Shunt Voltage Regulator Using An Op-Amp

Theory

A shunt voltage regulator controls the output voltage by shunting current away from the load. Current flows through the load from the unregulated input voltage. To keep the regulated output voltage across the load constant, the control element draws some current away. The sampling circuit sends a feedback signal to a comparator in case the load voltage tries to change as a result of a change in the load. The comparator then sends a control signal to adjust how much current is diverted away from the load. The sampling circuit sends a feedback signal to the comparator as the output voltage tries to increase, increasing the shunt current and decreasing the load current in order to prevent the regulated voltage from increasing.
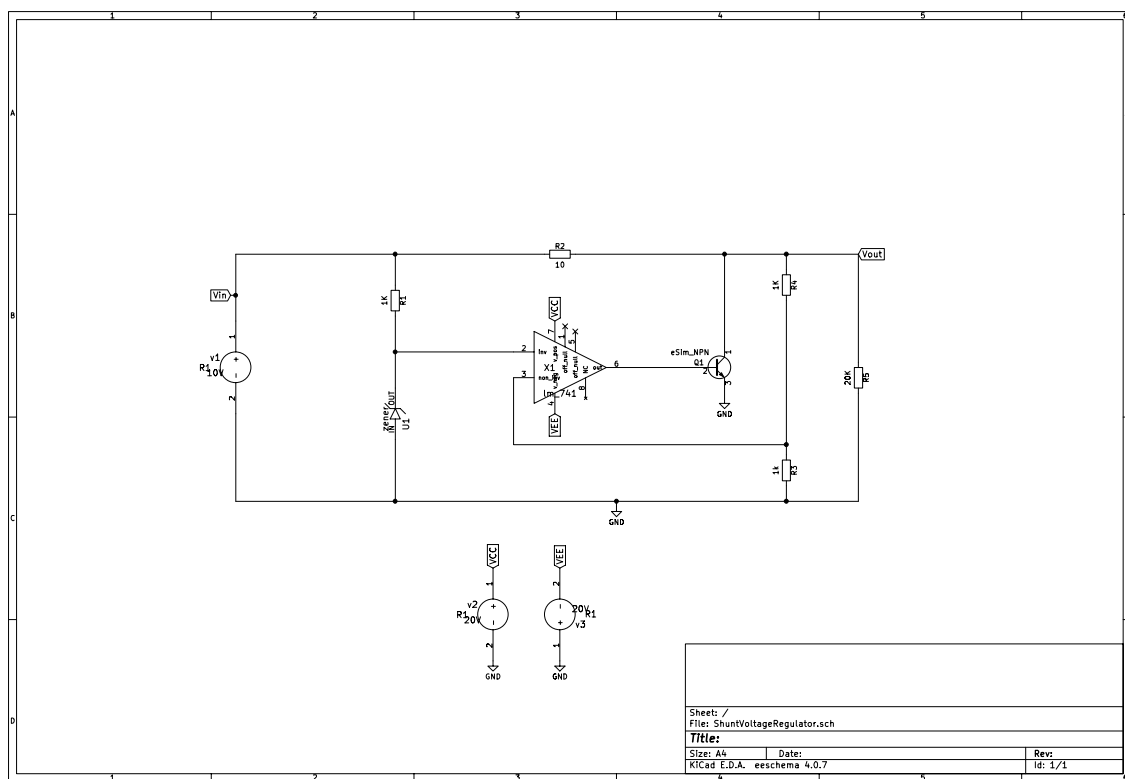

Figure 1 : Schematics of shunt voltage regulator using Op-Amp

An op-amp serves as the voltage comparator in this shunt voltage regulator. To supply the control drive current to shunt element, the Zener voltage is contrasted with the feedback voltage derived from voltage dividers R3 and R4. Thus, the output voltage is maintained by controlling the current through resistor R5 to drop a voltage across R5.

