

Chapter 4 - Methods of Analysis of Resistive Circuits

Lecture 14 Section 4.7

MEMS 0031 Electrical Circuits

Mechanical Engineering and Materials Science Department
University of Pittsburgh



Student Learning Objectives

Chapter 4 -
Methods of Analysis
of Resistive Circuits

MEMS 0031

Learning Objectives

4.7 Mesh Current
Analysis with
Dependent Sources

Summary

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

- ▶ Apply Mesh Current Analysis (MCA) to circuits with dependent sources



- ▶ We must write the dependent source value in terms of the mesh currents.
- ▶ 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”:

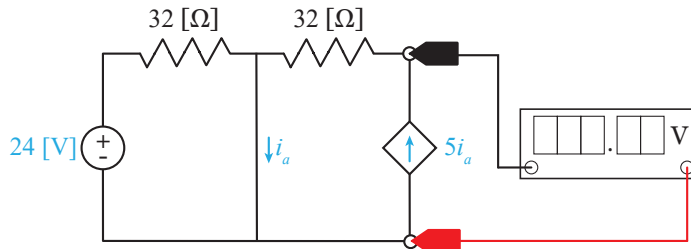
$$\# \text{ KVL Eqns.} = N - N_c$$

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



Example #1 - CCCS

- Using MCA, find the voltage measured by the voltmeter:



Example #1 - CCCS

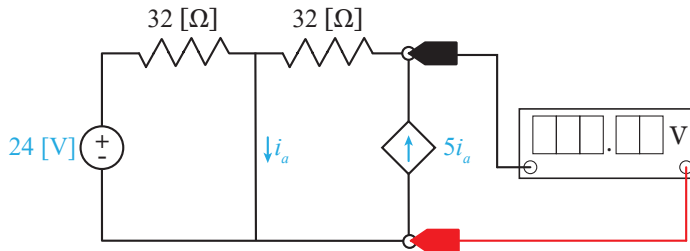
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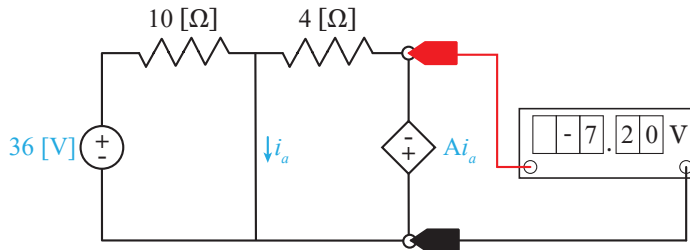
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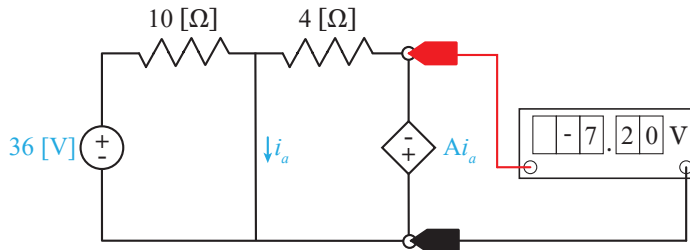


Example #2 - CCVS

- Find the gain of the CCVS:

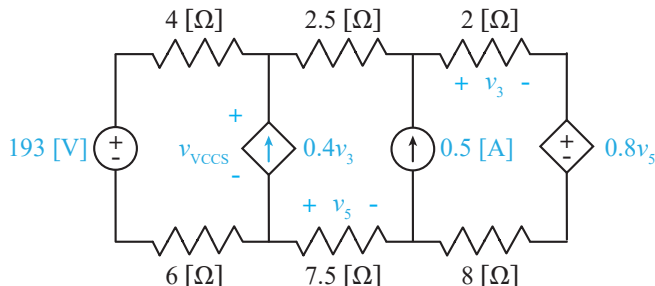


Example #2 - CCVS



Example #3 - VCCS and VCVS

- Find the voltage v_{VCCS}



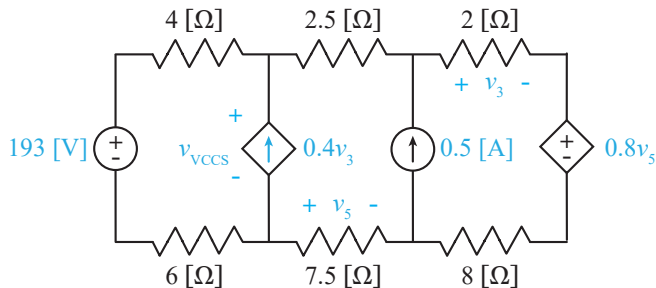
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4.7 Mesh Current Analysis with Dependent Sources

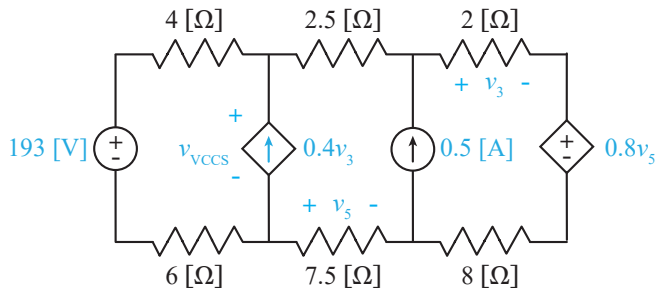
Summary



Example #3 - VCCS and VCVS



Example #3 - VCCS and VCVS



Student Learning Objectives

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

- ▶ Apply Mesh Current Analysis (MCA) to circuits with dependent sources
 - ▶ MCA requires us to specify $N - N_c$ 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”. The inclusion of dependent sources does not change our method of analysis.



Suggested Problems

- ▶ 4.7-1, 4.7-2, 4.7-3, 4.7-4, 4.7-5, 4.7-6, 4.7-7, 4.7-11, 4.7-12, 4.7-13, 4.7-14

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