

Ideal operational amplifier tutorial outline

Introduction:

In the voltage divider tutorial that you already completed, you learned the fundamentals of Simscape and Simulink by building a simple circuit. This tutorial will review these concepts while introducing the Simulink scope and its uses. In this tutorial you will build two different operational amplifier configurations, inverting and non-inverting.

Getting started:

- Open Simulink and start a new model. Save this model.
- Drag and drop an Electrical Reference and solver configuration into the model and connect them.
- Change the solver by accessing 'configuration parameters' in the 'simulation' drop down menu. The parameters should look as they do in Figure 1.

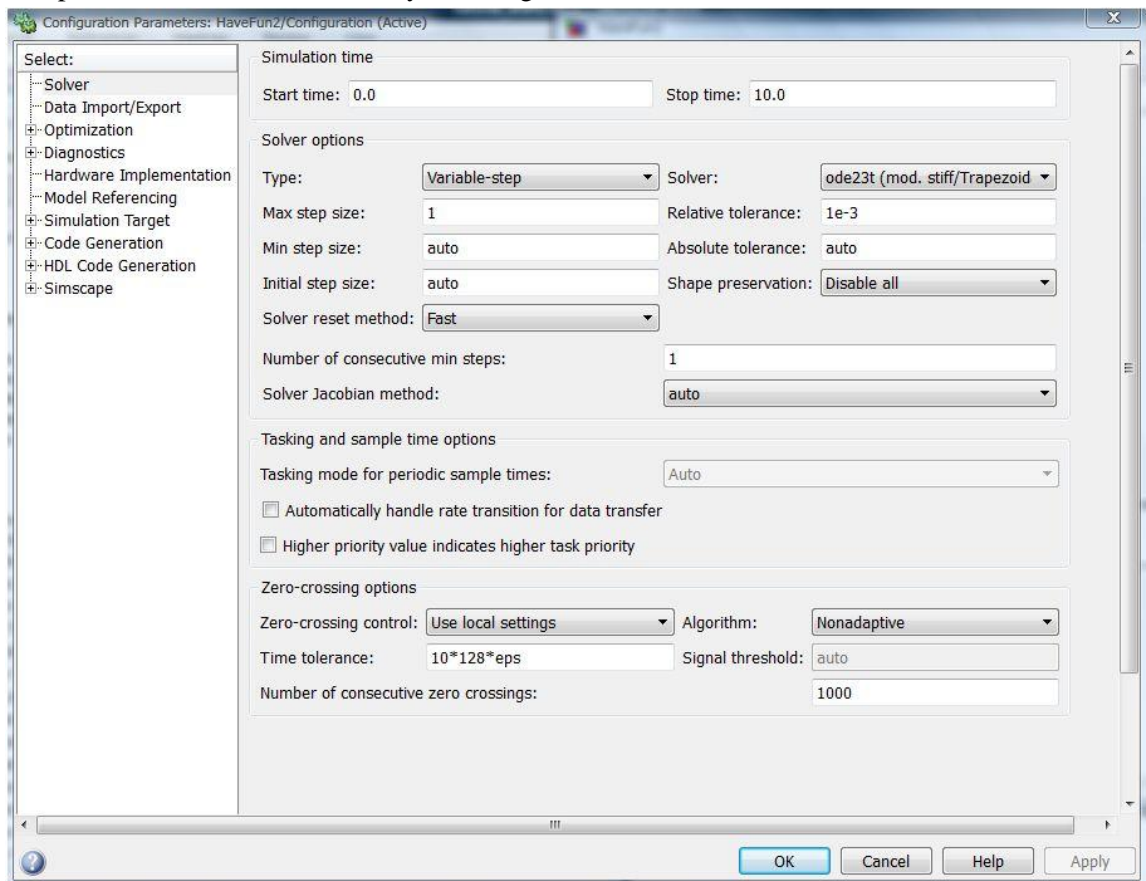


Figure 1: Configuration Parameters

Building the circuit:

- Drag in a **Finite Gain Op-Amp** (Simscape→SimElectronics→ Integrated Circuits). NOTE- this is not the same as the other two op-amps.
 - You can make the block bigger by dragging the corner of the block

- Set the values as shown in Figure 2.

