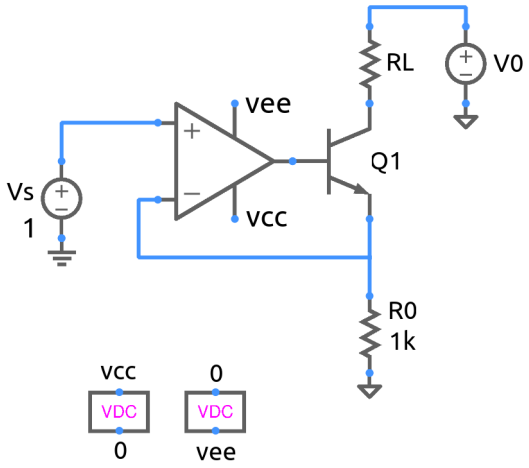
opamp_current_source.sqproj



The circuit shown in the figure can be used to provide a constant current to a load, irrespective of the voltage across the load. Assuming the Op Amp to be operating in the linear region, we have

$$V_- \approx V_+ = V_s \rightarrow I_{R0} = \frac{V_s}{R_0}\,. \tag{1}$$

Since the Op amp input current is negligible, the load current is nearly[1] equal to I_{R0}, irrespective of the value of R_L or the voltage across R_L, as long as the transistor is in its active mode.

Exercise Set

1. Run the simulation and plot I_{RL} versus R_L. Note that the current is independent of R_L for a wide range of R_L.

2. It can be seen from the plot that, if R_L is larger than a certain value (say, $R_L^{\max}$), I_{RL} starts dropping. Why does this happen? Can you predict $R_L^{\max}$?

3. Plot I_C, I_E, I_B (together) of the BJT versus R_L. Use this plot to understand the drop in current when R_L is increased beyond $R_L^{\max}$.

References

1. S. Franco, *Design with Operation Amplifiers and Analog Integrated Circuits,* McGraw-Hill, 1998.

[1]We assume that the base current of the transistor is negligibly small.