<center>Transformer-less AC to DC Converter</center>

Introduction:

AC-DC converters take the AC power from wall outlets and convert it to unregulated DC. These power supplies include transformers that change the voltage of the AC that comes through wall outlets, rectifiers to save it from AC to DC, and a filter that removes noise from the peaks and troths of the AC power waves. This project refers to a transformer-less AC to DC Converter.

Objective:

The AC-DC Converter aims to convert the input AC signal into a DC voltage and then optimize it through a filter to obtain an unregulated DC voltage. AC/DC converters are mainly used in consumer devices, medical devices, industrial and process control systems, measurement equipment. With a transformer, AC-DC Converter is much weight and large. But if we use a transformer-less ac-dc converter, we can carry it easily, also it reduces the cost.

Block diagram:
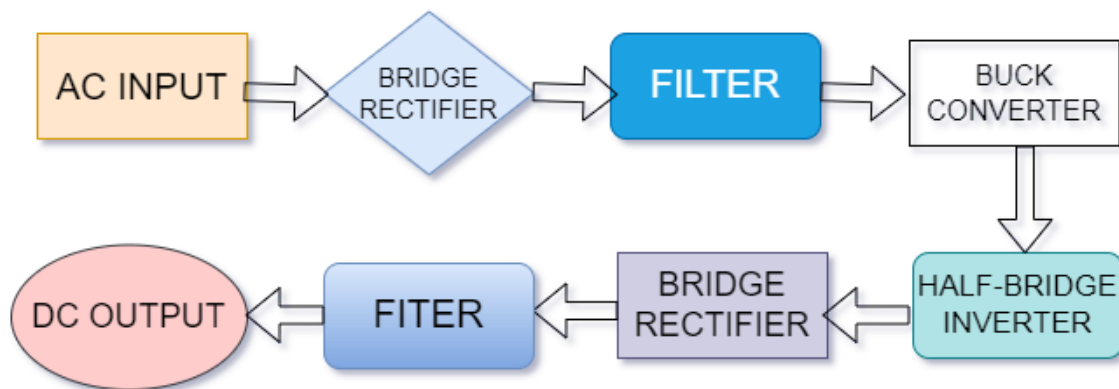
Ac input: wall outlet ac amplitude is 311v and the RMS voltage is 220. The frequency of the ac input is 50 Hz.

Rectifier: Full bridge rectifier helps to find the output in both positive and negative cycles. But this output is not fully dc so we need a filter to find smooth dc in output.
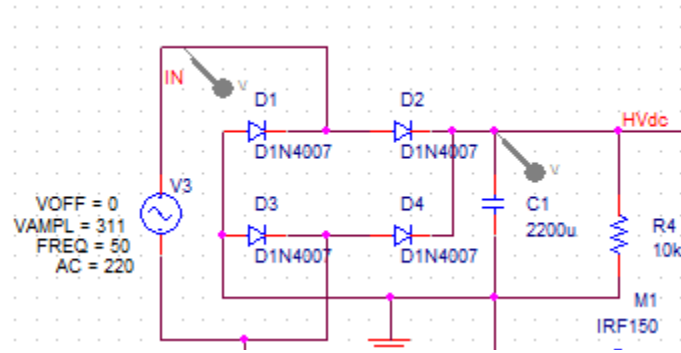
Fig 1: Bridge rectifier with RC filtering

Buck converter: This buck converter converts rectified dc voltage to lower dc voltage. The output of the buck converter depends on the duty cycles of the switching MOSFET.
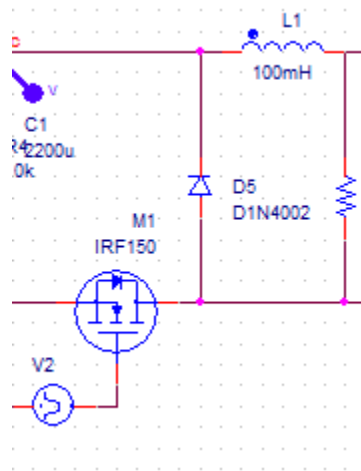

