**Op amp modeling with LTspice**

**Op amp model installation**

We use opamp **LM741** for the schematics. Go to Canvas, or <https://www.ti.com/product/LM741> and download the PSPICE model. Unzip to obtain the LM741.MOD file. Move the file to the sub-circuit (sub) directory of the library (lib) folder of the LTspice program on your computer (see example below). When you build your opamp circuit, add the “opamp2” component to your circuit schematic and give it the value “LM741/NS”. Add a .include SPICE directive to use this opamp. Here, your opamp will be powered by ±15V power rails.

Look up the **data sheet** for the opamp LM741. Some key points to note on the data sheet are:

(1) Supply voltage range: voltage rails to power the opamp

(2) Output swing: range of output voltage

(3) Maximum (i.e., short-circuit) current output: the most current you can draw from the opamp

(4) Bandwidth: range of input frequency where the opamp works normally

(5) Slew rate: fastest speed at which the opamp’s output can change

**Practice op amp circuit**

Build the following op amp voltage follower (buffer) circuit:

Diagram, schematic

Description automatically generated

Notice the following important issues of the above circuit:

1) Select the Opamps 🡪 opamp2 symbol to be your opamp here.

2) Your opamp’s instance name is U1 (which is arbitrary – your choice of name). Your opamp’s value must be set to LM741/NS, which the name of the sub-circuit of the LM741 opamp model. Cntl-Right click on your opamp to set this opamp value.

3) The .include (or .inc for short) Spice directive lets you import the LM741 opamp model (which is the “LM741.MOD” file) to your circuit. Here the LM741.MOD file is placed at C:\Program Files\...\sub. Put the .MOD file in the sub-circuit directory of the library of the LTSpice program on your computer.

4) The opamp is powered by a +15V power rail and a –15V power rail. Here the label nets V+ and V- are utilized to make your opamp connection look neat. Using label nets like this can make your circuit appear clean and organized.

5) The source voltage Vs is being DC-swept from -15V to +15V, which is the two power rail voltages. In general, a voltage follower (buffer) lets the output voltage Vout follow the input voltage Vin, but there is a limit to this voltage-following behavior. What is this limit? Probe the Vout node to find out.