to name the node and get acces to the anchors:
To then link them up with other components we would use the predefined node anchors.
For more information about all the components available and how you link components using node anchors, take a look at the documentation.
From the bottom left we have; a resistor, a variable resistor, a transmission line, a closing switch, a european current source, a european voltage source, an empty diode, a full led, a generic bipole and a sinusoidal voltage source.
Bipoles arent the only type of component we can use. We can also add in monopoles, tripoles, double bipoles, logic gates and amplifiers.
However we cant use the to keyword to add these in as weve done before, because they dont naturally fit on a single line. Instead we use node notation.
For example, this is how we would display an antenna[2, 3]
From the bottom left we have; a resistor, a variable resistor, a transmission line, a closing switch, a european current source, a european voltage source, an empty diode, a full led, a generic bipole and a sinusoidal voltage source.
Bipoles arent the only type of component we can use. We can also add in monopoles, tripoles, double bipoles, logic gates and amplifiers.[1, 2]
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1.5.1 More circuit diagrams

For more information about all the components available and how you link components using node anchors, take a look at the documentation. From the bottom left we have; a resistor, a variable resistor, a transmission line, a closing switch, a european current source, a european voltage source, an empty

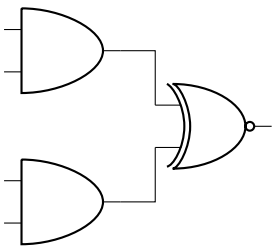

Figure 1.5: Logical ports

```
\begin{circuitikz} \draw
(1,0) node[not port] (not1) {}
(3,0) node[not port] (not2) {}
(0,0) -- (not1.in)
(not2.in) -- (not1.out)
++(0,-1) node[ground] {} to[C] (not1.out)
(not2.out) -| (4,1) -| (0,0);
\end{circuitikz}
```

Figure 1.6: Logical ports

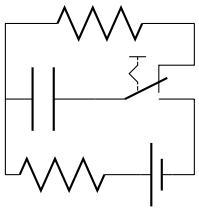

Figure 1.7: Logical ports

```
\begin{circuitikz} \draw
(0,0) to[C] (1,0) to[toggle switch ,
n=Sw] (2.5,0)
-- (2.5,-1) to[battery1] (1.5,-1)
to[R] (0,-1) -| (0,0)
(Sw.out 2) -| (2.5, 1) to[R] (0,1)
-- (0,0);
\end{circuitikz}
```

Figure 1.8: Logical ports

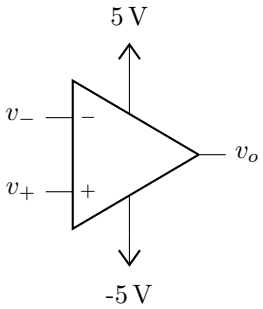

Figure 1.9: Logical ports

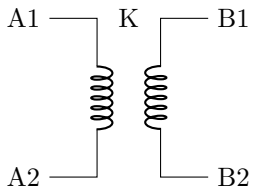

Figure 1.10: Logical ports

diode, a full led, a generic bipole and a sinusoidal voltage source. Bipoles arent the only type of component we can use. We can also add in monopoles, tripoles, double bipoles, logic gates and amplifiers. However we cant use the to keyword to add these in as weve done before, because they dont naturally fit on a single line. Instead we use node notation. For example, this is how we would display an antenna [2]

Chapter 2

Practical part

2.1 Work with GEDA programs

2.1.1 Work with gschem

After that you can use the environment wrapfig, it takes two parameters that are passed inside braces: the alignement that can be l, r, c, i or o; this letters stand for left, right, centre, inner and outer (the last two intended for two-sided documents). The second parameter is the width of the figure, in the example is 0.25 the width of the text. See the reference guide for a list of possible length units. After that you can use the environment wrapfig, it takes two parameters that are passed inside braces: the alignement that can be l, r, c, i or o; this letters stand for left, right, centre, inner and outer (the last two intended for two-sided documents). The second parameter is the width of the figure, in the example is 0.25 the width of the text. See the reference guide for a list of possible length units.
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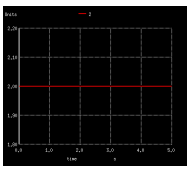

