ANALOG DEVICES

Mini Tutorial
MT-226

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An Engineering Manager's First Experience with Multisim

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Analog Devices, Inc.

IN THIS MINI TUTORIAL

A first-person account of an Analog Devices, Inc., manager's initial experience with the NI Multisim™ Component Evaluator–Analog Devices™ Edition simulation tool to design a simple op amp.

INTRODUCTION

As an engineering manager with several decades of experience in analog circuits, I am embarrassed to admit that until now I had never actually used SPICE or any other simulation software. I recently had the Analog Devices edition of Multisim installed on my PC, and now I am going to see if I can get a simple op amp circuit to work. Therefore, with my office door firmly locked, I open Multisim and begin my quest into the world of analog simulation.

GETTING STARTED

Of course, Multisim offers plenty of tutorials under the **Help** menu; however, like most engineers, I decide to bypass that step and dive right into the program. How difficult could it be?

I open the program and begin by looking at the menus. The **Place** menu item (see Figure 1) seems like a good starting point.

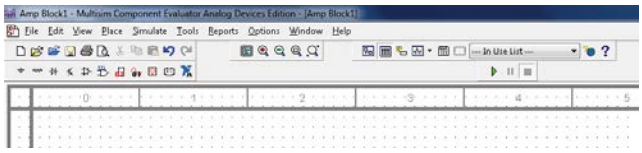

Figure 1. Multisim Menu Toolbar

After clicking **Place**, I choose **Component** (see Figure 2); now, I can choose an op amp. I pick the **OP282GP**.

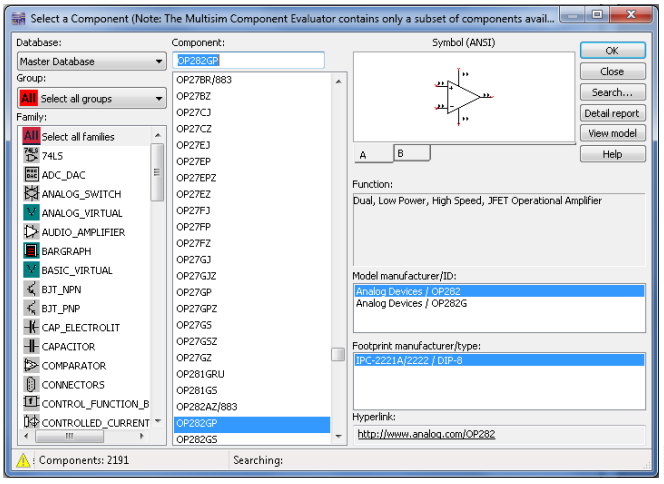

Figure 2. Selecting the Op Amp

MAKING SELECTIONS

Now, a choice of the letters (**A** or **B**) displays (see Figure 3). It seems that these are the different channels of the amplifier (although this is a two-channel op amp); I choose **A**. So far, so good. Next, another window pops up with more letters. I hit **Cancel**, because one selection seems enough for now. I am left with the display shown in Figure 4.

