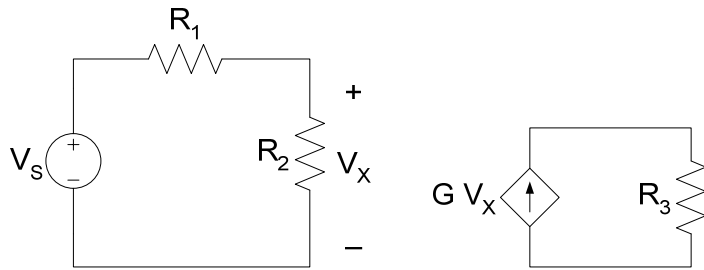


Lecture 7: Linear Dependent Sources

Today we will look at special voltage and current sources called **dependent sources**.

A dependent source has a voltage or current that depends on a different voltage or current somewhere in the circuit (or even in a different, detached circuit).



Four Types of Linear Dependent Sources

Constant of proportionality

Parameter being sensed
(controlling voltage/current)

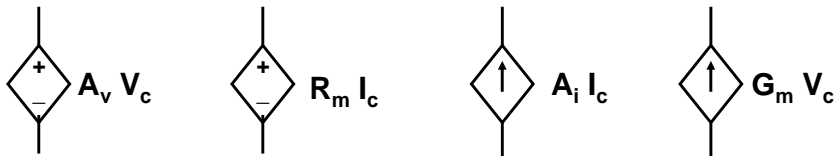
Output

Voltage-controlled voltage source ... $V = A_v V_c$

Current-controlled voltage source ... $V = R_m I_c$

Current-controlled current source ... $I = A_i I_c$

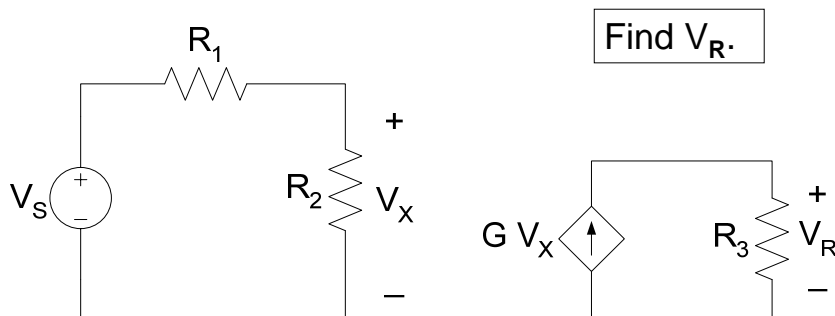
Voltage-controlled current source ... $I = G_m V_c$



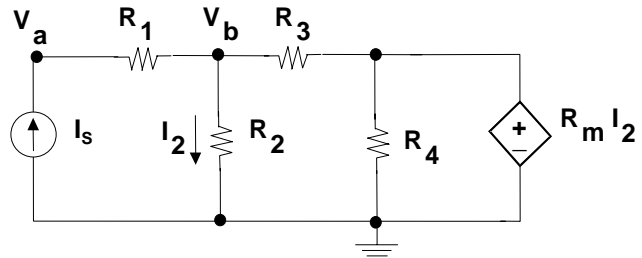
Analyzing Circuits with Linear Dependent Sources

- Circuits with linear dependent sources can be analyzed using the tools we have learned so far.
- A dependent voltage source acts like an independent ideal voltage source: it tells us what its voltage is, but the current is unknown.
- Similarly, a dependent current source tells us what its current is, but the voltage is unknown.
- We just need to write an **extra equation** that specifies what the **controlling voltage or current** is.

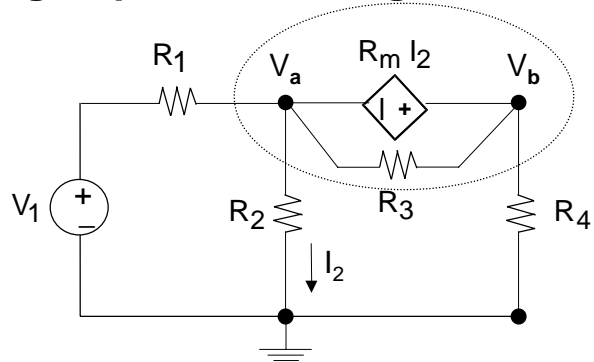
Example



Nodal Analysis with Dependent Sources



Floating Dependent Voltage Sources

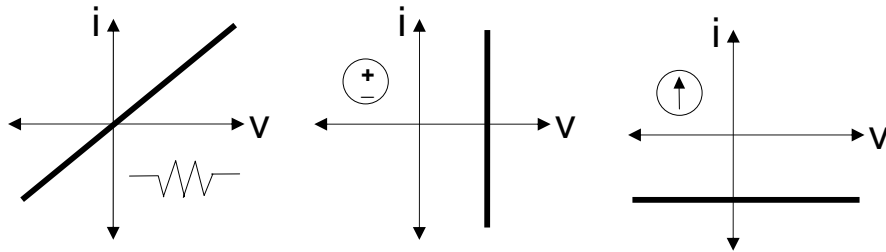


Linearity of I-V Relationship

- Whenever a circuit is composed only of the elements we have studied so far,

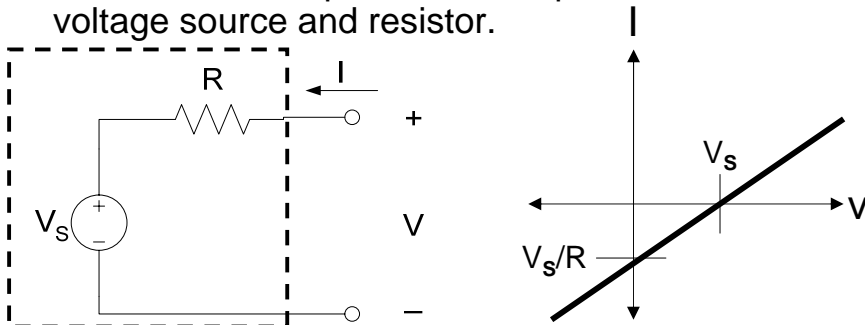
- Ideal Independent Voltage and Current Sources
- Linear Dependent Voltage and Current Sources
- Resistors

the I-V relationship is always a line. Simple examples:



Equivalent Circuits

- Consider the simple circuit composed of a voltage source and resistor.



- This circuit has a linear I-V relationship:

$$I = (V - V_S) / R \quad I = (1/R) V - V_S / R$$
- With proper choice of V_S and R , this circuit can mimic any other circuit we have studied so far.

I think the pace of the course is:

Too slow

Okay

Too Fast

I think the pace of lecture is:

Too slow

Okay

Too Fast

I think the pace of discussion section is:

Too slow

Okay

Too Fast

I have previously taken a course in:

Physics (Calculus/College Level)

Physics (High School)

Electricity/Electronics