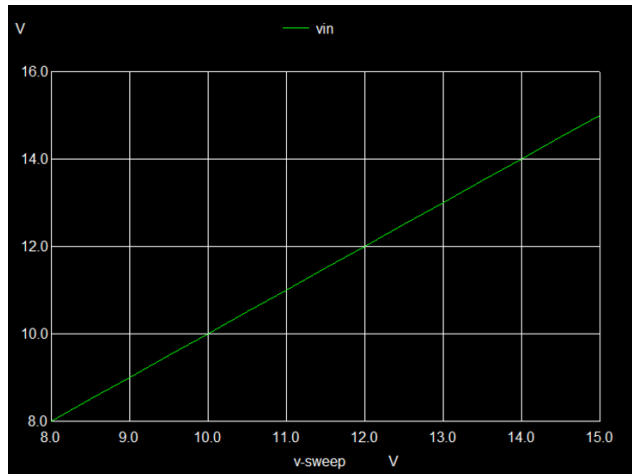# Simulation Output Results

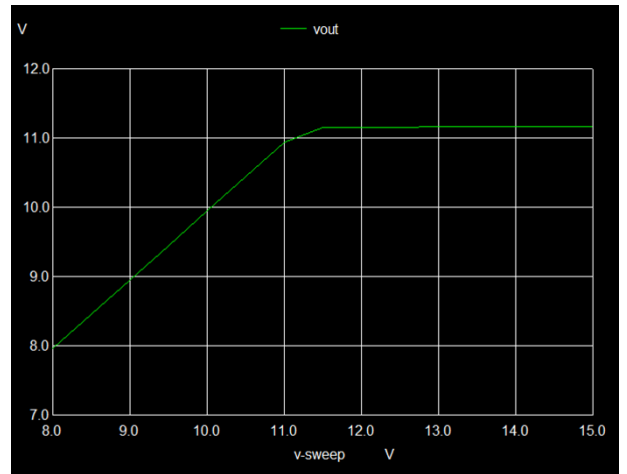## Ng SPICE Plots

Figure 2: Unregulated voltage

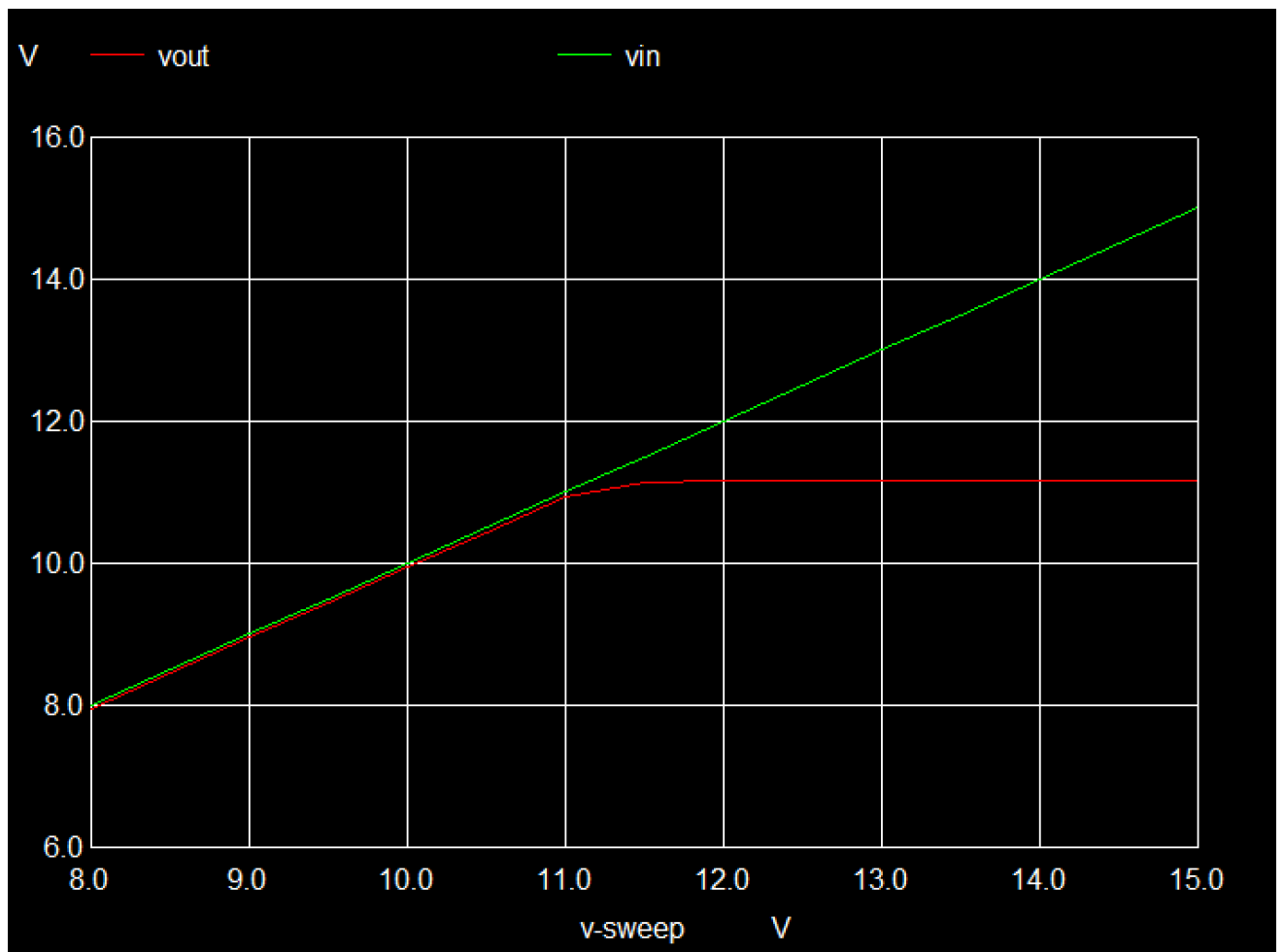

Figure 3: Regulated voltage

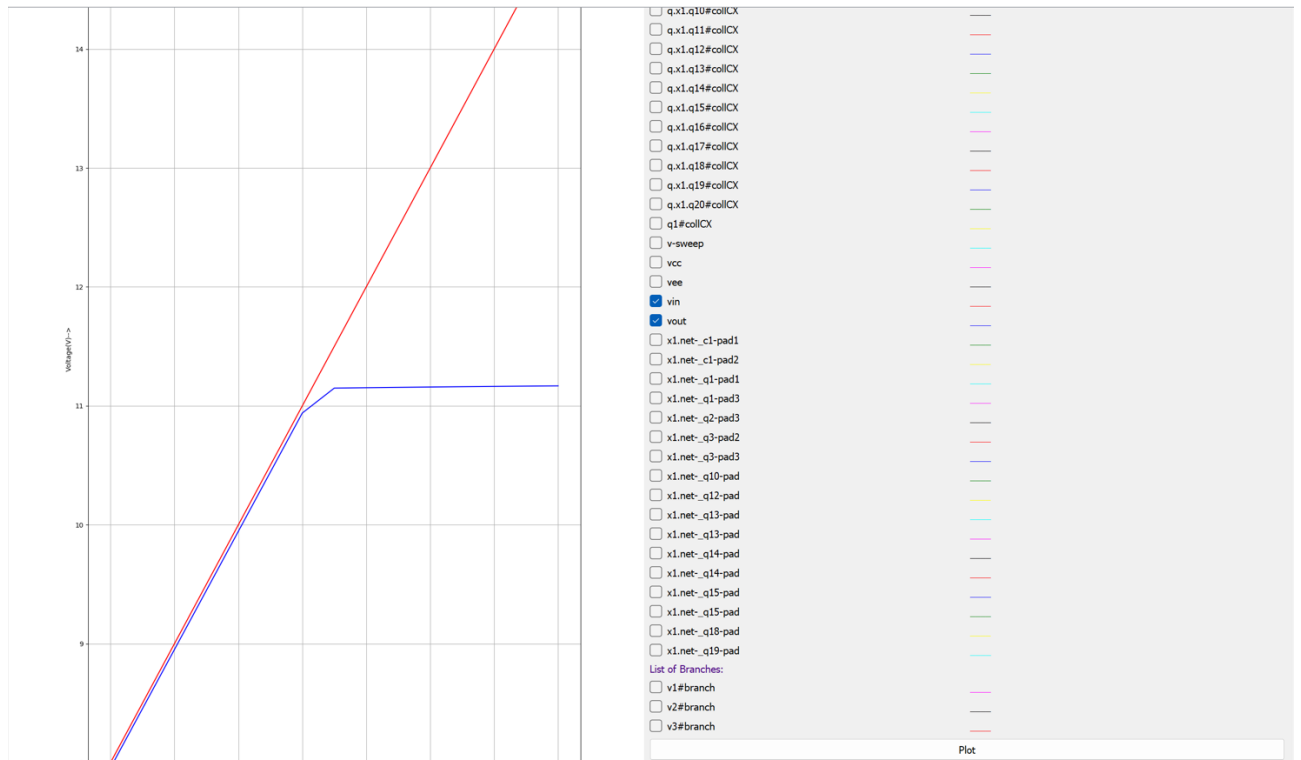Figure 3: Both Unregulated voltage (Green) and Regulated voltage (Red)

Python Plot

Figure 5: Both Unregulated voltage (Red) and Regulated voltage (Blue) in python plot

Conclusion

Thus, we have studied the Shunt Voltage Regulator Using An Op-Amp using eSim and we get the appropriate waveforms for a dc voltage sweep from 8V to 15 V in 0.5V increments and supply is regulated.

References

https://ia802709.us.archive.org/13/items/ElectronicDevicesAndCircuitTheory/Electronic%20Devices%20and%20Circuit%20Theory.pdf