

Chapter 6 - The Operational Amplifier

Lecture 20

Section 6.6

Learning Objectives

6.6 Operational
Amplifier Circuits
and Linear
Algebraic Equations

Summary

MEMS 0031 Electrical Circuits

Mechanical Engineering and Materials Science Department
University of Pittsburgh



Student Learning Objectives

Chapter 6 - The
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At the end of the lecture, students should be able to:

- ▶ Analyze and design operational amplifiers to process signals

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Signals

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- ▶ A signal is a voltage or current waveform that represents some phenomena

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Linear Combination of Signals

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- ▶ Linear circuits obey superposition:

$$f(ax_1 + bx_2) = af(x_1) + bf(x_2)$$

- ▶ If there are three inputs, x_1 , x_2 , and $x_3=5$, and one output, y , then, for example, the output may be formulated as:

$$y = 4x_1 - 2x_2 + 5$$

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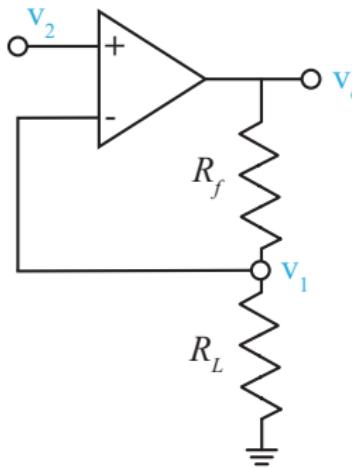


Multiplication by a Constant

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- ▶ Say we want the output to be $y = 4x_1 - 2x_2 + 5$
- ▶ To achieve $4x_1$, using a non-inverting op-amp



Learning Objectives

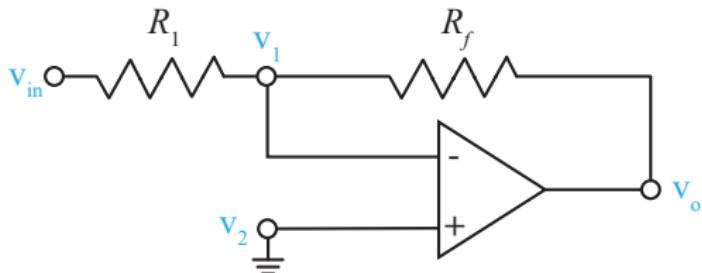
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Multiplication by a Constant

- ▶ Say we want the output to be $y = 4x_1 - 2x_2 + 5$
- ▶ To achieve $-2x_2$, using an inverting op-amp



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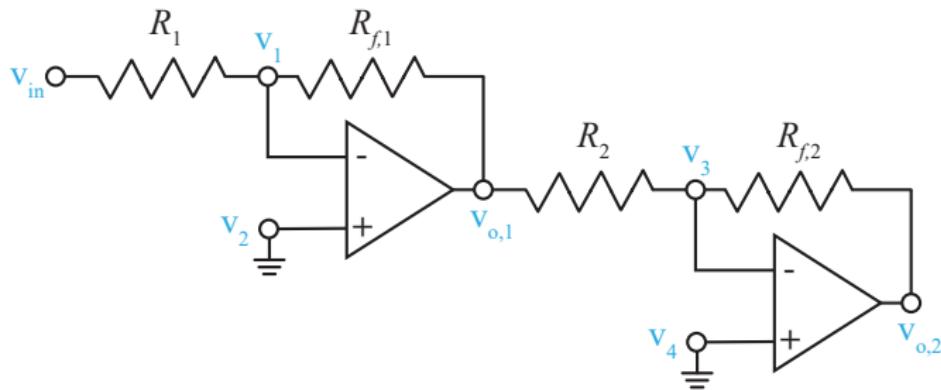


Multiplication by a Constant

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- ▶ What happens when we need a positive gain such that $0 < k < 1$?



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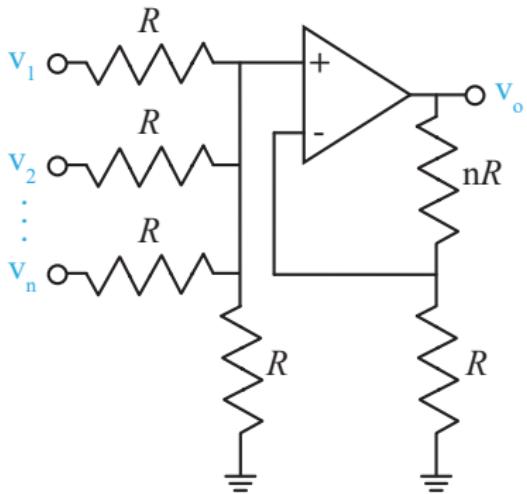
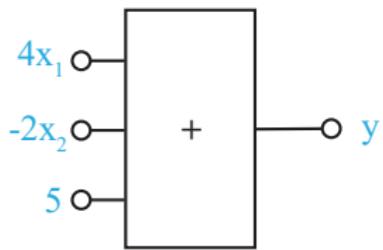
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Addition of Signals

- We can use a summing amplifier to add multiple inputs



Learning Objectives

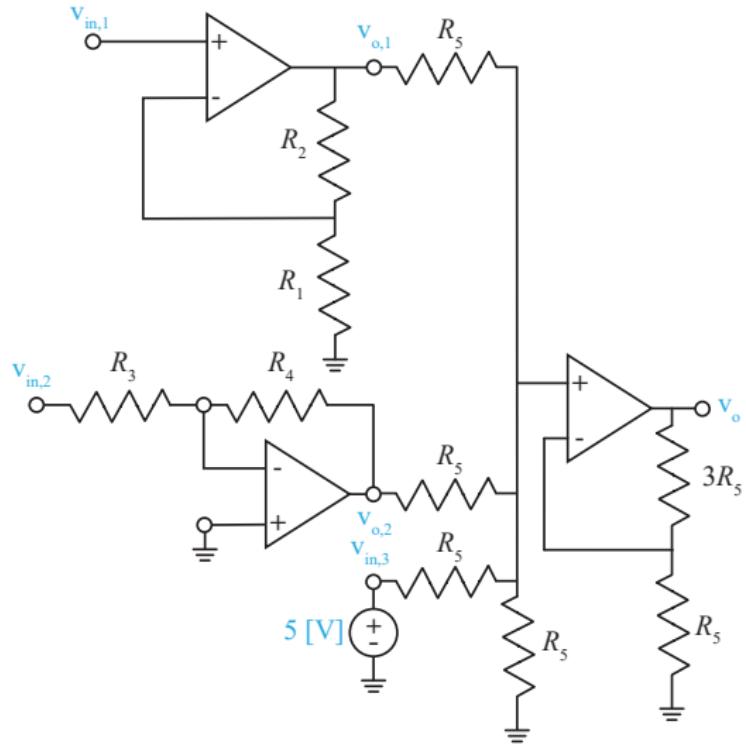
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Addition of Signals

- ▶ Say we want the output to be $y = 4x_1 - 2x_2 + 5$



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

- ▶ Analyze and design operational amplifiers to process signals
- ▶ The use of a summing amplifier let's use add multiple input signals. If all the input resistances are the same, there will be equal weights to the inputs.

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6.6 Operational Amplifier Circuits and Linear Algebraic Equations

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Suggested Problems

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- ▶ 6.5-1, 6.5-3, 6.5-7, 6.5-9, 6.5-11, 6.5-13, 6.6-1, 6.6-2

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