Aidan Chin Aidan Carey Lab Report 3 10/5/2023

Introduce and define concept

The purpose of this lab is to introduce us to simulation software, this time we will be working with LTSpice. These allow us to easily and quickly create a model of a circuit to see its behavior, without needing to make it in real life. However, This does not mean that it can completely replace real circuits, they are still invaluable

Motivation

Our motivation for this lab is to manually calculate node voltage, then using the software, we will simulate the current and verify our calculations alongside new values. We will use this circuit to check out the circuit's behavior.

Vocabulary

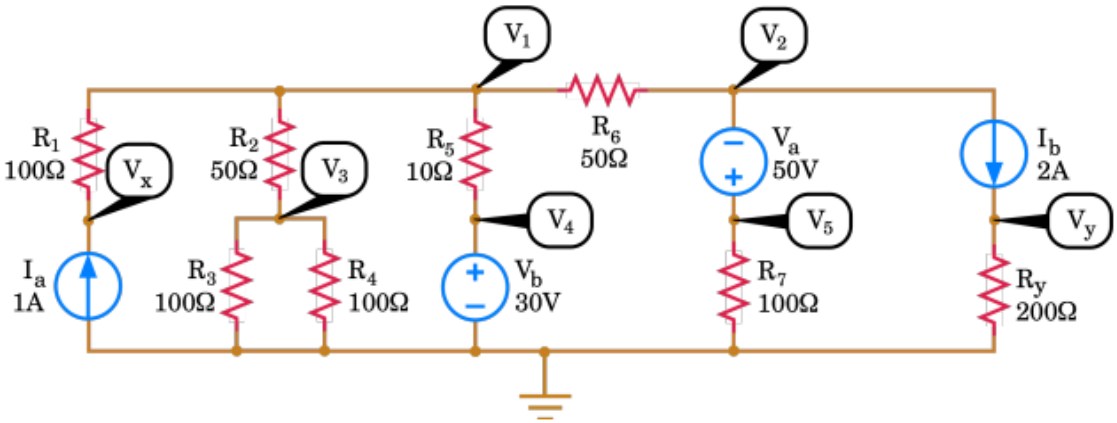
Simulation Software: a Computer program designed to simulate real-world things.

LTSpice: the specific simulation software mentioned. LTSpice is a widely used circuit simulation tool.

Circuit: A closed loop or path through which an electric current can flow. It consists of various components like resistors, capacitors, and transistors.

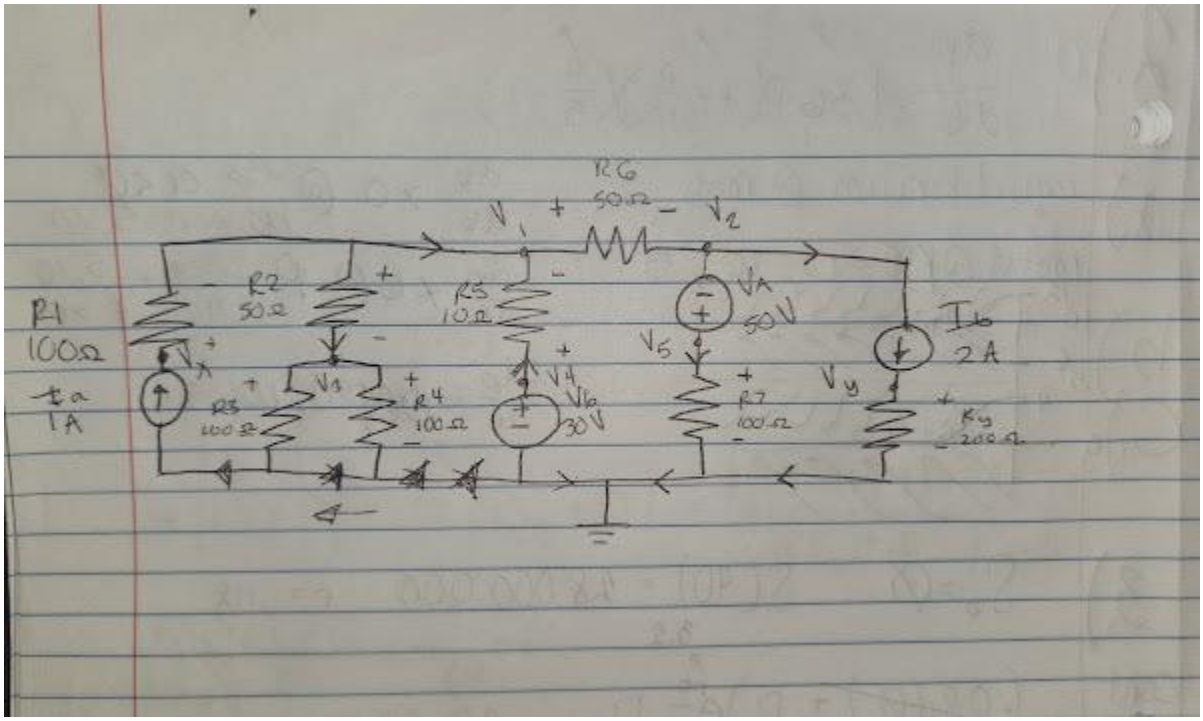
Node Voltage: The voltage at a specific point (node) in an electrical circuit concerning a reference point or ground.

