BIRZEIT UNIVERSITY

Faculty of Engineering & Technology
Electrical & Computer Engineering Department

ENEE2103

PreLab#09

The Operational Amplifier

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Section : 5

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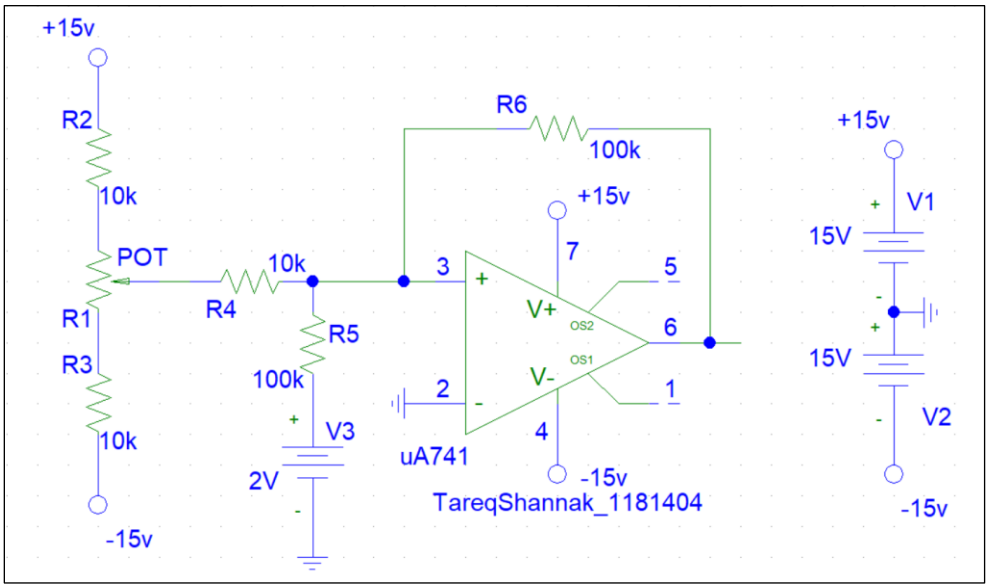
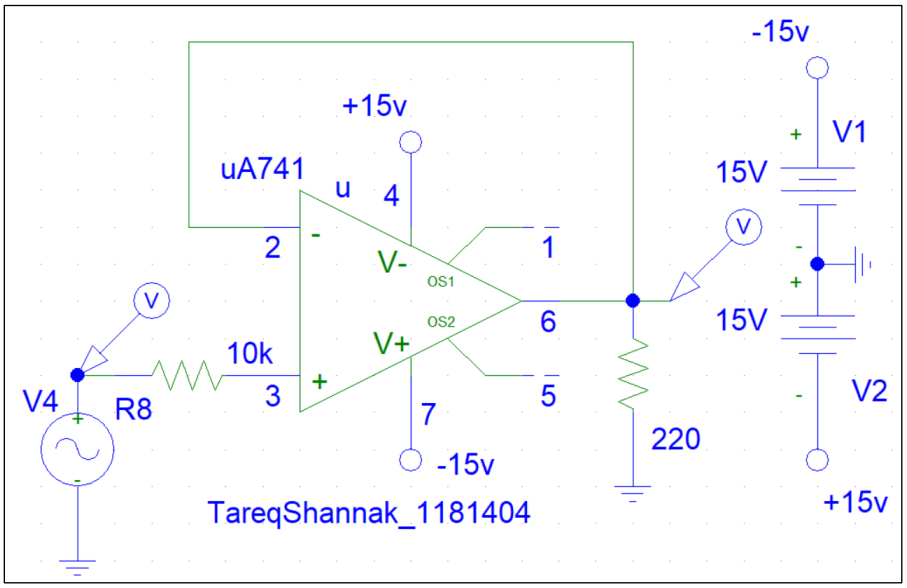
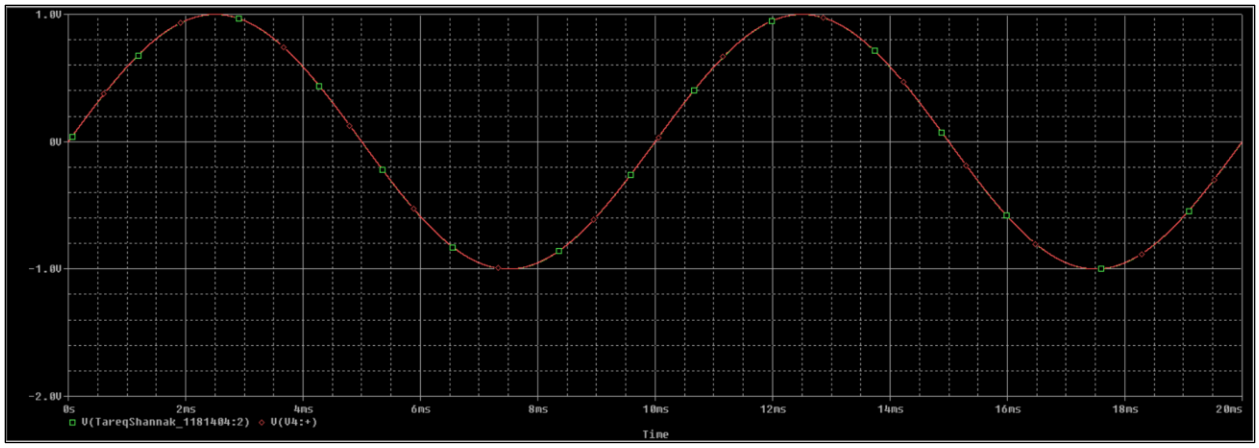
Part I – Adding Application



Input Voltage		Output Voltage	
V_1	V_2	V_O	Calculated Voltage
0.5	2	-6.993	-7
0.1	6	-6.996	-7
0.3	4	-6.993	-7
-0.9	2	7.01	7
-1.1	4	6.999	7
-1.5	6	8.999	9

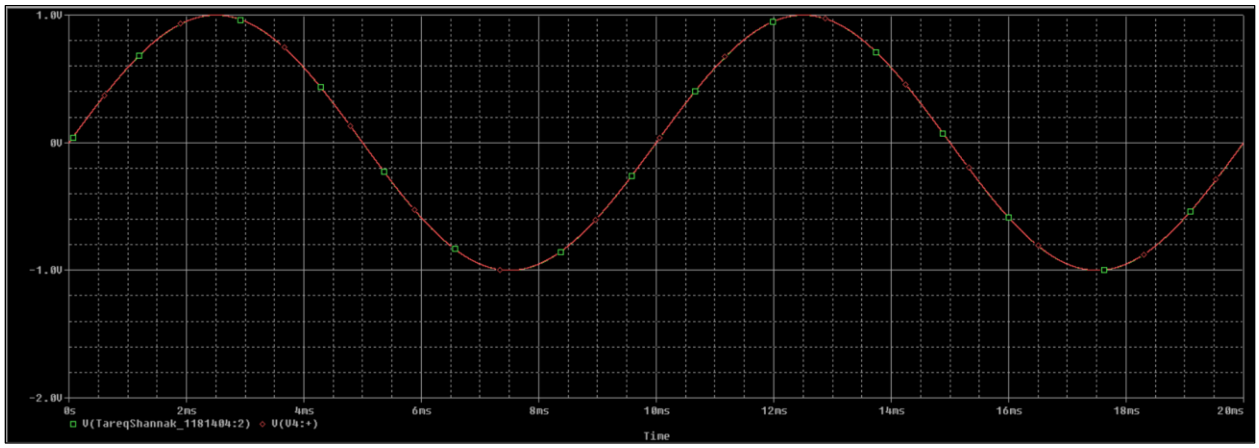
Part II – Voltage Follower Application





V_i	1V	2V	3V	4V	5V	6V	7V
V_o	1V	2V	3V	4V	5V	6V	7V

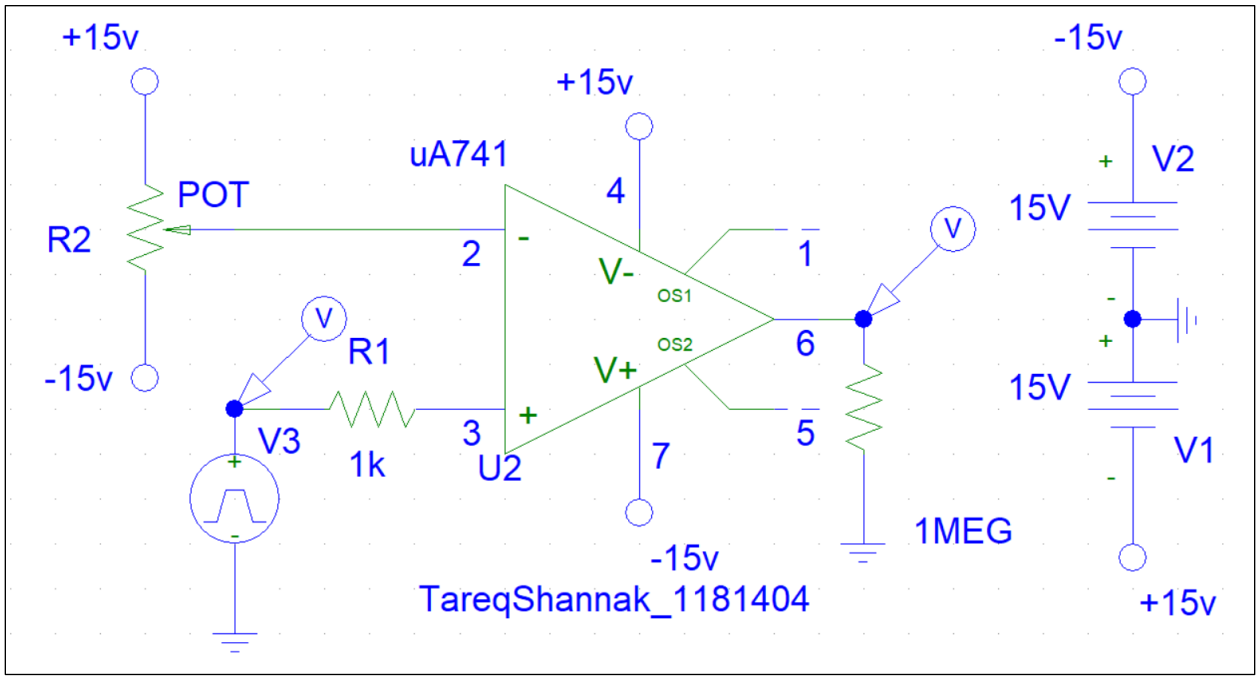
Change RL (220Ω) to 1KΩ

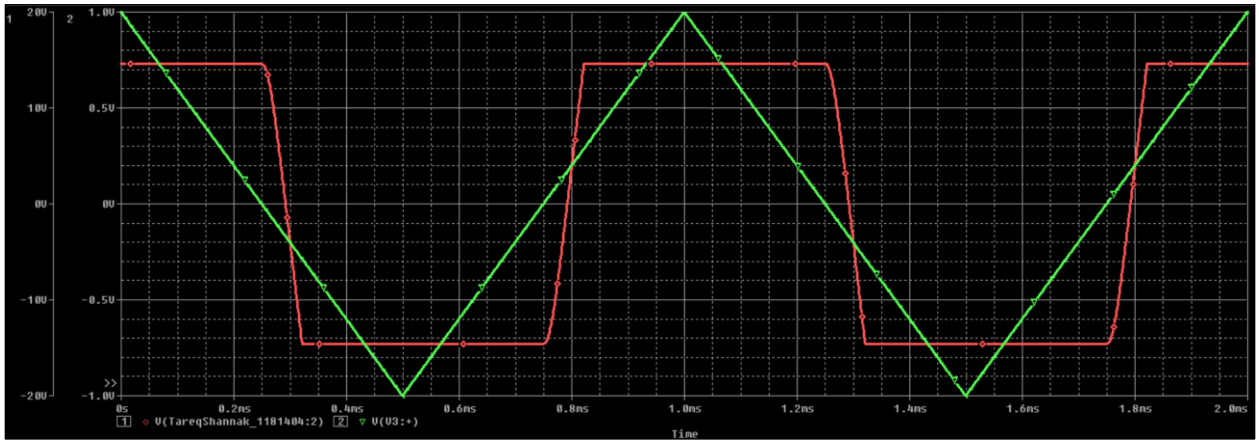


Nothing Changed, Voltage Gain = 1

V_i	6V	8V	10V	12V	15V
V_o	6V	8V	10V	12V	14.6V(because the output voltage is bounded)

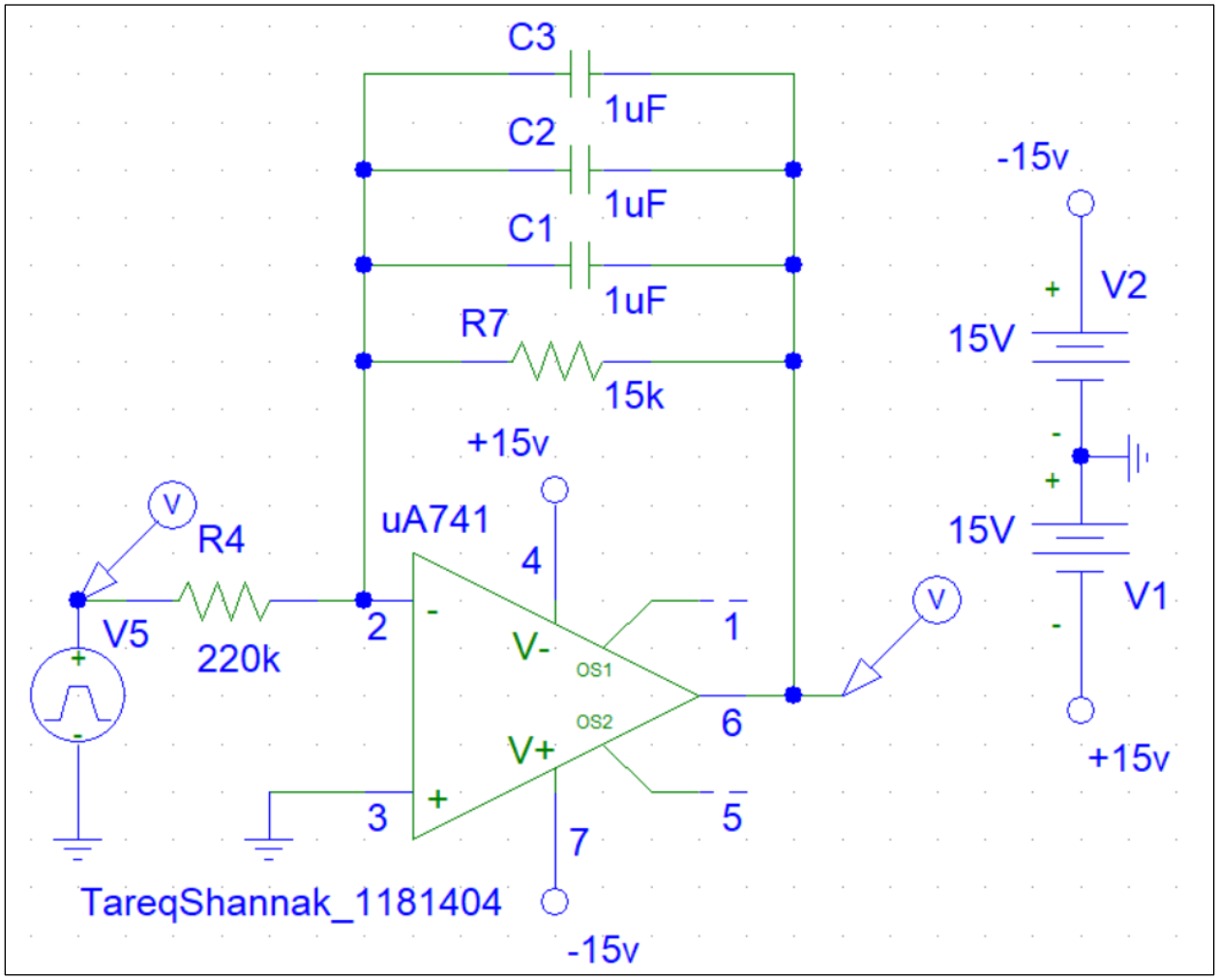
Part III – Comparator Application



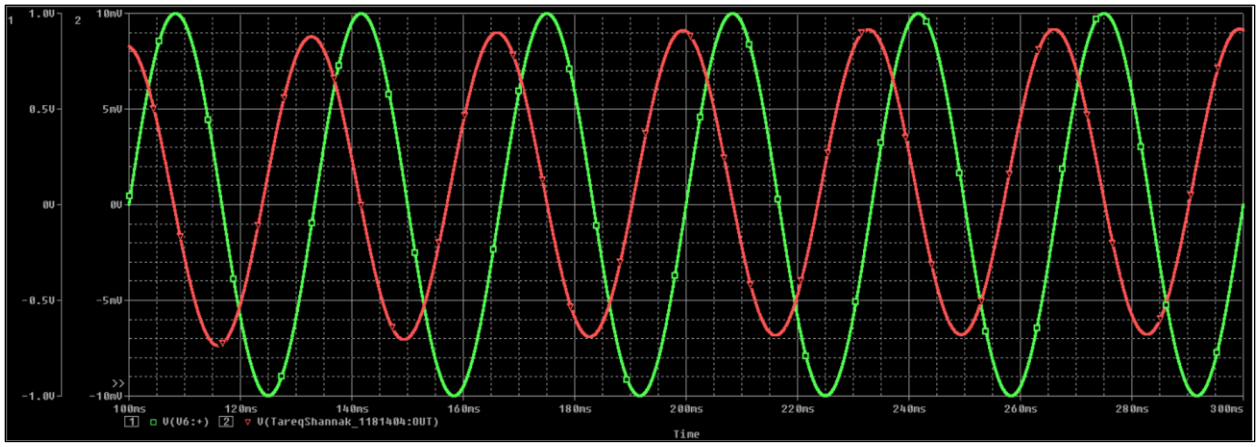


Part IV – Integrator and Differentiator

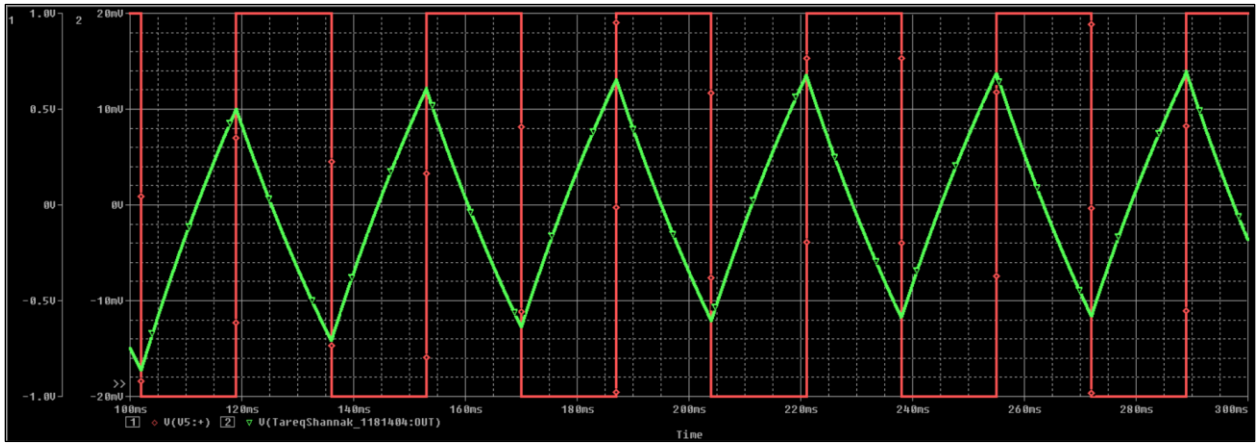
Integrator



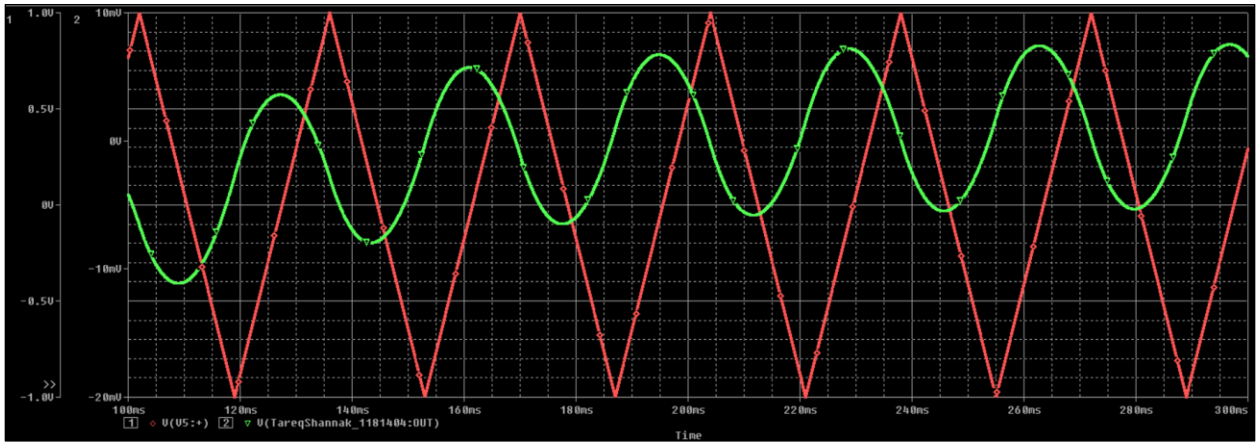
Sine Wave Input



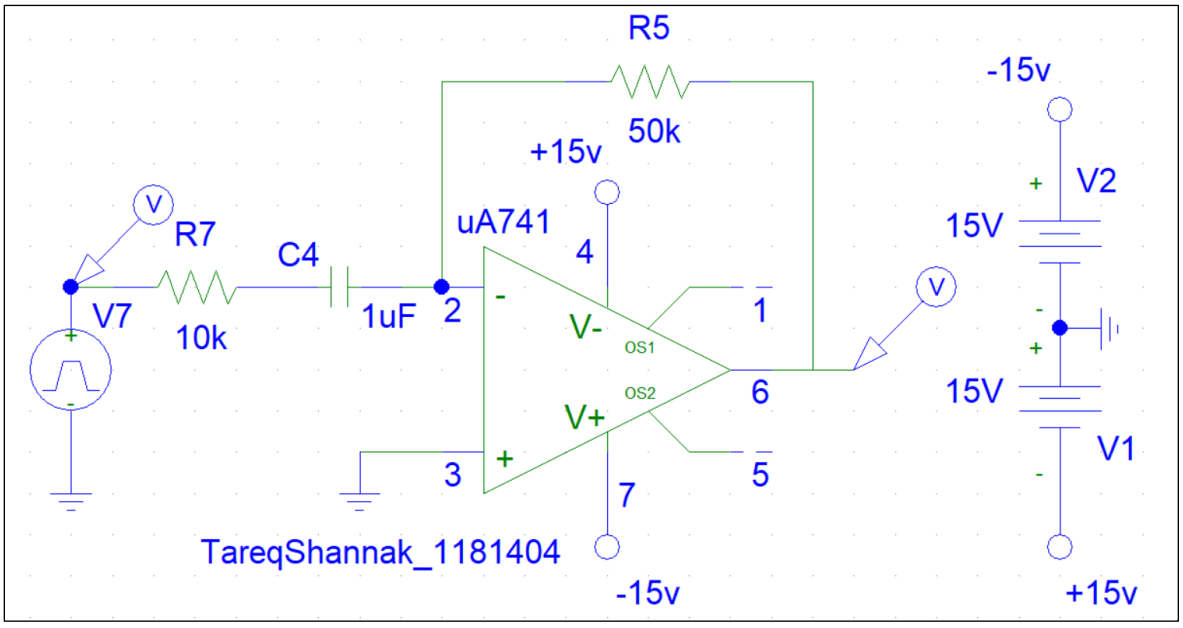
Square Wave Input