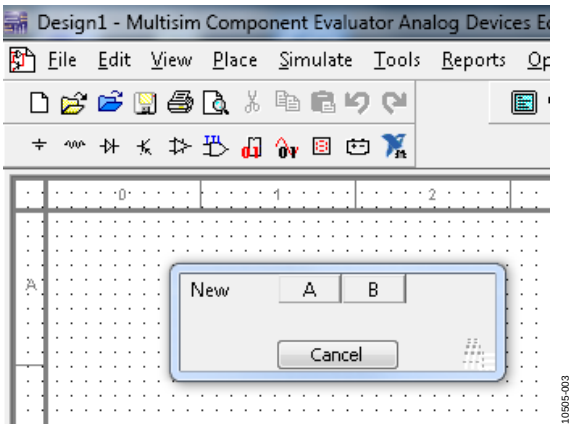

Figure 3. Getting Rid of the Second Op Amp in a Dual Op Amp

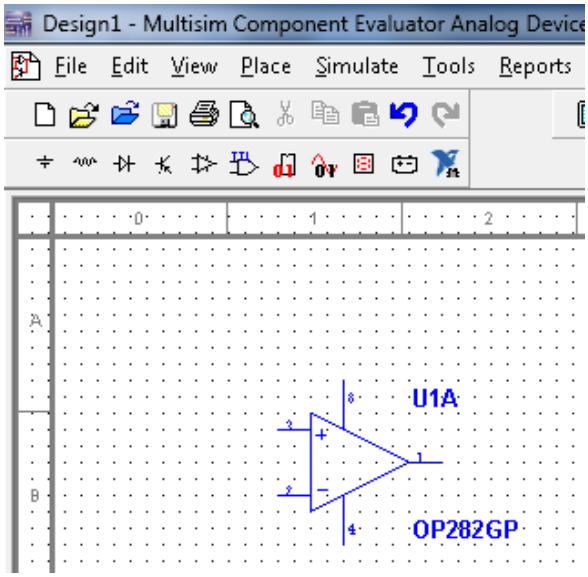

Figure 4. A Single Op Amp Ready for More Connections

Later, I learn that there are multiple ways to place a component. Right-clicking anywhere on the grid displays a window that easily allows you to **Select a Component** as shown in Figure 2.

This is a good time to think about saving. I save my file, naming my circuit **AMP Block1**.

CONNECTING THE POWER SUPPLIES

As I look at the part displayed on the screen, I decide to connect the power supplies. Though I do not see a menu that looks like it provides power supplies, I learn later that this can be accomplished via the **Component** menu.

When I right-click on the menu bar, a drop-down box supplies choices to select power source components. Unsure what to do, I move the cursor over the possible supplies. One is Digital Ground and another is Ground. I know I will need an analog ground, so I choose Ground. I place it on the drawing.

Next, I choose VCC and click on Pin 8 of the amplifier; it automatically connects. VEE should work the same. It does, but it looks funny (see Figure 5) on top of the Pin 4 line. I drag it lower and it looks better (see Figure 6). I have got + and − 5 V on my supplies. The part will work with these values, so I leave them alone for now.

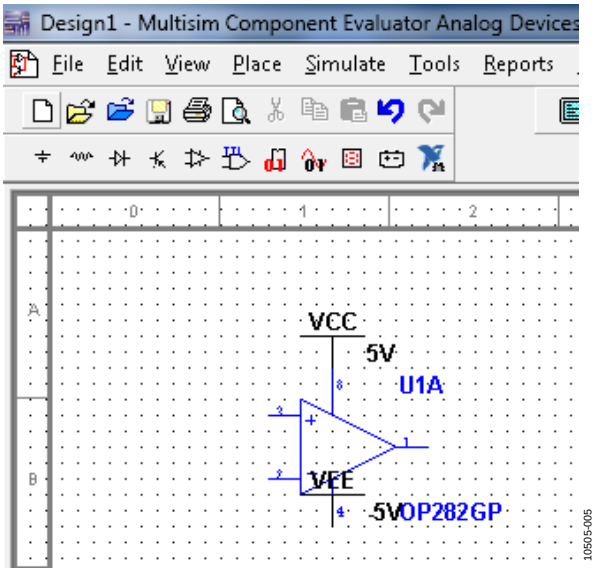

Figure 5. First Attempt to Connect VEE

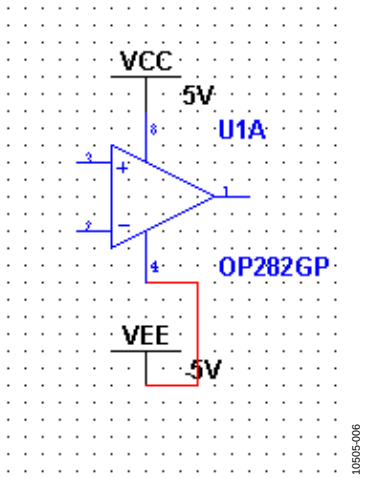

Figure 6. Dragging VEE Makes it Look Better

ADDING RESISTORS

My interest is amplifiers, and an inverting gain amplifier is about as simple as it gets; I am going to put in a few resistors. Again, I select the **Place** menu that I used for the amplifier. However, I notice at the left of the screen a selection of various components. From **Family**, I choose **RESISTOR** (see Figure 7) with a value of **10 kΩ**, and then click **OK** and place the resistor connecting it to Pin 2. The menu automatically pops up, and I place another 10 kΩ to the same node. Again, the menu pops up. I need one more resistor for the noninverting input and choose a 5 kΩ resister, even though this is a JFET op amp, and I may have done better to leave it off. I can check later to see if this increased the noise and was or was not a good decision.

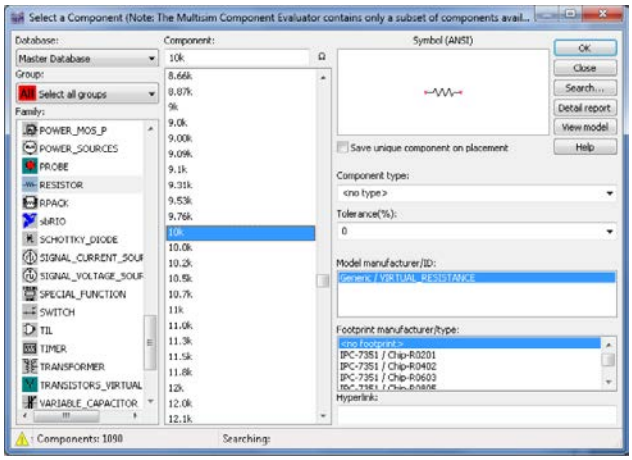

Figure 7. Selecting Resistor Values

This seems like a good time to connect the 5 kΩ resistor to ground. I click on it and drag to the ground symbol. It connects. If I want to rotate it, I can do a **Control-R**. The 10 kΩ feedback resistor is sitting on top of the amplifier, so I drag it lower. Now I find out it is not connected to the input; it does not connect. After looking at the menus, I decide to select **Place** and then **Junction**. After some playing around, I am finally able to connect three components to the same node (see Figure 8).

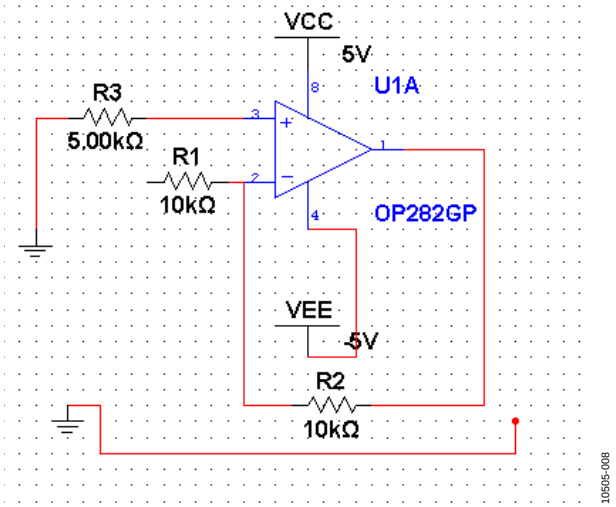

Figure 8. All Resistors Placed, but Some Connections Missing

At this point, I think I am getting close. I am going to add another junction so that I can have an output.

FINISHING UP

After that, I'm almost done. I do not know how to connect inputs and output or how to do anything. I decide to toggle the **Simulation** switch. I get a note at the bottom of the window (see Figure 9).

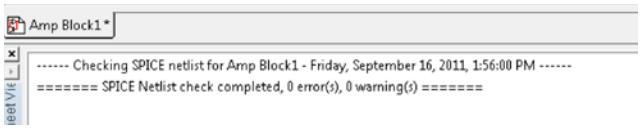

Figure 9. No Errors Present in the Circuit

Not too impressive, but not too bad. There are no errors. I suppose I need an input and something to measure the output.

After looking through the menus, I select **Place > Component > Sources**, and chose **SIGNAL_VOLTAGE_SOURCES**. Then, I chose **AC_VOLTAGW**. I connected this to the 10 kΩ input resistor.

