ELEC 2110

Electric Circuit Analysis

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Section 002

DC Mesh and Nodal Analysis

Introduction

This lab tasks the student with using Nodal and Mesh analysis to solve multiple circuits. The student will be given a circuit and told to use Nodal and Mesh analysis on each one. Also, use MATLAB to solve the matrix equations.

Exercise 1

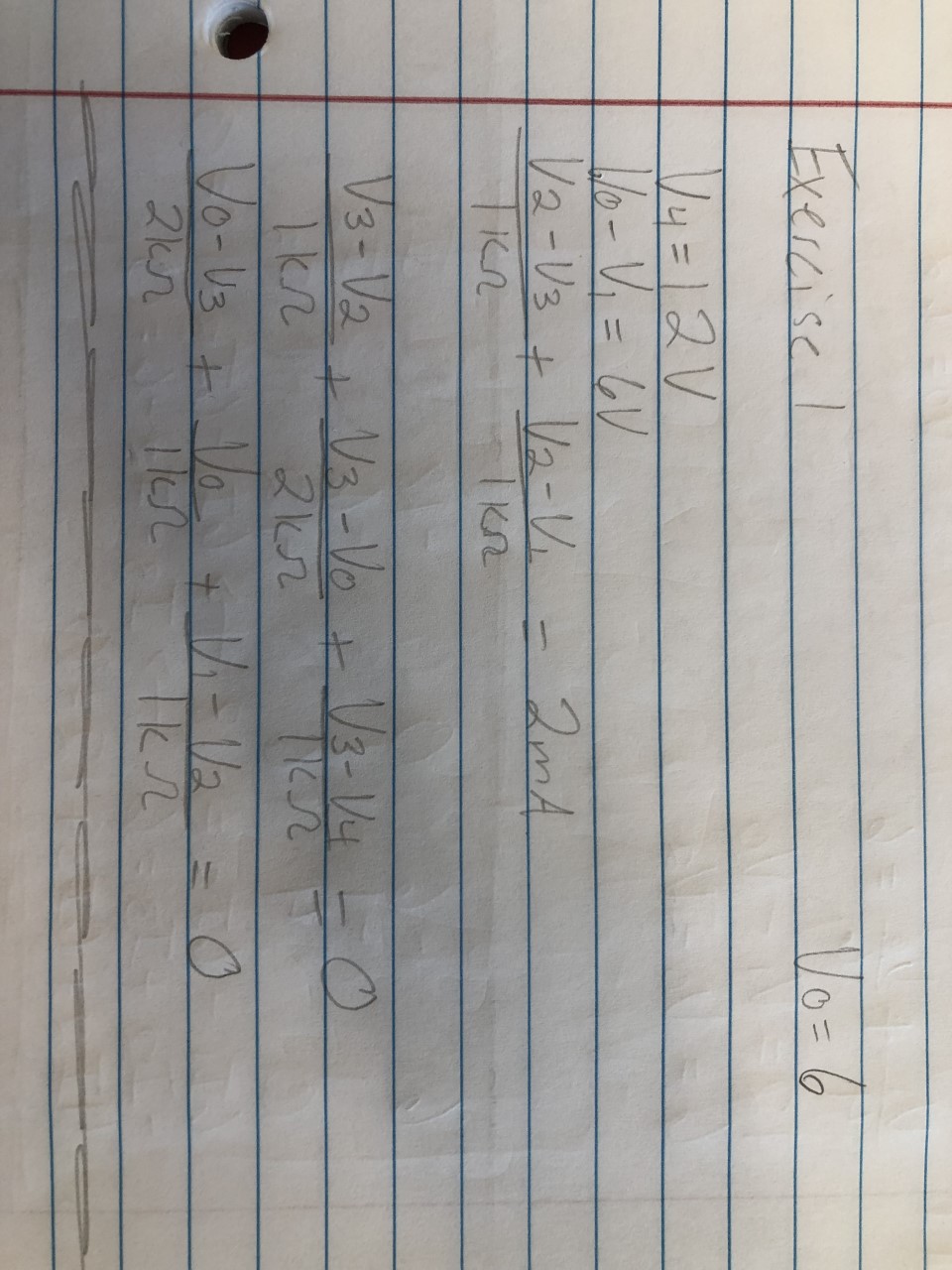
Analyze the circuit given using Nodal and Mesh analysis.

