DC analysis:

1. DC source of 12V

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Figure 1: Vout at 12V DC input

Vout=5.0301V

Vinverting=2.5148V

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Figure 2: adjusted resistor for 5v output

It was found that the inverting node always stay at 2.5148v, which is sampled by the R2, in order to maintain Vout at 5V, R2 was initially calculated by =5.0296k, with further adjustment using simulations, it was found R1=4.96985k and R2=5.03015k

a.

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Figure 3: input voltage and output voltage as a function of input voltage

Drop out voltage is found by taking the difference of the input voltage (collector voltage) and the starting point where output voltage is regulated. Vdropout=6.3180-4.8287=1.4893V.

b.

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figure 4: output voltage as function of input voltage

c.

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Figure 5: output voltage as a function of load resistance

The plot is obtained by using parameter sweep to vary the resistance and then simulate in DC operating point mode.

d.

Graphical user interface

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Figure 6: output voltage when regulator is open circuit

Open circuit regulator has a 5.000v output, So Voc=5v.

To obtain the plot of regulation as a function of load current. I simulated both regulation and load current in multism as shown below in figure 7. To plot the regulation as function of current. I exported the data into excel and plot regulation vs load current found at the same resistance as shown in figure 8. Regulation of RL at 5ohm is shown in figure 9 at 2.76E-6.

Graphical user interface

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Figure 7: simulated load current and regulation as function of resistance

Chart

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Figure 8. regulation vs load current



Figure 9: regulation when RL is 5ohm

3.2

1.

Diagram

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Figure 10: schematic of 3.2

2.

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Figure 11. output voltage of 300ohm load

As shown in figure 11, the output voltage of the rectifier is not stable due to the fast discharging of capacitor

3.

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Figure 12: output voltage after connected to voltage regulator

4.

There is an improvement in the voltage output. The voltage is getting much more flat than before. Peak to peak voltage before regulator is 10.1962-9.3086=0.8876v, 0.8876/9=9.86%. after using regulator is 4.9702-4.9603=0.0099v. 0.0099/5=0.198%

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Figure 13: peak to peak voltage before using voltage regulator

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Figure 14: peak to peak voltage after using voltage regulator