Power Supply - part 1

1. Scope

- Build various type of voltage regulator
  - **Zener diode,**
  - **Zener diode+ transitor (series),**
  - Buck Switching Regulator,
  - Boost Switching Regulator,
  - Buck-Boost Switching Regulator,
  - Flyback Switching Regulator.
- Calculate circuit parameters to achieve reference voltage.

2. Zener Diode Voltage Regulator

Run Matlab and load file named LAB4.slx. Uncomment block called *Zener Diode*.

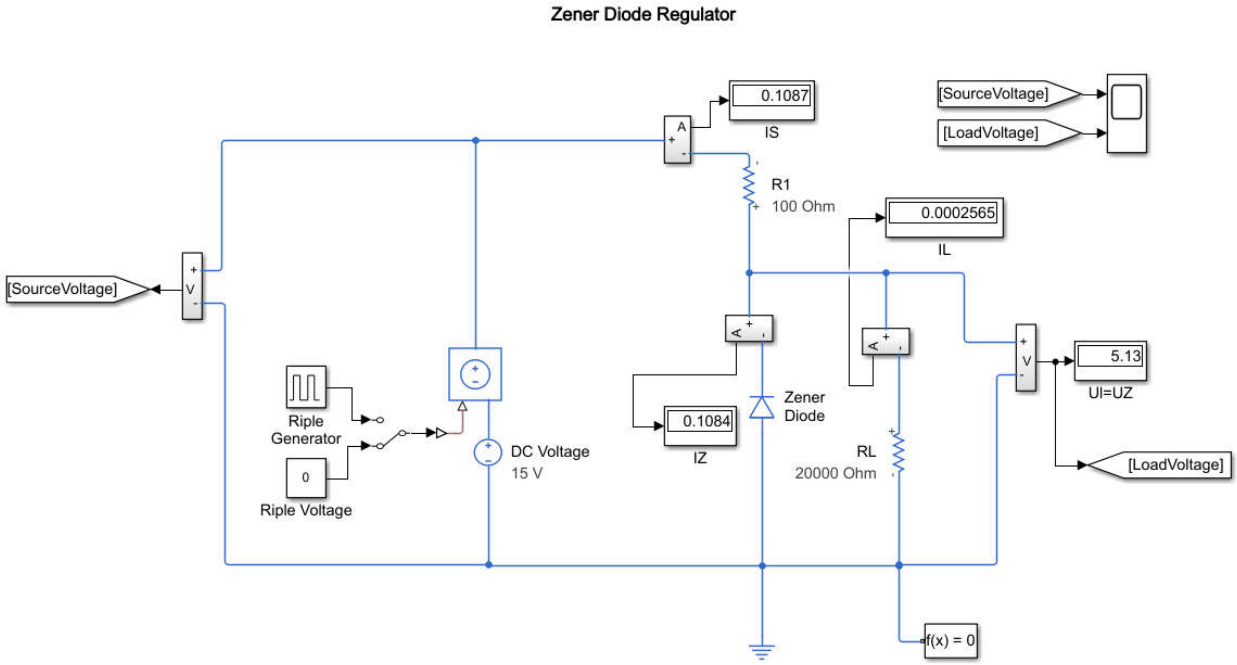

Fig. 1 Schematic of the Zener Diode Regulator

Diode parameters: IZmax=..... , UZ=.....
Assume Zener diode works correctly with the current IZ in range 10%-100% IZmax.

a) calculate value of the resistor R1 to be sure, that Zener diode works correctly.
b) calculate range of load resistance that could be supplied from the Zener regulator,
c) calculate power dissipated on load and R1,
d) plot in the Fig. 2 the characteristic UL=f(IL) with constant DC Voltage. Change IL from 0 up to max,
e) plot in the Fig. 3 the characteristic UL=f(US) with constant IL. Change US (DC voltage) IL from 10 up to 20V, modify RL to maintain constant IL.
f) change the switch to enable pulse generator. Check how pulse in the source voltage are transmitted to the load voltage. Plot results in Fig. 4.

