Chapter 4 - Methods of Analysis of Resistive Circuits

Lecture 13

Section 4.6

MEMS 0031 Electrical Circuits

Mechanical Engineering and Materials Science Department
University of Pittsburgh

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Student Learning Objectives

Chapter 4 -
Methods of Analysis
of Resistive Circuits

MEMS 0031

Learning Objectives

4.6 Mesh Current
Analysis with
Independent
Current and
Voltage Sources

Summary

At the end of the lecture, students should be able to:

▶ Apply Mesh Current Analysis (MCA) to circuits
with independent current and voltage sources

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MCA with Independent Current and VS

▶ For N_c current sources, we will construct N_c current equations relating each current source to 1 or more mesh currents

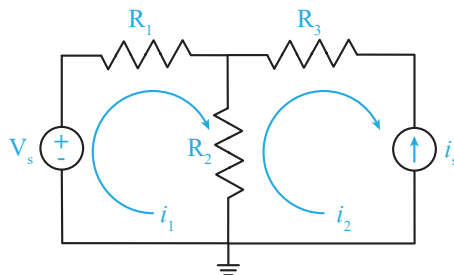▶ When a current source is shared by two mesh currents, we construct a "supermesh":

$$\# \text{KVL Eqns.} = N - N_c$$

▶ Otherwise, we will construct N KVL equations where we apply a voltage drop across the current source

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Current Source with Singular MC

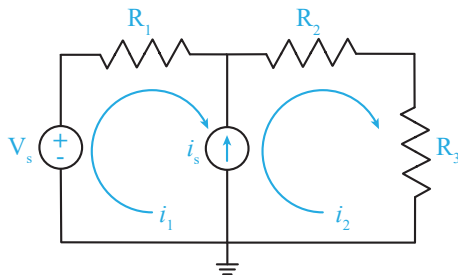▶ Relate the mesh current i_2 to the current source i_s

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Current Sources with Multiple MC

▶ Relate the mesh currents i_1 and i_2 to the current source i_s
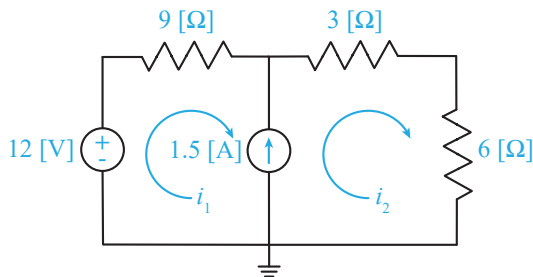

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Example #1

Learning Objectives

4.6 Mesh Current
Analysis with
Independent
Current and
Voltage Sources

Summary

▶ Solve without the use of a "supermesh"

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Example #1

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4.6 Mesh Current
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Summary

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Example #2

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Learning Objectives

4.6 Mesh Current
Analysis with
Independent
Current and
Voltage Sources

Summary

▶ Solve with the use of a "supermesh"
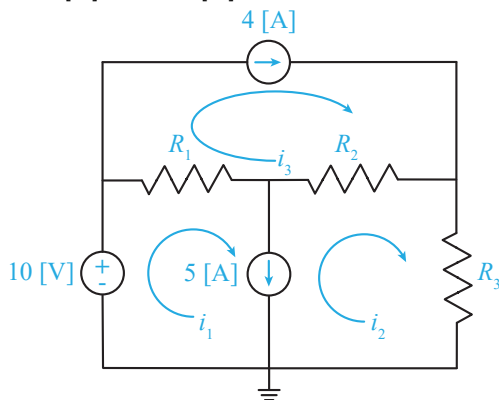
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Example #3

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4.6 Mesh Current
Analysis with
Independent
Current and
Voltage Sources

Summary

▶ Using MCA, find the mesh currents if $R_1=R_2=1$ [Ω], $R_3=2$ [Ω] with the use of a "supermesh"

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Example #3

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Learning Objectives

4.6 Mesh Current
Analysis with
Independent
Current and
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Summary

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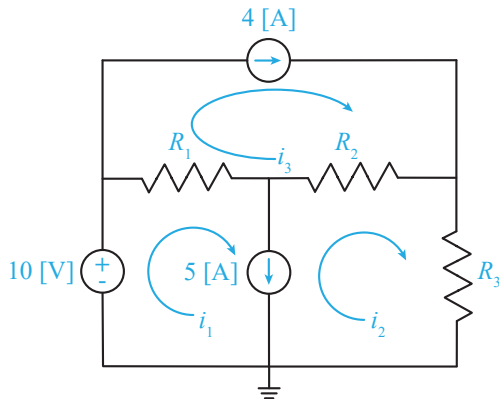# Example #4

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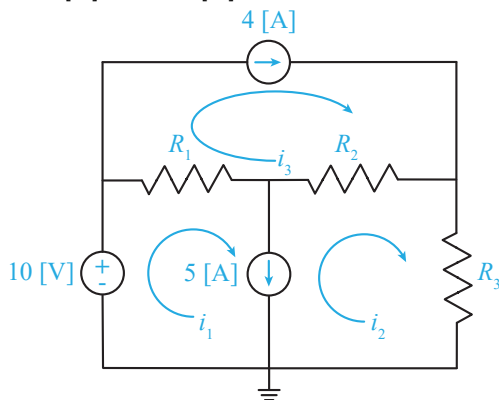Methods of Analysis
of Resistive Circuits

MEMS 0031

Learning Objectives

4.6 Mesh Current
Analysis with
Independent
Current and
Voltage Sources

Summary

▶ Using MCA, find the mesh currents if $R_1=R_2=1$ [Ω], $R_3=2$ [Ω] without the use of a "supermesh"

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Example #4

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4.6 Mesh Current
Analysis with
Independent
Current and
Voltage Sources

Summary

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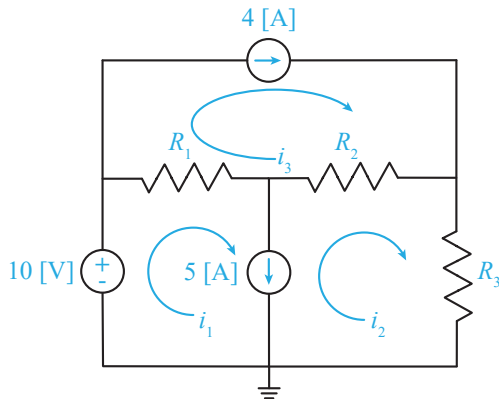# Example #5

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Learning Objectives
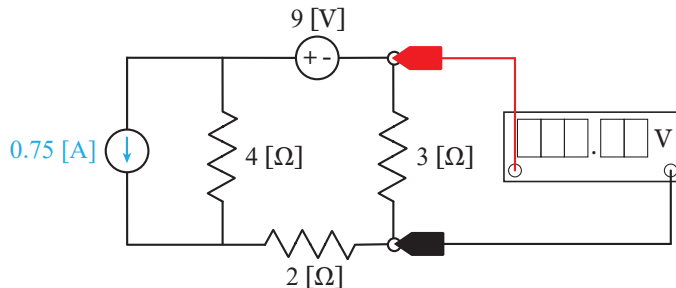
4.6 Mesh Current
Analysis with
Independent
Current and
Voltage Sources

Summary

▶ Using MCA, determine the voltage measured by
the voltmeter:
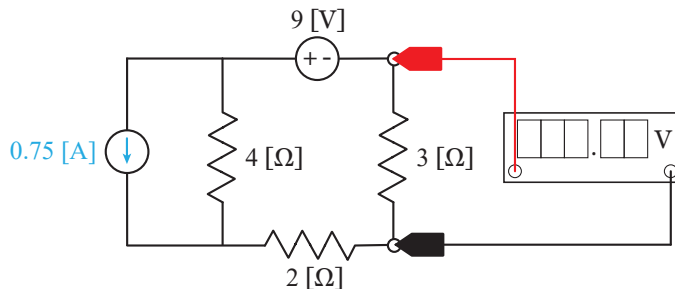
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Example #5

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Learning Objectives

4.6 Mesh Current
Analysis with
Independent
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Summary

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Student Learning Objectives

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Learning Objectives

4.6 Mesh Current
Analysis with
Independent
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Voltage Sources

Summary

At the end of the lecture, students should be able to:

► Apply Mesh Current Analysis (MCA) to circuits with independent current and voltage sources

  ► MCA requires us to specific $N - N_c$ KVL loops, and solve for the mesh currents using Ohm's law. The current source(s) specify the mesh current(s). A current source shared by two mesh currents is known as a "supermesh"

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Suggested Problems

- ▶ 4.6-1, 4.6-2, 4.6-4, 4.6-5, 4.6-7, 4.6-8, 4.6-13

Learning Objectives

4.6 Mesh Current
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Summary

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