Figure 2.1: Gschem

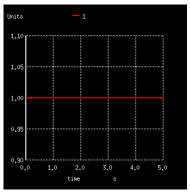

Figure 2.2: Gschem graph

two parameters that are passed inside braces: the alignement that can be l, r, c, i or o; this letters stand for left, right, centre, inner and outer (the last two intended for two-sided documents). The second parameter is the width of the figure, in the example is 0.25 the width of the text. See the reference guide for a list of possible length units. After that you can use the environment wrapfig, it takes two parameters that are passed inside braces: the alignement that can be l, r, c, i or o; this letters stand for left, right, centre, inner and outer (the last two intended for two-sided documents). The second parameter is the width of the figure, in the example is 0.25 the width of the text. See the reference guide for a list of possible length units. [1, 3]

2.1.2 Work with gnetlist

```
* Spice netlister for gnetlist
V1 2 0 1.2
R2 0 1 3
R1 2 1 2
.END
```

2.1.3 Work with ngspice

After that you can use the environment wrapfig, it takes two parameters that are passed inside braces: the alignement that can be l, r, c, i or o; this letters stand for left, right, centre, inner and outer (the last two intended for two-sided documents). The second parameter is the width of the figure, in the example is 0.25 the width of the text. See the reference guide for a list of possible length units. After that you can use the environment wrapfig, it takes two parameters that are passed inside braces: the alignement that can be l, r, c, i or o; this letters stand for left, right, centre, inner and outer (the last two intended for two-sided documents). The second parameter is the width of the figure, in the example is 0.25 the width of the text. See the reference guide for a list of possible length units. [1, 3]
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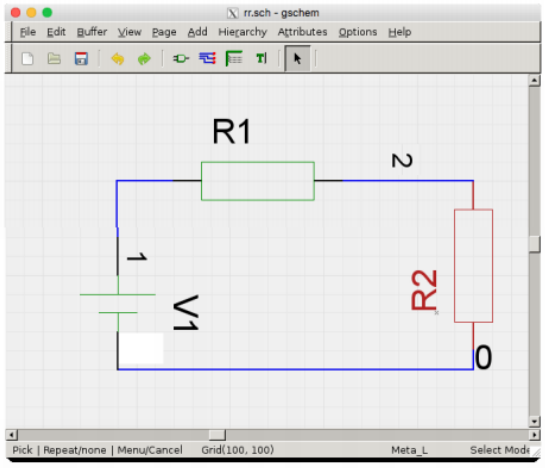

Figure 2.3: Plots from the simulations of voltage on R1 and R2

two-sided documents). The second parameter is the width of the figure, in the example is 0.25 the width of the text. See the reference guide for a list of possible length units.[1, 3]
After that you can use the environment wrapfig, it takes two parameters that are passed inside braces: the alignement that can be l, r, c, i or o; this letters stand for left, right, centre, inner and outer (the last two intended for two-sided documents). The second parameter is the width of the figure, in the example is 0.25 the width of the text. See the reference guide for a list of possible length units.[1, 3]

2.2 Work with QUCS programs

- Image of the schematics
- Plot (curve) of DC simulation.
- Curve from Sweep simulation (advanced topic).
- Sweep simulation table (advanced topic).
- Explanations for each image and table (advanced topic).

Bibliography

[1] Documentation of ShareLetatex, Online *The LaTeX Companion*. Addison-Wesley, Reading, Massachusetts, 2003.

[2] Massimo A. Redaelli (m.redaelli@gmail.com) *CircuiTikZ*. (German) [*On the electrodynamics of moving bodies*]. Annalen der Physik, 322(10):891921, 2006.

[3] Latex Tutorial Online *http://www.latex-tutorial.com/tutorials*