A close up of text on a white background

Description automatically generated

(1)

Circuit 1



(2)

Nodal Analysis equations

A screenshot of text

Description automatically generated

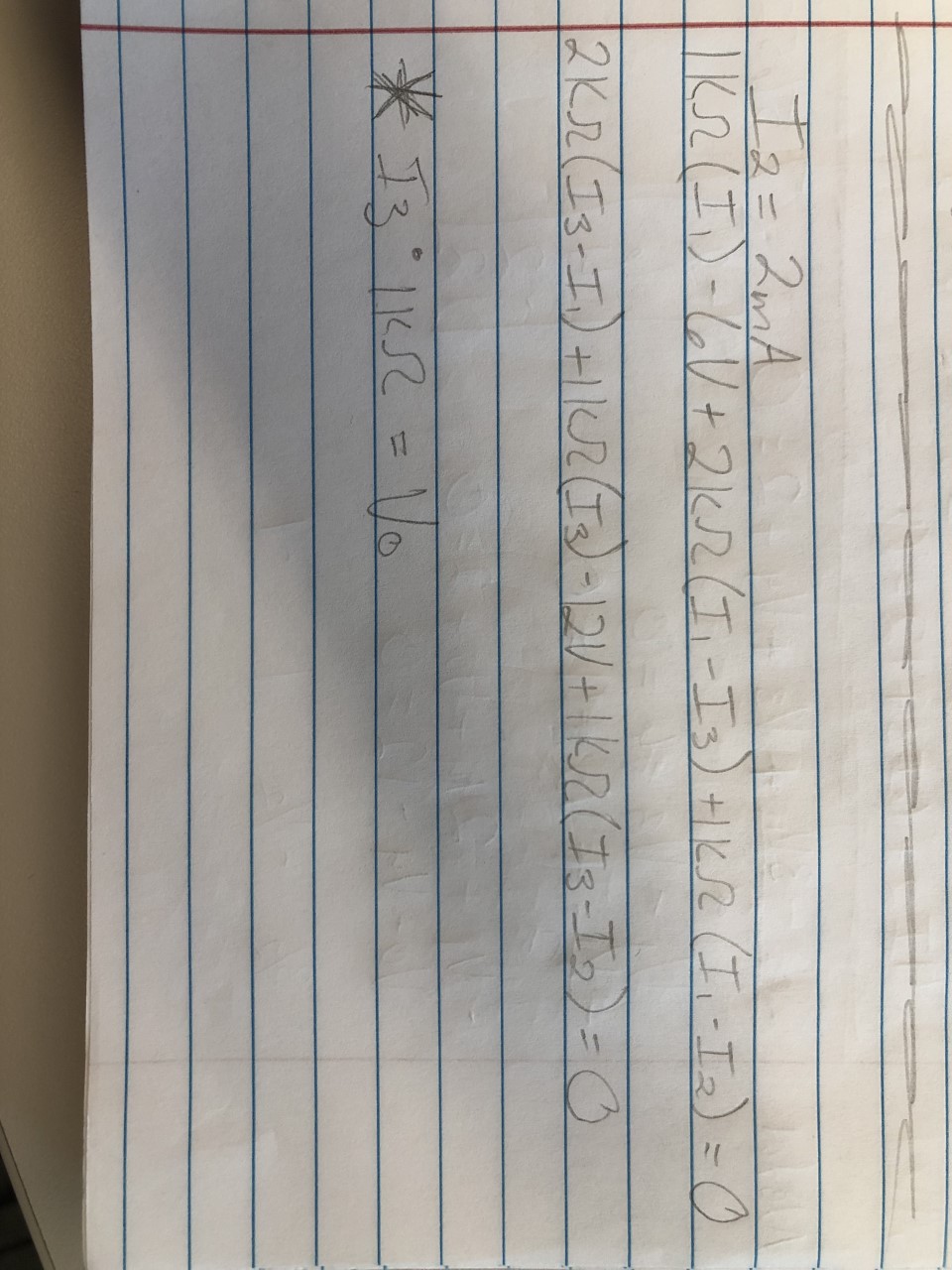
(3)

Matrix Code and Answer

Nodal Summary Table

|  |  |
| --- | --- |
| V1 | 0V |
| V2 | 5V |
| V3 | 8V |
| V4 | 12V |
| Vo | 6V |

Mesh Analysis



(4)

Mesh Analysis equations

A close up of text on a white background

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(5)

Matrix Code and Answer

Mesh Summary Table

|  |  |
| --- | --- |
| I1 | 5mA |
| I2 | 2mA |
| I3 | 6mA |
| I3\*1KOhms = Vo | = 6\*1 = 6V |

Exercise 2

Given a new circuit, use Nodal and Mesh analysis to find voltage and current.