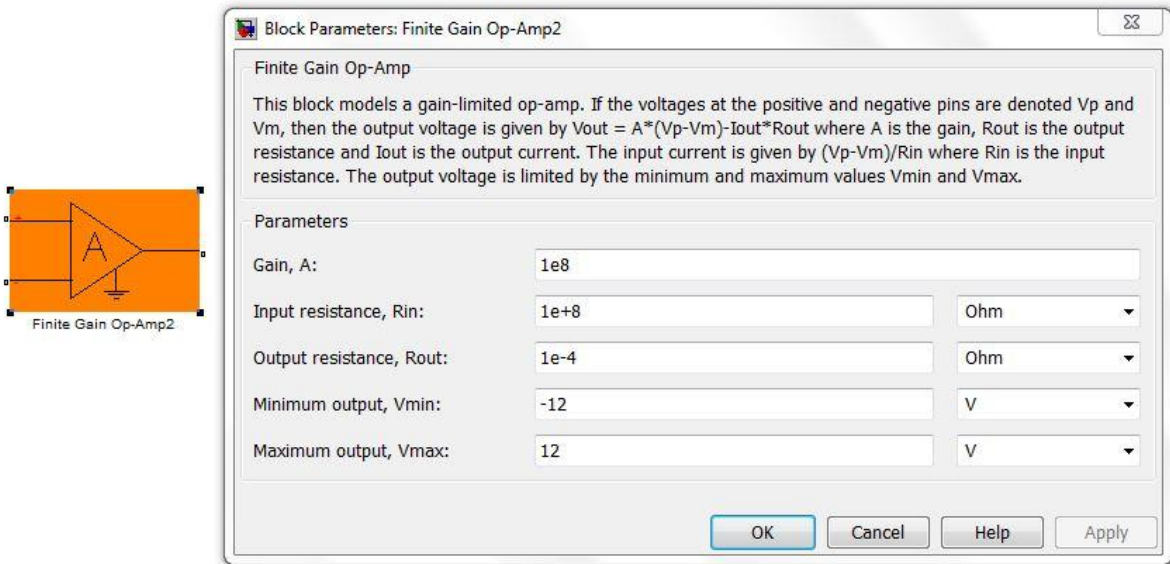


Figure 2: Finite Gain Op-Amp Parameters

- Drag in the **resistors** (Simscape→ Foundation Library → Electrical →Electrical Elements → Resistor) and a **DC voltage source** (Simscape→ Foundation Library → Electrical →Electrical Sources → DC Voltage Source). For an inverting configuration, see Figure 3. For a non-inverting configuration, see Figure 4. The circuit components are shown in orange.
 - Double click on the voltage source and set the voltage to 1 Volt.
 - Set your resistor values to achieve your desired gain