Next, I need a way to view the output. I find an oscilloscope by selection **Simulate > Instruments**. I chose the oscilloscope and connect one channel to the output of the AC_VOLTAGW and the other to the output of the amplifier. I ground one oscilloscope channel. Later, I find that this is not necessary, in most instances. I think I am ready to try this now (see Figure 10).

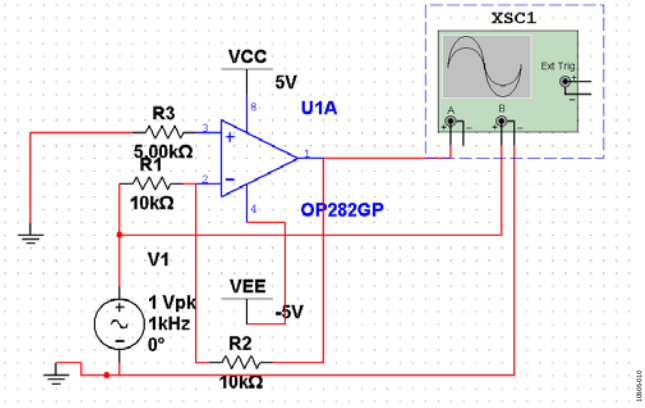

Figure 10. Connecting the Input Source and an Oscilloscope to the Output

When I click the **Simulate** button in the upper right nothing happens.

Then, I double-click the oscilloscope and —surprise—this thing works (see Figure 11)!

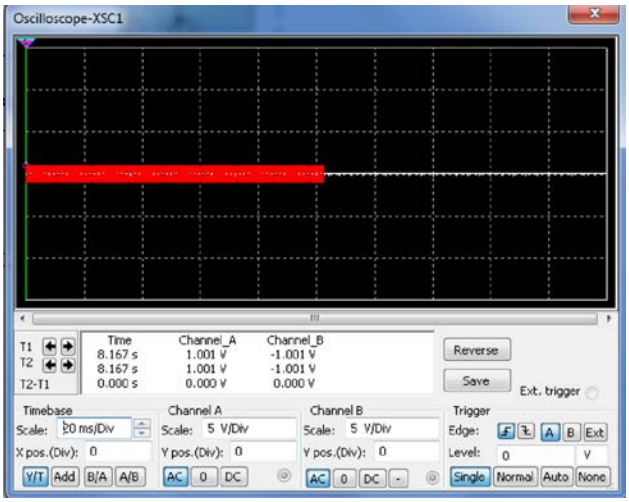

Figure 11. Oscilloscope Display

With a quick change of scales, I get the results shown in Figure 12.

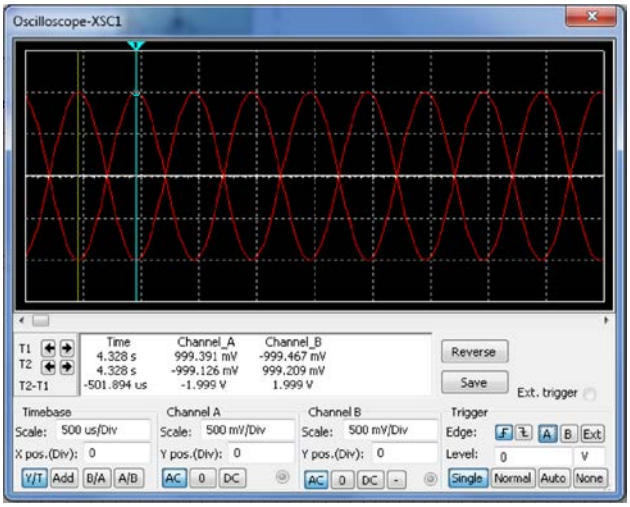

Figure 12. Oscilloscope Display After Changing Scales

I have completed my first simulation. Although it is only a simple inverting amplifier, I am ready to try more. I could easily make a filter. On the other hand, maybe I will try to see if the noise is low enough for my application. I can at least unlock my office door now.

REVISION HISTORY

1/12—Revision 0: Initial Version

MT10505-0-1/12(0)