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(6)

Circuit 2

A picture containing building

Description automatically generated

(7)

Nodal Analysis equations

A close up of text on a white background

Description automatically generated

(8)

Matrix Code and Answer

Nodal Summary Table

|  |  |
| --- | --- |
| V1 | 19.2V |
| V2 | 1.2V |
| Vo | 7.2V |

Mesh Analysis

A close up of a door

Description automatically generated

(9)

Mesh Analysis equations

A close up of text on a white background

Description automatically generated

(10)

Matrix Code and Answer

Mesh Summary Table

|  |  |
| --- | --- |
| I1 | -7.8mA |
| I2 | -4.8mA |
| I3 | 1.2mA |
| (I3\*1)+6 = Vo | = (1.2\*1)+6 = 7.2V |

Exercise 3

Given a new circuit, use Nodal and Mesh analysis to find voltage and current.

A close up of a clock

Description automatically generated

(11)

Circuit 3

A close up of a door

Description automatically generated

(12)

Nodal Analysis equation

A close up of text on a white background

Description automatically generated

(13)

Matrix Code and Answer

Nodal Summary Table

|  |  |
| --- | --- |
| V1 | 0.6957V |
| V2 | 4.3478V |
| V3 | -5.3043V |
| V4 | -4.4348V |
| Vo | 7.5652V |

Mesh Analysis

A close up of a door

Description automatically generated

(14)

Mesh Analysis equations

A screen shot of a computer

Description automatically generated

(15)

Matrix Code and Answer

Mesh Summary Table

|  |  |
| --- | --- |
| I1 | 1.8261mA |
| I2 | -2.1739mA |
| I3 | 3.1304mA |
| I4 | -2.0mA |
| I5 | 7.5652mA |
| Vo = I5\*1KOhm | = 7.5652\*1 = 7.5652V |

Exercise 4

Given a new circuit, use Nodal and Mesh analysis to find voltage and current.

A close up of text on a white background

Description automatically generated

(16)

Circuit 4

A close up of a door

Description automatically generated

(17)

Nodal Analysis equations

A close up of text on a white surface

Description automatically generated

(18)

Matrix Code and Answer

Nodal Summary Table

|  |  |
| --- | --- |
| V1 | 150.2609V |
| Vx | 31.3043V |
| Vo | -162.7826V |

Mesh Analysis

A close up of a door

Description automatically generated

(19)

Mesh Analysis equations



(20)

Matrix Code and Answer

Mesh Summary Table

|  |  |
| --- | --- |
| I1 | -32.3478mA |
| I2 | -12.5217mA |
| I3 | -20.3478mA |
| Vx | 31.3043V |
| Vo = (I3\*8k) | = -20.3478\*8k = -162.7826V |

Exercise 5

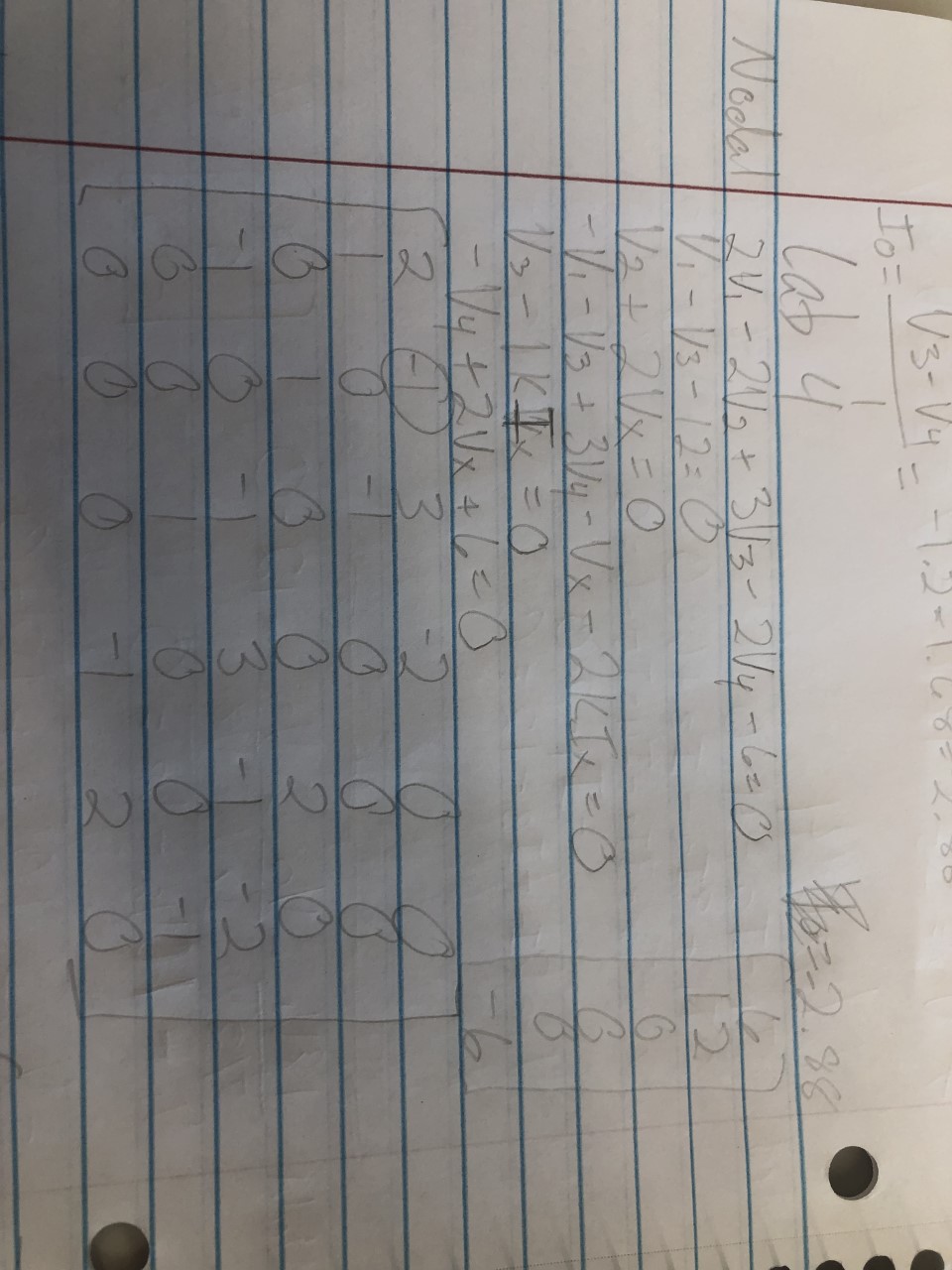
Given a new circuit, use Nodal and Mesh analysis to find voltage and current.