Circuit Diagram

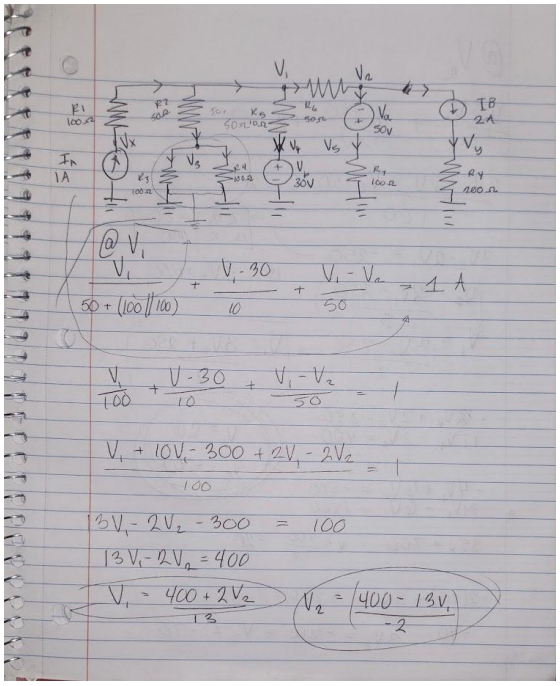


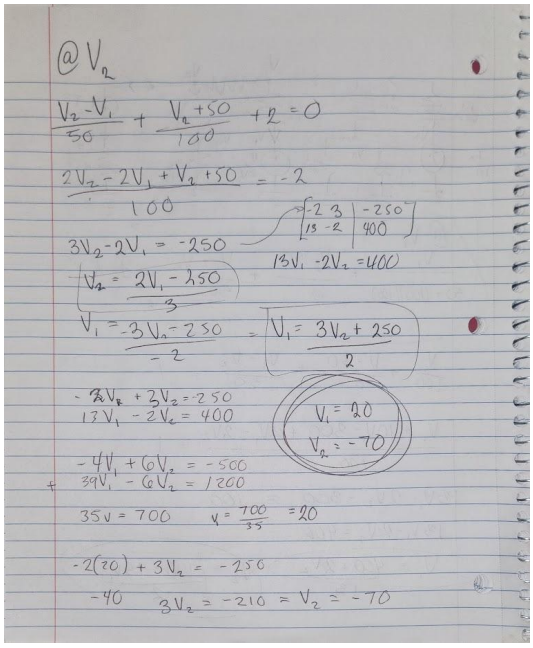
taken straight from lab procedure

Nodal Analysis

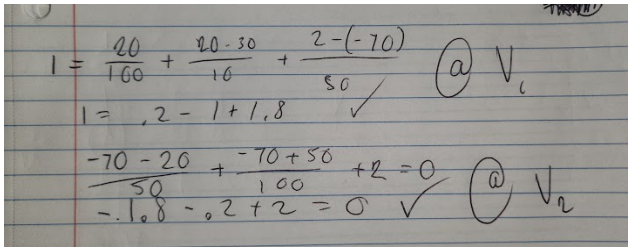


V1 and V2 + work

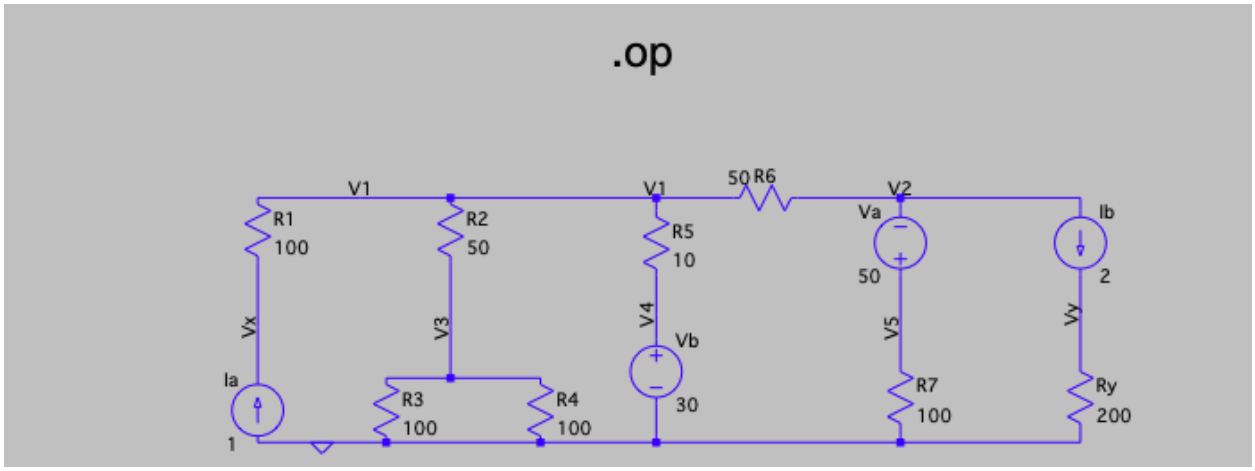




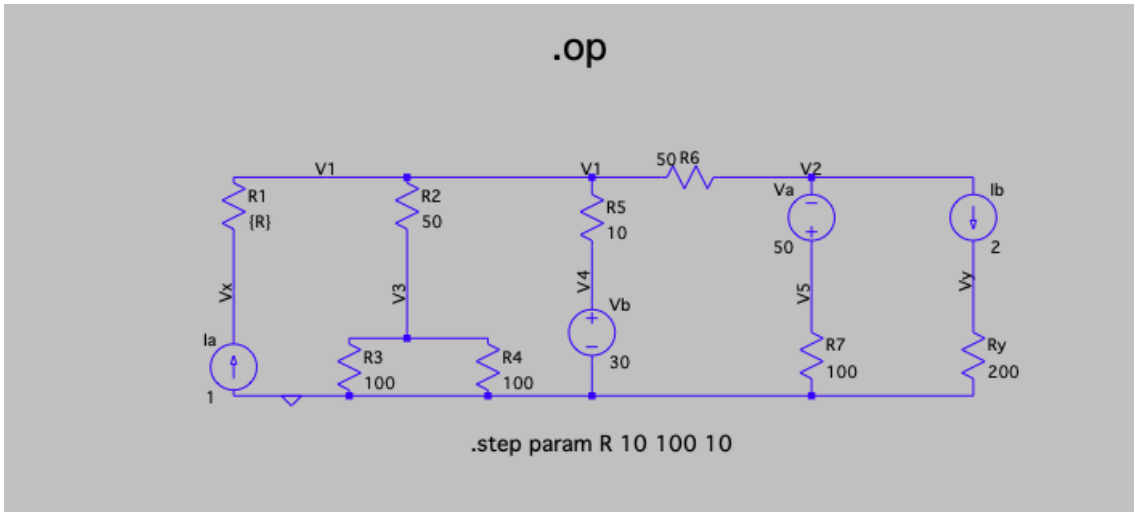
KCL checks



LTspice



DC operating point



Search

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Circuit: * /Users/aidancarey/Documents/LTspice/Draft1.asc

Direct Newton iteration for .op point succeeded.
Operating Bias Point Solution:
V(vx)                          120   voltage
V(v1)                           20   voltage
V(v3)                           10   voltage
V(v4)                           30   voltage
V(v2)                          -70   voltage
V(v5)                          -20   voltage
V(vy)                          400   voltage
I(Ia)                            1   device_current
I(Ib)                            2   device_current
I(R1)                           -1   device_current
I(R2)                          0.2   device_current
I(R3)                          0.1   device_current
I(R4)                          0.1   device_current
I(R5)                           -1   device_current
I(R6)                         -1.8   device_current
I(R7)                         -0.2   device_current
I(R8)                            2   device_current
I(Vb)                           -1   device_current
I(Va)                          0.2   device_current


Date: Fri Oct  6 12:31:06 2023
Total elapsed time: 0.012 seconds.
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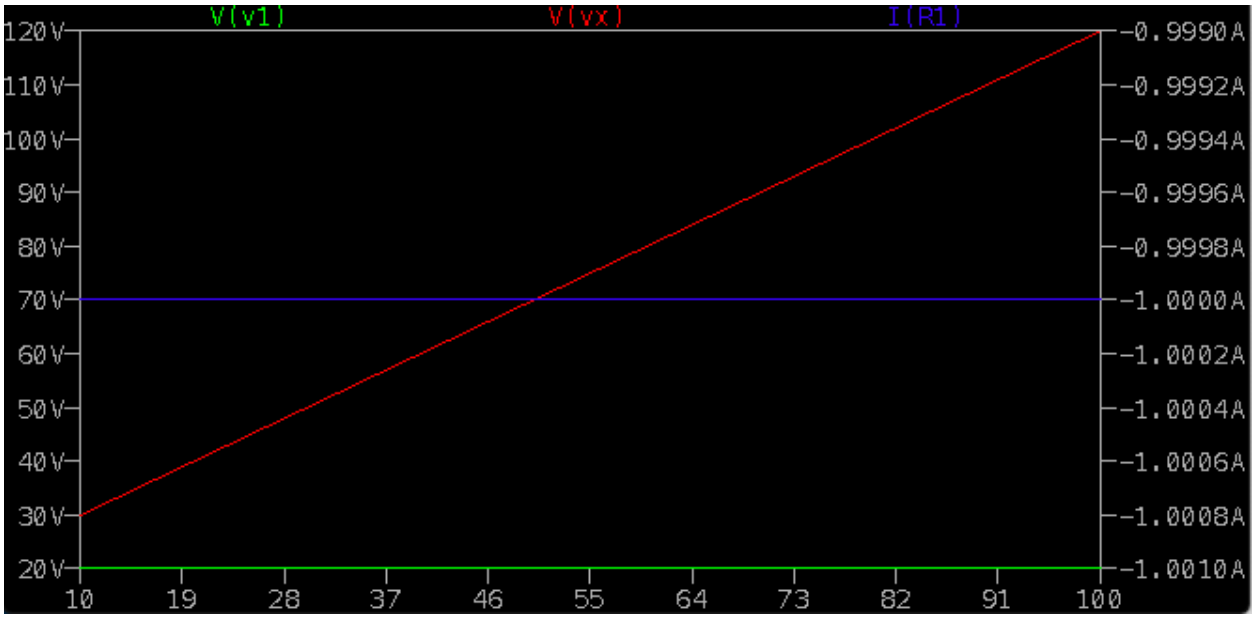
Power Dissipation

	measured Power Absorbed	
R1	100	W
R2	2	W
R3	1	W
R4	1	W
R5	10	W

R6	162	W
R7	4	W
Ry	800	W
IA	-120	W
IB	-940	W
VA	10W	W
VB	-30	W
TOTAL	-10	W

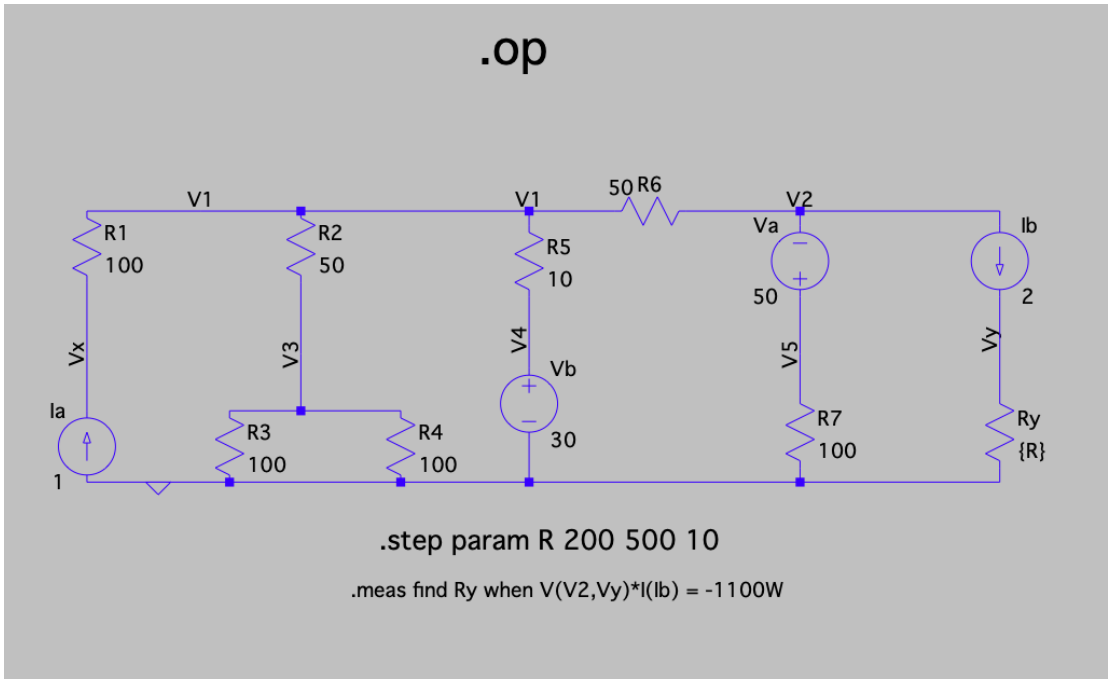
The total power absorbed by the circuit is -10 W, the circuit is not using 10W of the power delivered to it. The sources that are following the current directions are what are supplying power to the circuit. This means that the components drawing power do not draw enough to dissipate all the power.

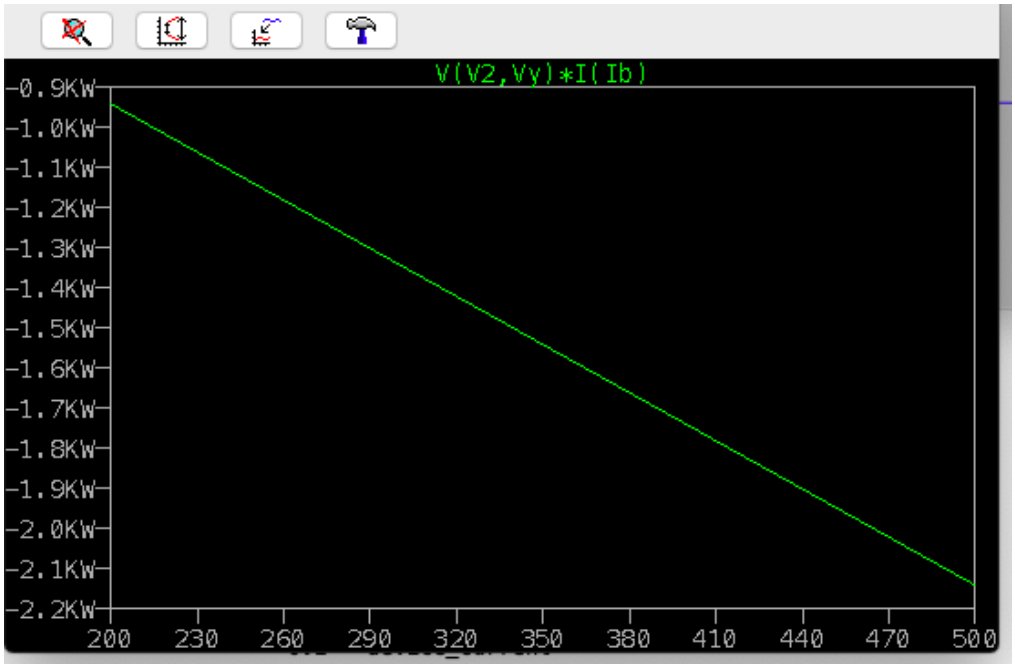
DC Sweep



a) V1 and R1 are independent of the resistor value and that is why they don't change, as plotted by straight lines with a slope of 0.
b) Vx positivity increases in a linear fashion from 30V to 120V over an interval of 10 to 100 Ohms.
c) Changing the resistor value changes branch voltage across the resistor which changes node voltage at V1
d) There is no dependence on the resistor so in the formula, the value of the resistor doesn't even exist, we only use that part of the circuit for amperage, which does not change over resistor

DC Sweep for Design




V(V2,Vy)*I(Ib)
-0.9KW
-1.0KW
-1.1KW
-1.2KW
-1.3KW
-1.4KW
-1.5KW
-1.6KW
-1.7KW
-1.8KW
-1.9KW
-2.0KW
-2.1KW
-2.2KW
200
230
260
290
320
350
380
410
440
470
500

```
Circuit: * /Users/aidancarey/Documents/LTspice/Draft1.asc

Direct Newton iteration for .op point succeeded.
Operating Bias Point Solution:
V(vx)                            120   voltage
V(v1)                             20   voltage
V(v3)                             10   voltage
V(v4)                             30   voltage
V(v2)                            -70   voltage
V(v5)                            -20   voltage
V(vy)                            400   voltage
I(Ia)                              1   device_current
I(Ib)                              2   device_current
I(R1)                             -1   device_current
I(R2)                            0.2   device_current
I(R3)                            0.1   device_current
I(R4)                            0.1   device_current
I(R5)                             -1   device_current
I(R6)                           -1.8   device_current
I(R7)                           -0.2   device_current
I(Ry)                              2   device_current
I(Vb)                             -1   device_current
I(Va)                            0.2   device_current


find: v(v2,vy)*i(ib)=-1100w AT 240


Date: Fri Oct  6 13:36:33 2023
Total elapsed time: 0.132 seconds.

tnom = 27
temp = 27
method = trap
totiter = 3
traniter = 0
tranpoints = 0
accept = 0
rejected = 0
matrix size = 9
fillins = 1
solver = Normal
Avg thread counts: 4.0/0.0/4.0/4.0
Matrix Compiler1:      19 opcodes
Matrix Compiler2:      49 opcodes
```

4. Ry at value 240 Ohms will make IB absorb -1100W
Last digit of Aidan Chin ID is 1, 33803321