Experiment-2

Linear IC Based Regulator

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Schematic:

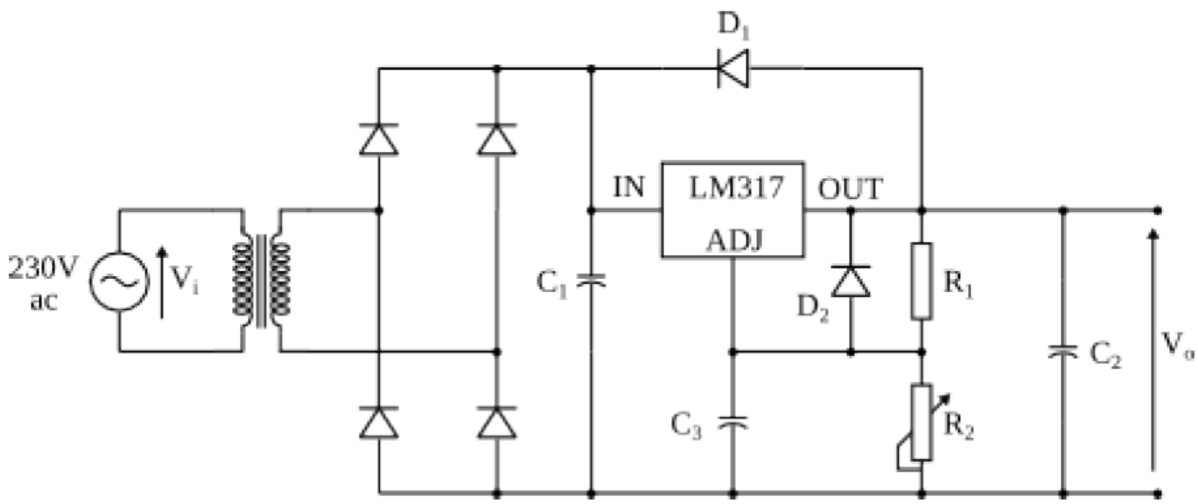


Fig: LM317 based linear regulator

1. Datasheet is downloaded and studied.
2. Design-.m file is included in the zip folder

Simulator Schematic:

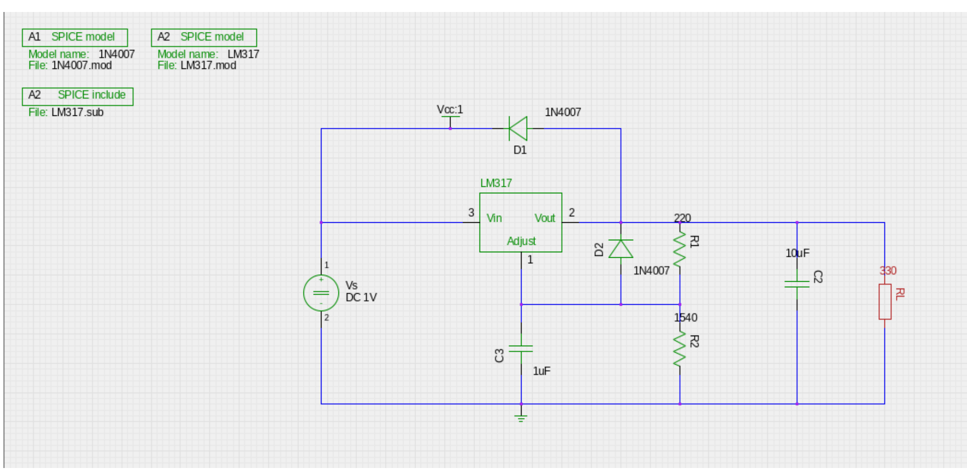


Fig: LM317 Linear IC based supply simulator schematic

3. Line Regulation:

Line regulation is performed by varying input voltage keeping the load resistance constant(100Ω). Input voltage is varied using an auto transformer. Input voltage is measured at the secondary side to maintain safety. The output voltage remains almost same around 10V. But when the input voltage variation is very high, then the regulator is no longer able to maintain the output voltage.