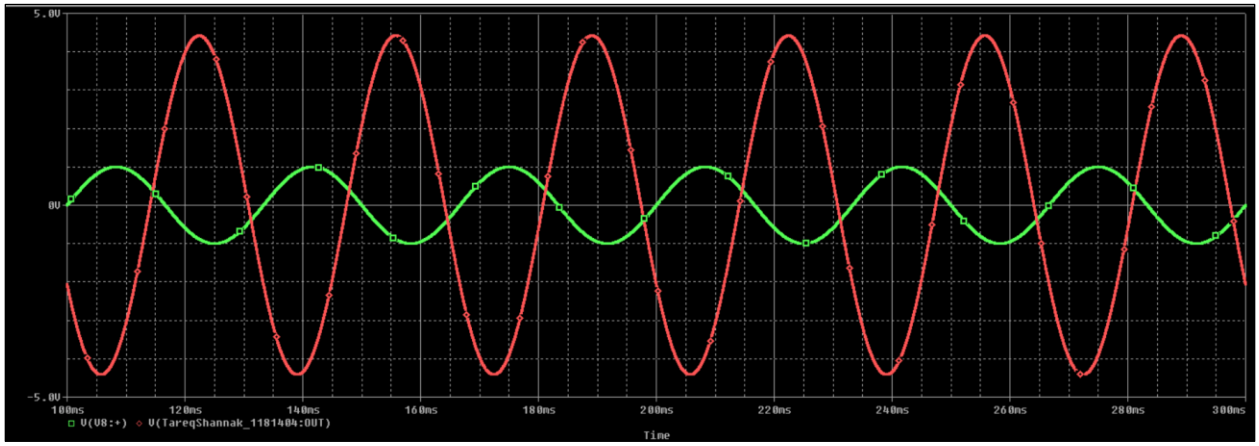
Saw tooth Input



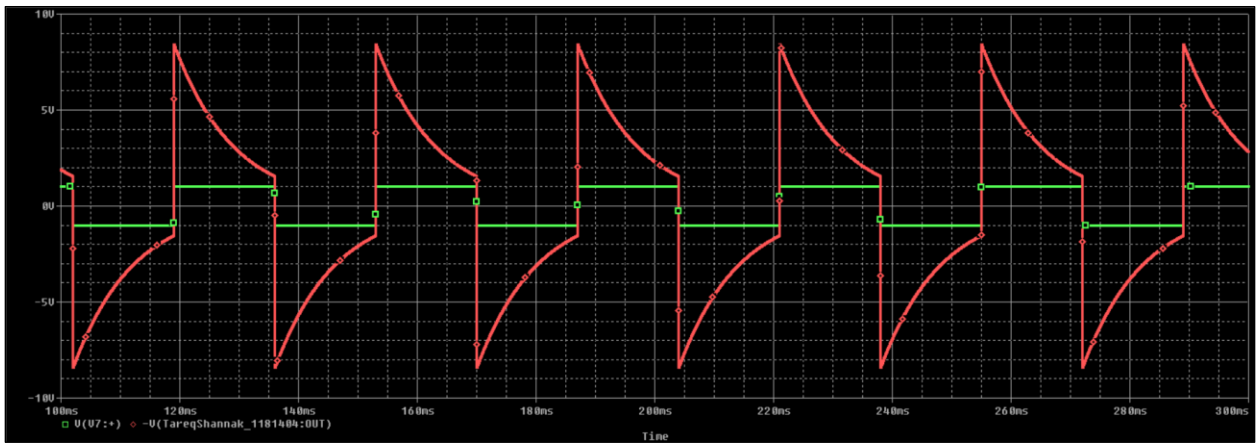
Differentiator



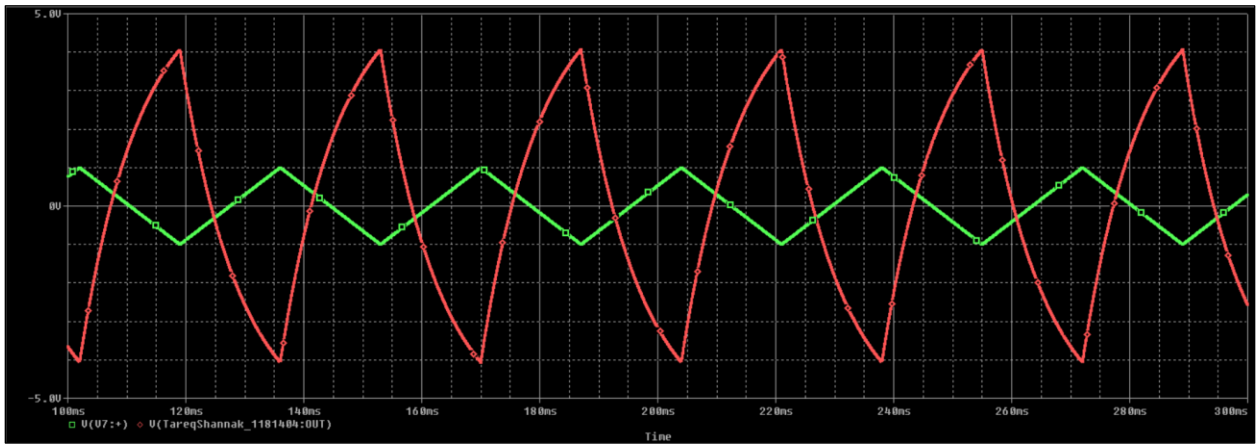
Sine Wave Input



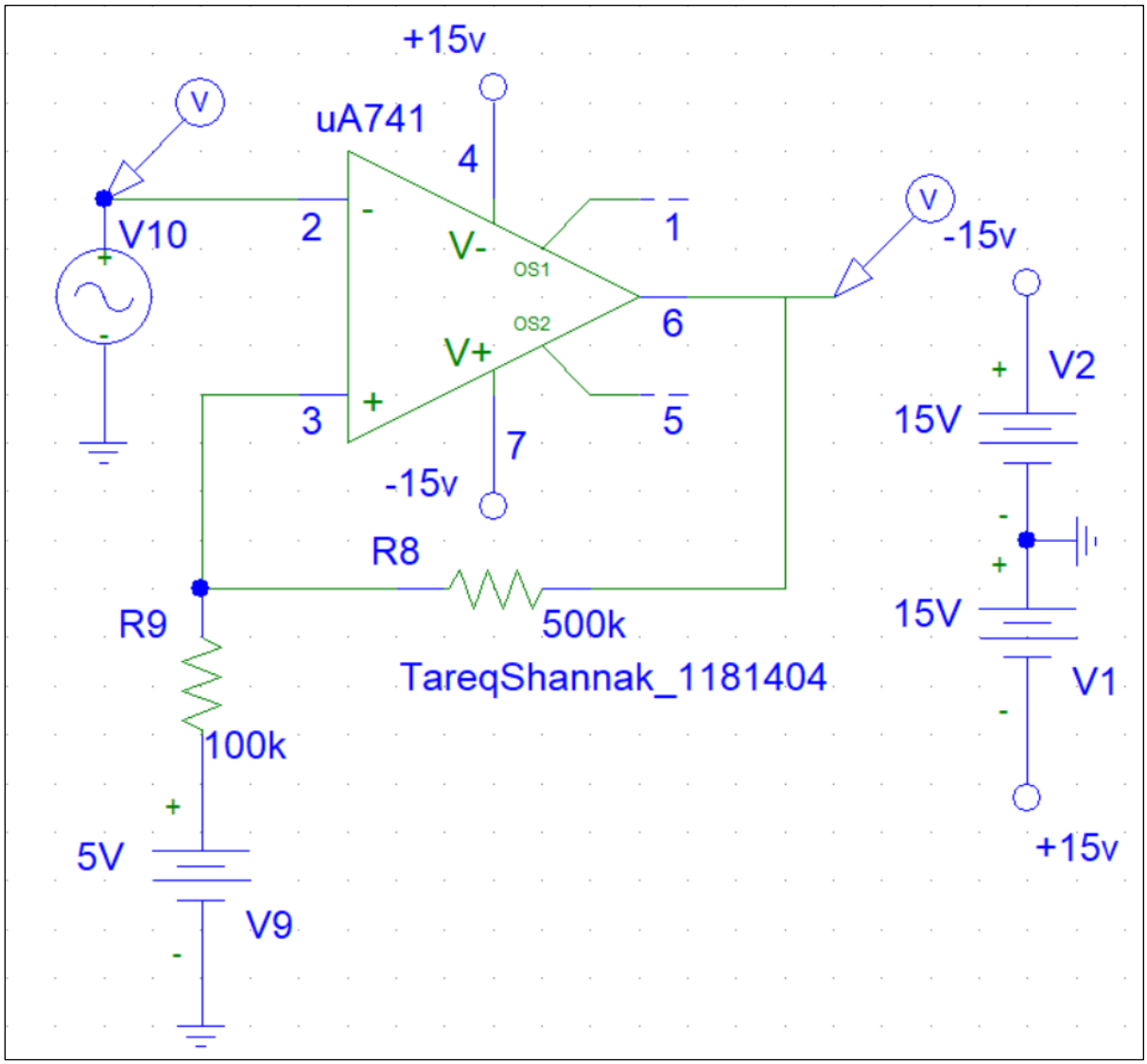
Square Wave Input



Saw tooth Input



Part V – Adding Hysteresis



- $Let\ V = +V_{SAT} \rightarrow V(+) - V(-) > 0 \rightarrow V(+) > V(-)$

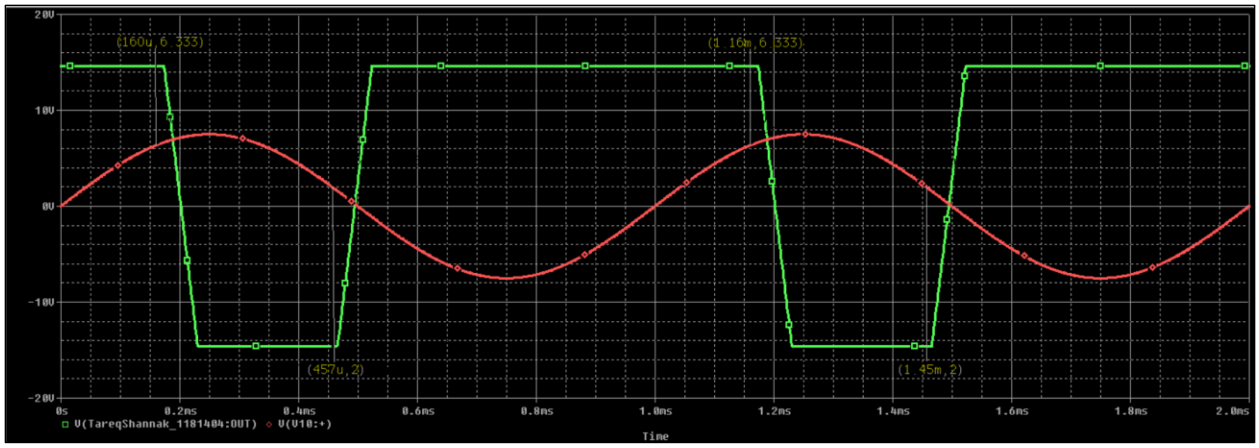
  $\frac{5}{6} \times 5 + \frac{1}{6} \times 13 > V_i \rightarrow 6.333V > V_i \rightarrow V_{UT} = 6.333V$

- $Let\ V = -V_{SAT} \rightarrow V(-) - V(+) > 0 \rightarrow V(-) > V(+)$

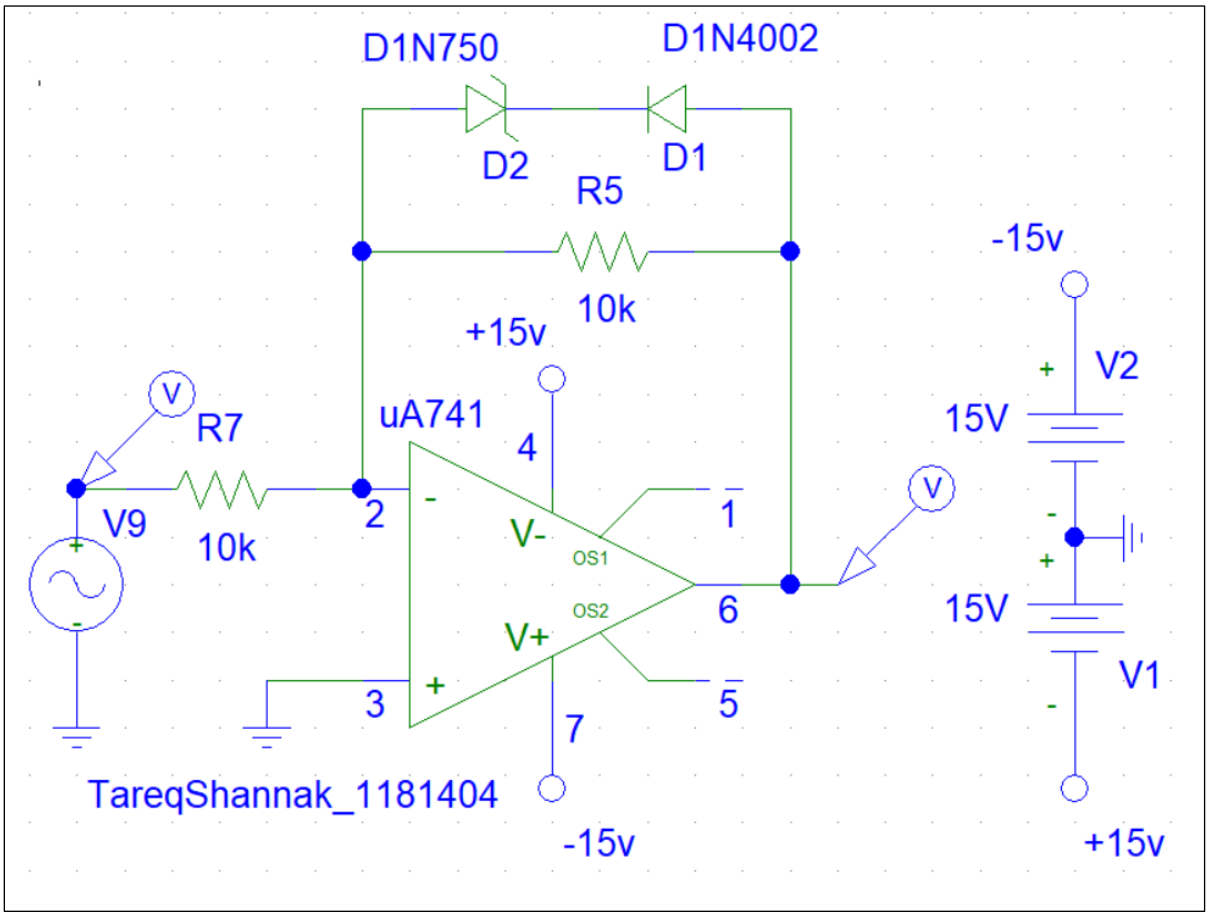
  $\frac{5}{6} \times 5 - \frac{1}{6} \times 13 < V_i \rightarrow 2V < V_i \rightarrow V_{LT} = 2V$

The measured lower and upper trigger levels for the circuit:

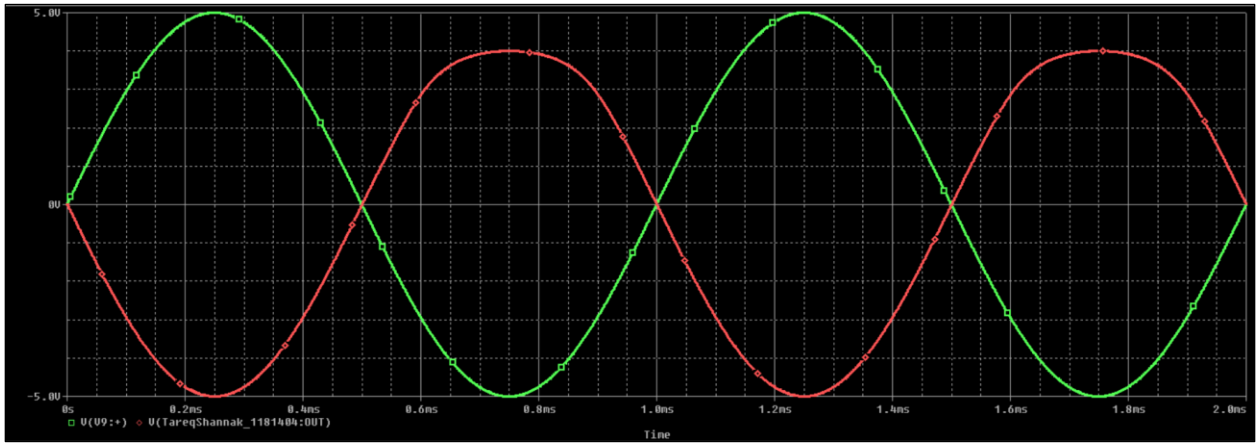
$$V_{UT} = 6.33V, V_{LT} = 2V$$



Part VI – Active Clipping Circuit



When the amplitude = 5V, there is a clipped output voltage



Both diode connections reversed