Fig2: Buck converter

Inverter: Inverter change input dc to output ac. Here I use a half-bridge inverter that changes the buck converter dc output in small ac output. And a bridge rectifier that changes the half-bridge ac into a small dc voltage. A filter circuit is used to smooth the output DC.
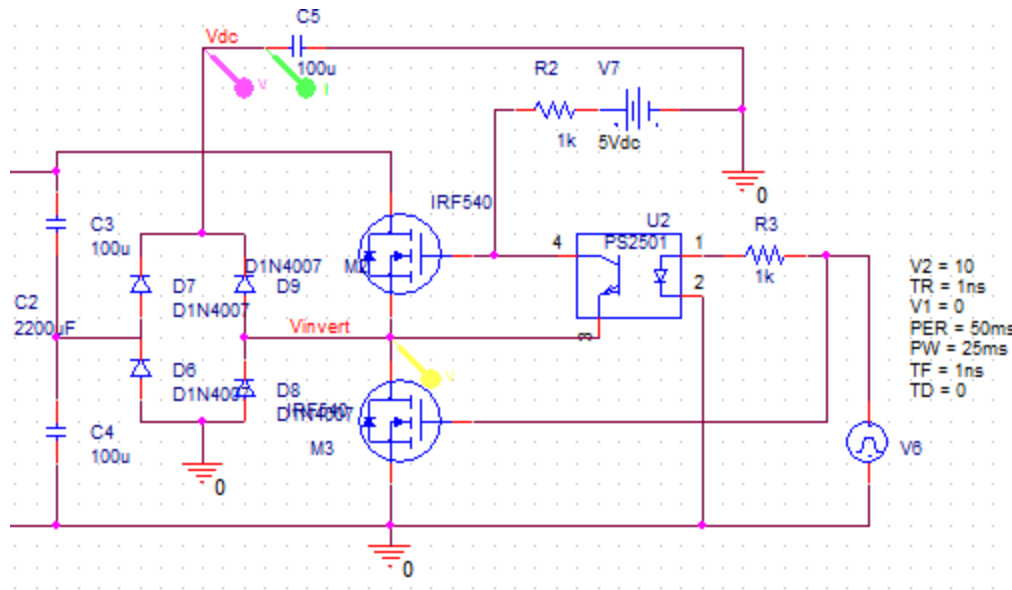
Fig3: Half-bridge inverter with rectifier and filter

Output: This ac to DC converter takes input 311V AC and the output of the circuit is around100V DC.
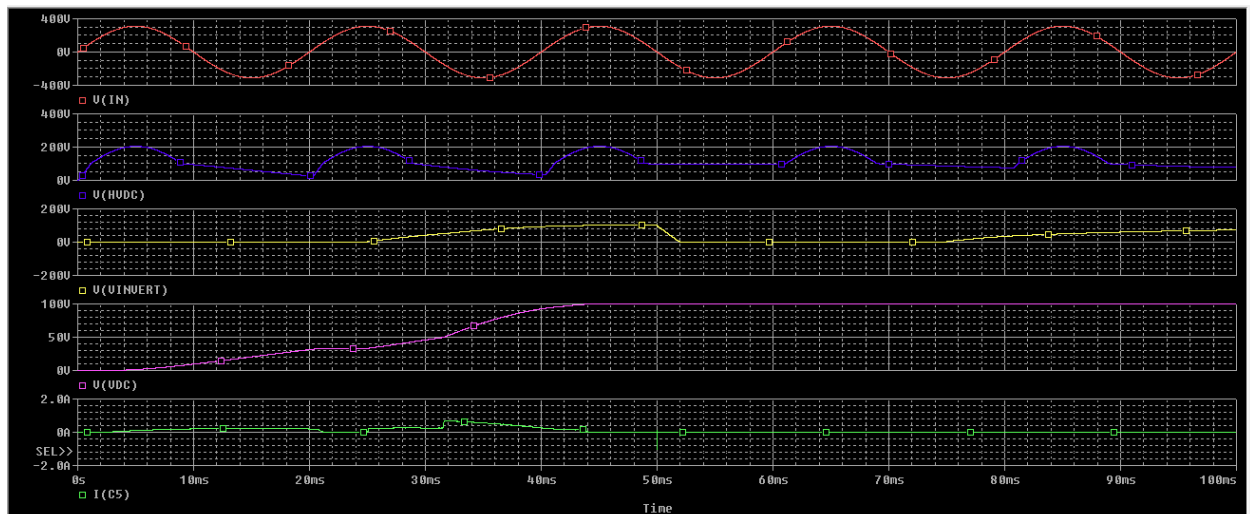

Fig4: output graph of transient analysis

Conclusion: This project is developed only for simulation purposes. For this reason, there is no protection circuit. In real life, hardware and simulation result is much different. But the simulation result helps us to develop the hardware.