V_{in} (RMS)	V_{out} (V)
14	10.1
13	10.1
12	10.1
10	10.1
9.5	9.64
9	9.03
8.5	8.44
8	7.82
7.5	7.18
7	6.54

Table: Line Regulation

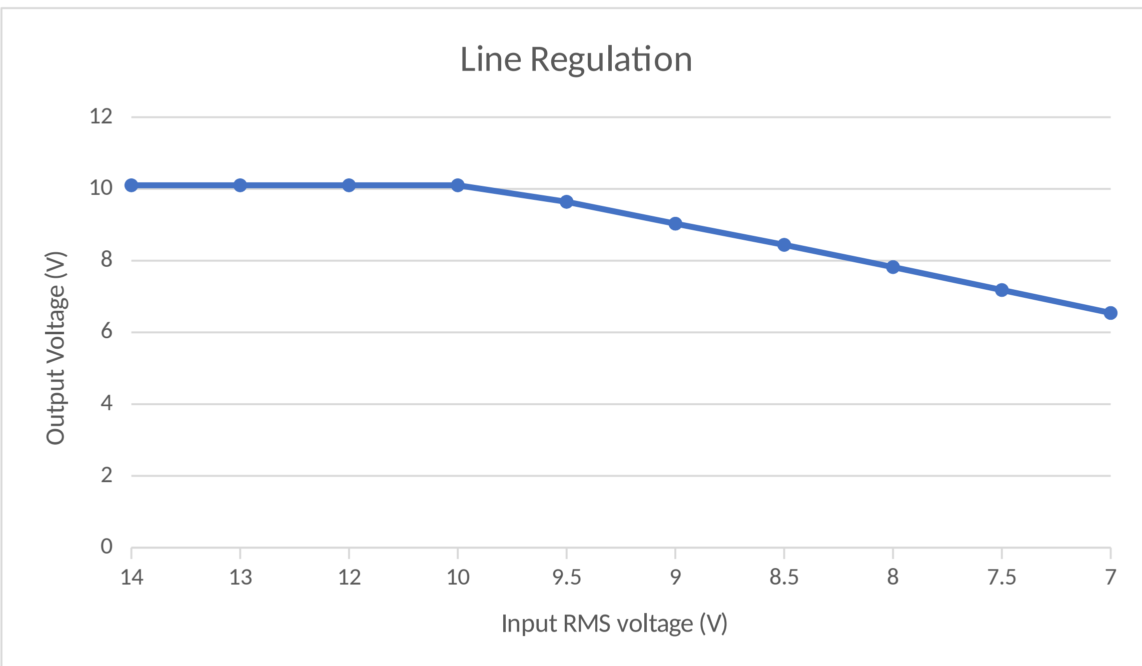


Fig: Line Regulation Plot

4. Load Regulation:

Load regulation test is performed by keeping the input voltage constant and changing the load resistance. The supply voltage is fixed at 20 volts RMS. We have observed that even after changing the value of load resistance, the output voltage remains constant at 10 volts. Thus, verifying the load regulation of the IC.

I_o (A)	V_o (V)
0.03	10.1
0.05	10.1
0.1	10.1
0.2	10.1
0.40	10.1
0.67	10.1
0.91	9.14
1.42	7.11

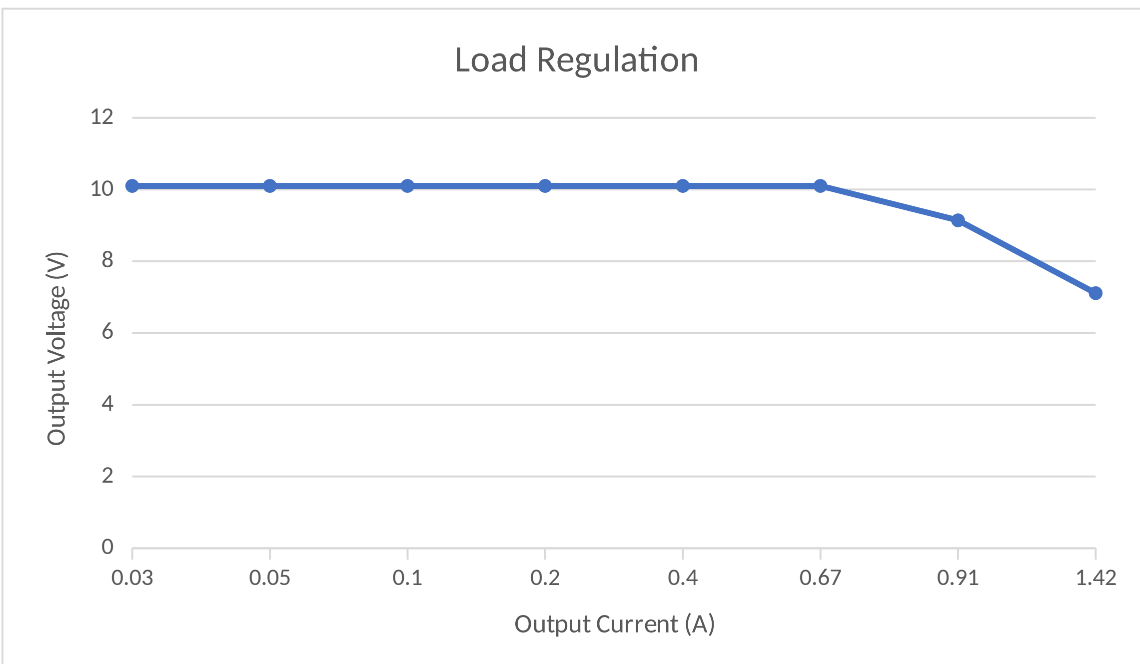
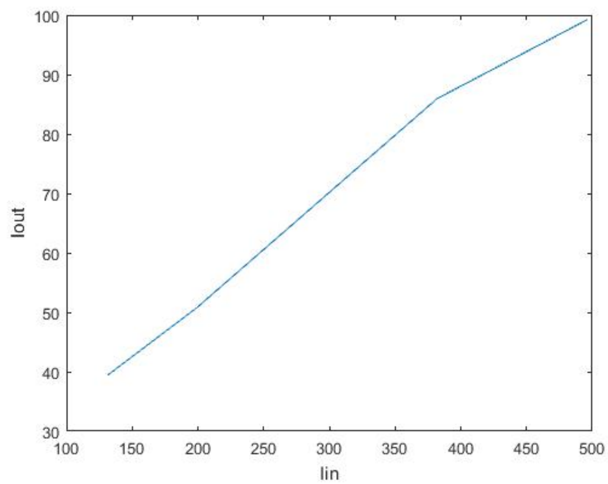


Fig: Load Regulation plot

6. Peak input current Vs output current:

The various readings of peak input current and output current for different values of load resistance are shown below.

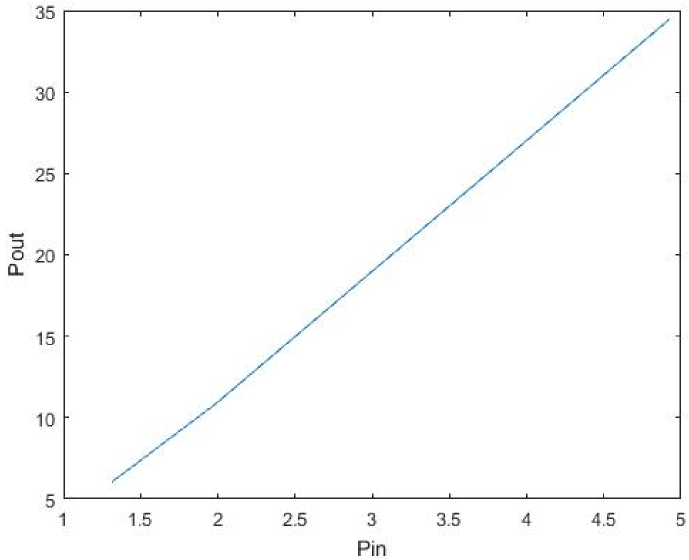
$I_{in}(max)(mA)$	$I_{OUT}(mA)$
99.20	496
85.95	382
50.745	199
39.45	131.5



7. Peak input power Vs Output power:

The table and plot between peak input power to the circuit and output power for different loads are shown below.

$P_{in(max)}$ (Watt)	P_{out} (Watt)
34.475	4.925
25.36	3.794
10.8	1.98
6.044	1.314



Efficiency of the Regulator:

Efficiency of the regulator is $\eta = \frac{Pout}{Pin}$

Where, Pout= Average output power from the regulator.

Pin = Average Input power to the regulator.

The readings of Input power and Output power are taken for different loads and the observations are tabulated and the plot for efficiency is also drawn.

$R_L(\Omega)$	$P_{in(max)}$ (Watt)	P_{out} (Watt)	Efficiency (%)
20	9.03	4.925	54.54
26	8.29	3.794	45.76
50	4.652	1.98	42.56
76	3.298	1.314	39.84

Power gets dropped across the Regulator i.e. the series transistor inside the LM317 IC and other dissipative components of the IC.

8. Functions of C_3, D_1 and D_2-

C_3 : C_3 is recommended to improve ripple rejection. It prevents amplification of the ripple as the output voltage is adjusted higher.
D_1: D_1 provides a low-impedance discharge path to C_2 to prevent it from discharging into the output of the regulator.
D_2 :D_2 provides a low-impedance discharge path for C_3, so that it dosent gets discharged through the IC.

9. Surge protection is not included in this circuit because it is already present inside the LM317 IC. In the series path from IN pin to OUT pin.