A close up of text on a white background

Description automatically generated

(21)

Circuit 5



(22)

Nodal Analysis equations

A picture containing monitor, electronics, indoor

Description automatically generated

(23)

Matrix Code and Answer

Nodal Summary Table

|  |  |
| --- | --- |
| V1 | 10.8V |
| V2 | 4.32V |
| V3 | -1.2V |
| V4 | 1.68V |
| Vx | -2.16V |
| Ix | -1.2mA |
| Io = (V3-V4)/1k | = (-1.2 – 1.68)/1 = -2.88mA |

Mesh Analysis

A close up of a door

Description automatically generated

(24)

Mesh Analysis equations

A screen shot of a computer monitor

Description automatically generated

(25)

Matrix Code and Answer

Mesh Summary Table

|  |  |
| --- | --- |
| I1 | -6.48mA |
| I2 | 3.12mA |
| I3 | -6.00mA |
| I4 | -0.96mA |
| I5 | 0.24mA |
| I6 | -2.16mA |
| Vx | -2.16V |
| Ix | -1.2mA |
| Io = I5 – I2 | = 0.24 – 3.12 = -2.88mA |

Bibliography

1. Circuit 1 given to analyze for exercise 1
2. Hand-written Nodal Analysis equations for exercise 1
3. Multisim matrix of answer for Nodal analysis exercise 1
4. Hand-written Mesh Analysis equations for exercise 1
5. Multisim matrix of answer for Mesh analysis exercise 1
6. Circuit 2 given to analyze for exercise 2
7. Hand-written Nodal Analysis equations for exercise 2
8. Multisim matrix of answer for Nodal analysis exercise 2
9. Hand-written Mesh Analysis equations for exercise 2
10. Multisim matrix of answer for Mesh analysis exercise 2
11. Circuit 3 given to analyze for exercise 3
12. Hand-written Nodal Analysis equations for exercise 3
13. Multisim matrix of answer for Nodal analysis exercise 3
14. Hand-written Mesh Analysis equations for exercise 3
15. Multisim matrix of answer for Mesh analysis exercise 3
16. Circuit 4 given to analyze for exercise 4
17. Hand-written Nodal Analysis equations for exercise 4
18. Multisim matrix of answer for Nodal analysis exercise 4
19. Hand-written Mesh Analysis equations for exercise 4
20. Multisim matrix of answer for Mesh analysis exercise 4
21. Circuit 5 given to analyze for exercise 5
22. Hand-written Nodal Analysis equations for exercise 5
23. Multisim matrix of answer for Nodal analysis exercise 5
24. Hand-written Mesh Analysis equations for exercise 5
25. Multisim matrix of answer for Mesh analysis exercise 5