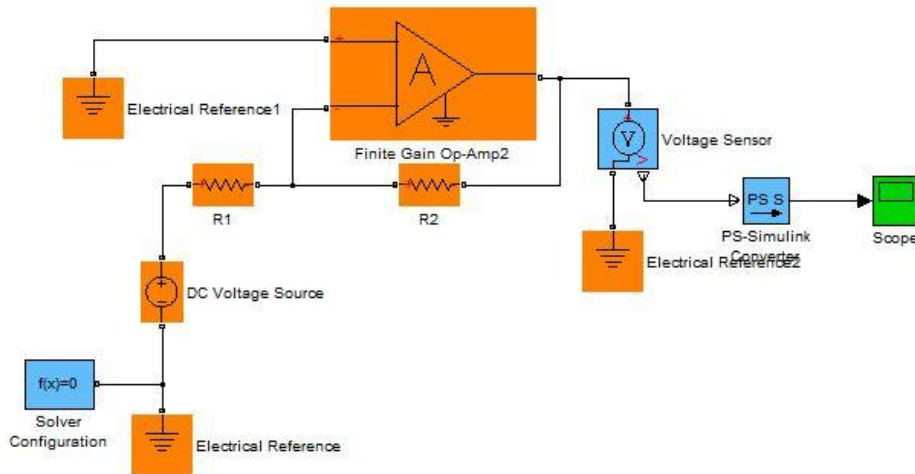


Figure 3: Inverting amplifier configuration

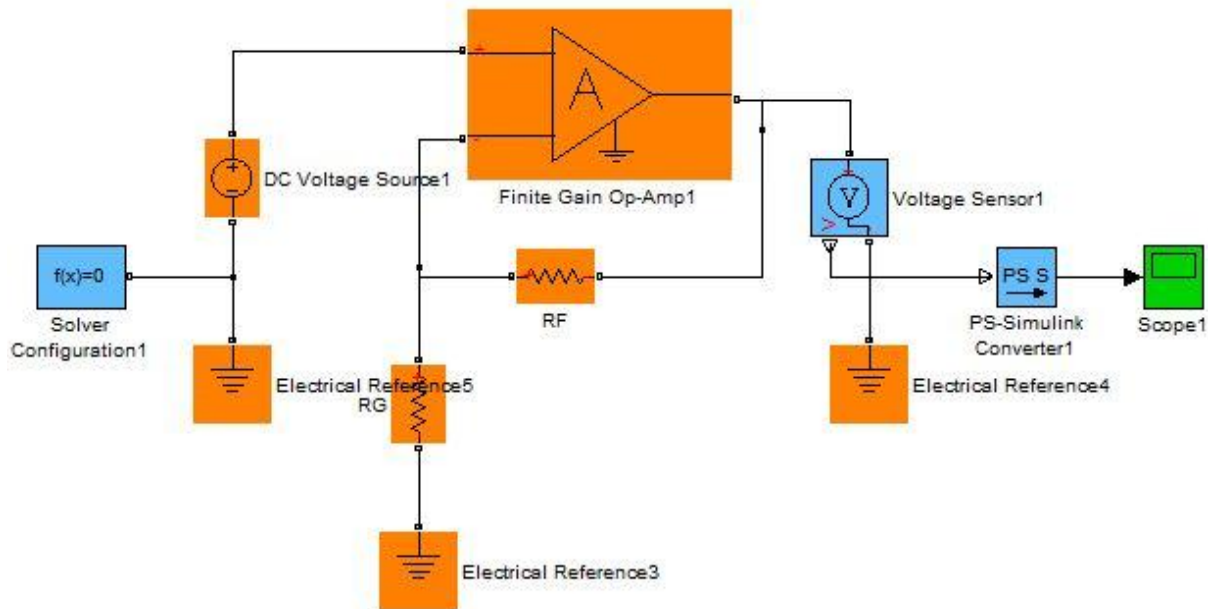


Figure 4: Non-inverting amplifier configuration

Exporting the signal to Simulink

- Connect the **voltage sensor** (Simscape→ Foundation Library → Electrical →Electrical Sensors → Voltage Sensor) and the **PS-Simulink converter**(Simscape→ Utilities →PS-Simulink converter) to the output of the circuit.

The Simulink Scope, Viewing Results:

Connect a Simulink scope to the output of the PS-Simulink converter. The Simulink scope offers several different ways to view the results of a simulation. Knowing about these different features is pivotal in effectively using this program.

1. Scope vs. Display
 - a. As a reminder, the Simulink display and scope can be found:
 - i. Simulink → Sinks → Display *or* Scope
 - b. Generally, the **scope block** is good for viewing AC circuits, transients, and any other type of non-static output. The **display block** used in the voltage divider tutorial is good for displaying a single final value. This feature is good when the output is one, unchanging, value.
2. Using the Scope block
 - a. Scope parameters
 - b. Autozoom
 - c.
3. Viewing separate data on the same axes
4. Viewing results on two different axes