Fig. 2 UL=f(IL) with constant DC Voltage

Fig. 3 UL=f(US) with constant IL

Fig. 4 Source Voltage, Load Voltage

Comments:

3. Zener Diode with Transistor (Series Voltage Regulator)

Run Matlab and load file named LAB4.slx. Uncomment block called *Zener Diode with Transitor (Series)*

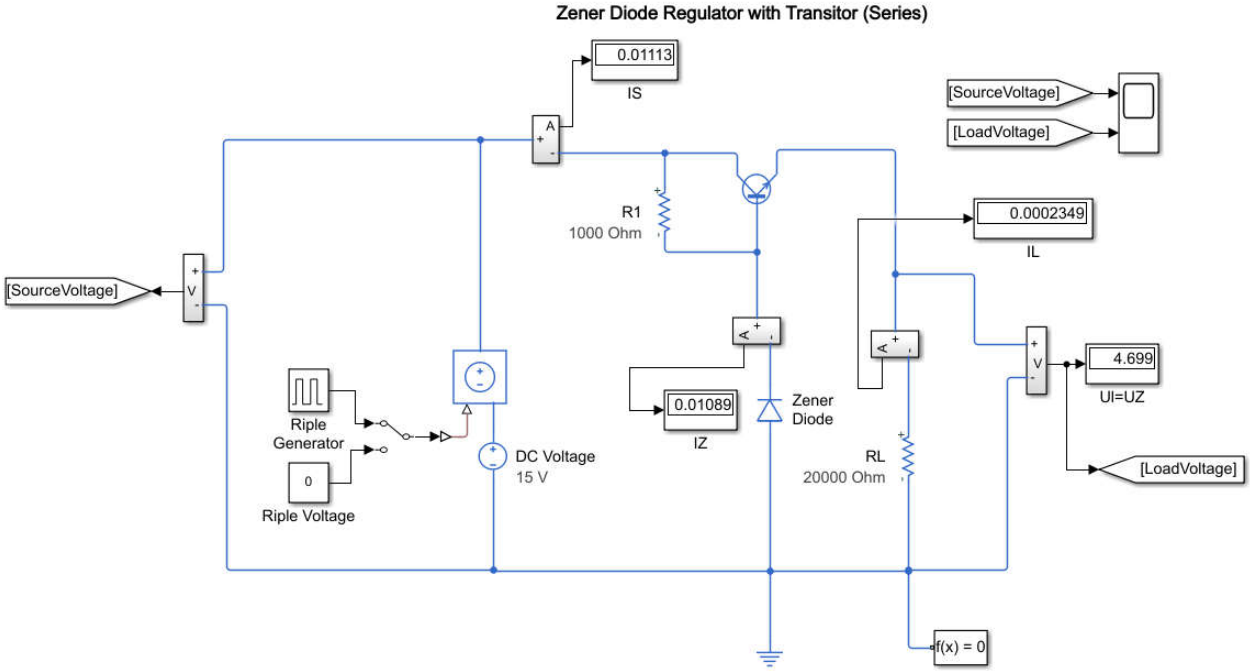

Fig. 5 Schematic of the Zener Diode Regulator with Transistor (series)

Modify the Zener Diode parameters (Reverse breakdown voltage) to get the load voltage equal 5.1 V. IZmax remain unchanged.

a) calculate value of the resistor R1 to be sure, that Zener diode works correctly.
b) determine range of load resistance that could be supplied from the regulator (load voltage is about. 5.1V),
c) calculate power dissipated on load, R1 and transistor (modify schematic to measure transitor voltage Uce),
d) plot in the Fig. 6 the characteristic UL=f(IL) with constant DC Voltage. Change IL from 0 up to max,
e) plot in the Fig. 7 the characteristic UL=f(US) with constant IL. Change US (DC voltage) IL from 10 up to 20V, modify RL to maintain constant IL.
f) change the switch to enable pulse generator. Check how pulse in the source voltage are transmitted to the load voltage. Plot results in Fig. 8.

Fig. 6 UL=f(IL) with constant DC Voltage

Fig. 7 UL=f(US) with constant IL

Fig. 8 Source Voltage, Load Voltage

Comments:

Compare results for both type of regulators: