Single Phase Dual Converter

Contribution Page

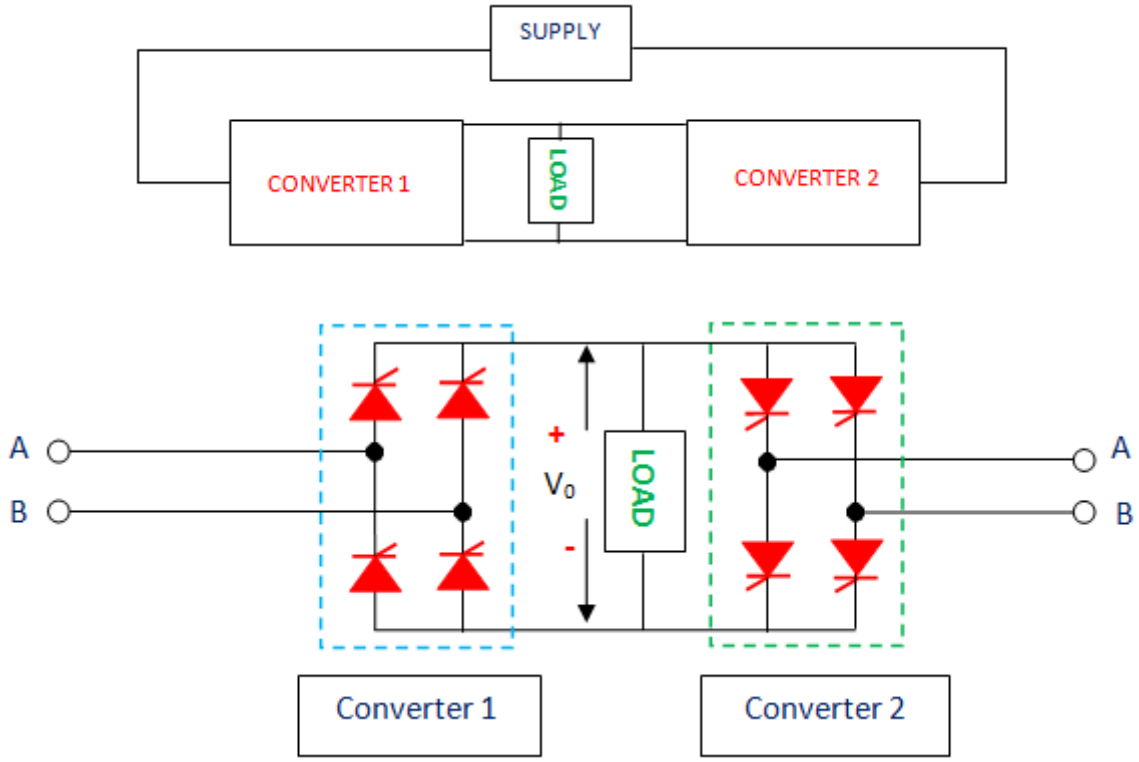
Muhammad Hanzala (2015-EE-507):

- Simulation of dual converter performed on ORCAD and Proteus.
- Hardware implementation of project. (Soldering and testing).
- Troubleshoot and de-soldering of one half of converter.
- Simulation of full converter circuit on MATLAB.
- Simulation of gate controlling circuit on PSpice and MATLAB.
- Soldering of one of the converter
- Calculation of performance parameters.
- Project Report.
- Simulation of half wave rectifier on Proteus using Arduino.
- Troubleshooting of the circuit.

DUAL CONVERTER

Introduction:

The name itself shows it has two converters. If two full converters are connected in back to back configuration, then it is formed. One converter will be act as rectifier and second will be act as inverter. So, we can say that two processes occur at same time. These converters are connected in anti-parallel manner and connected to same dc load. This system provides a four-quadrant operation.



Modes of Operation:

There are two functional modes.

- Non circulating current mode.
- Circulating current mode.

Non circulating current mode:

One converter will perform at same time.

During the converter 1 operation, firing angle (α_1) will be $0<\alpha_1< 90^o$; V_{dc} and I_{dc} are positive.

During the converter 2 operation, firing angle (α_2) will be $0<\alpha_2< 90^o$; V_{dc} and I_{dc} are negative.

Circulating current mode:

Because the instantaneous output voltages of the converters are out of phase there can be instantaneous voltage difference and this can be circulating current between the two converters. This circulating current cannot flow through load and is normally limited by circulating current reactor L_r.

Converter 1 perform as rectifier if firing angle

$$0<\alpha_1< 90^o$$

Converter 2 perform as inverter if firing angle

$$90^o<\alpha_2< 180^o$$

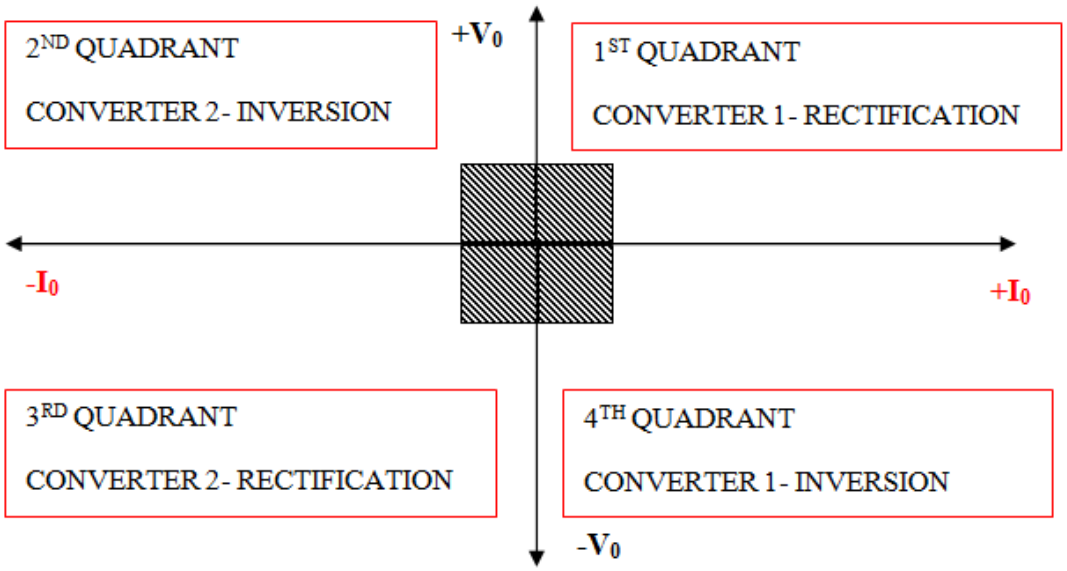
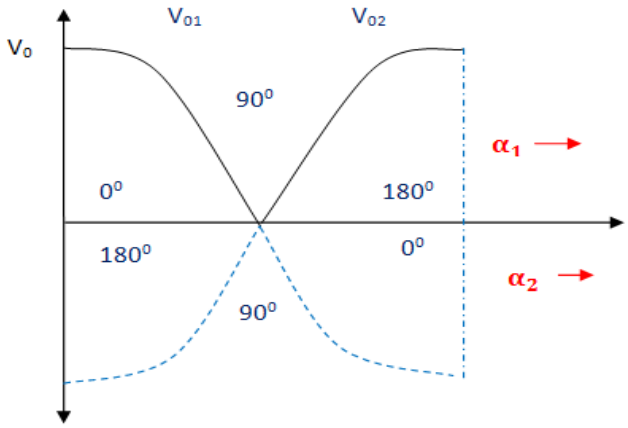


Figure 2

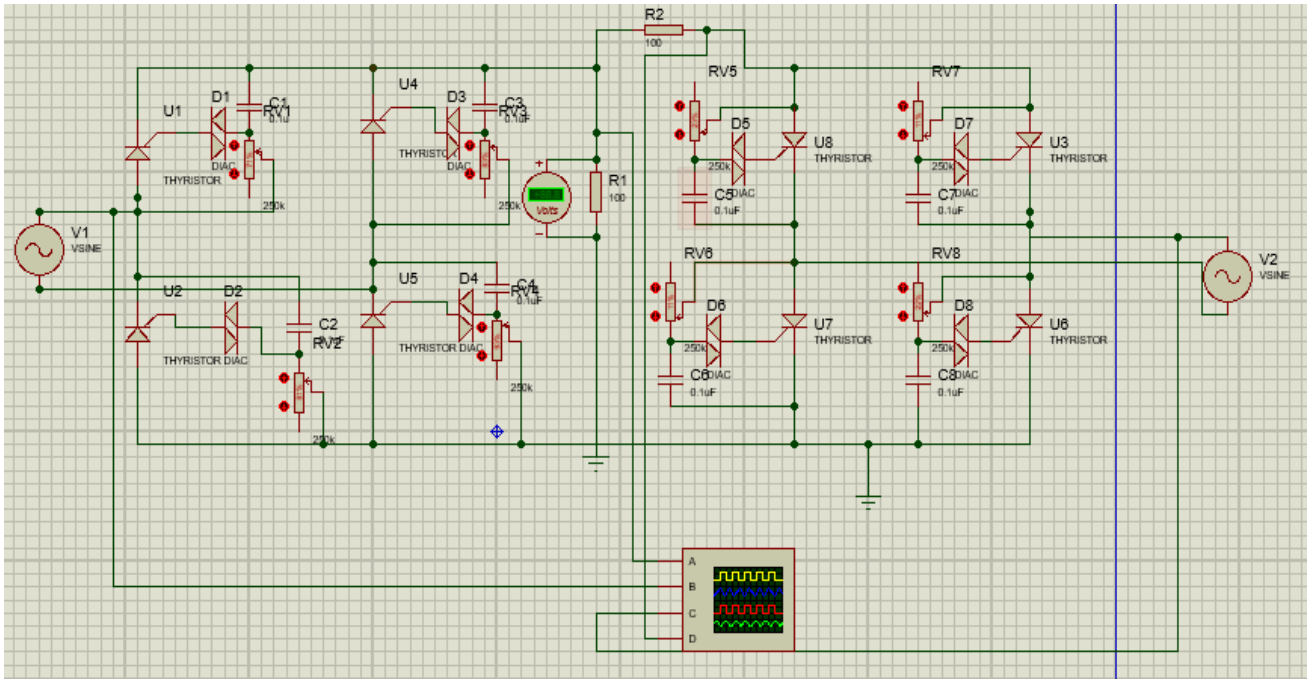
The firing angle can never be greater than 180.So,

$$\alpha_1 + \alpha_2 = 180^o$$

The delay angles are controlled such that one converter operates as rectifier and other converter operates as an inverter; but both converters produce the same average output voltage.



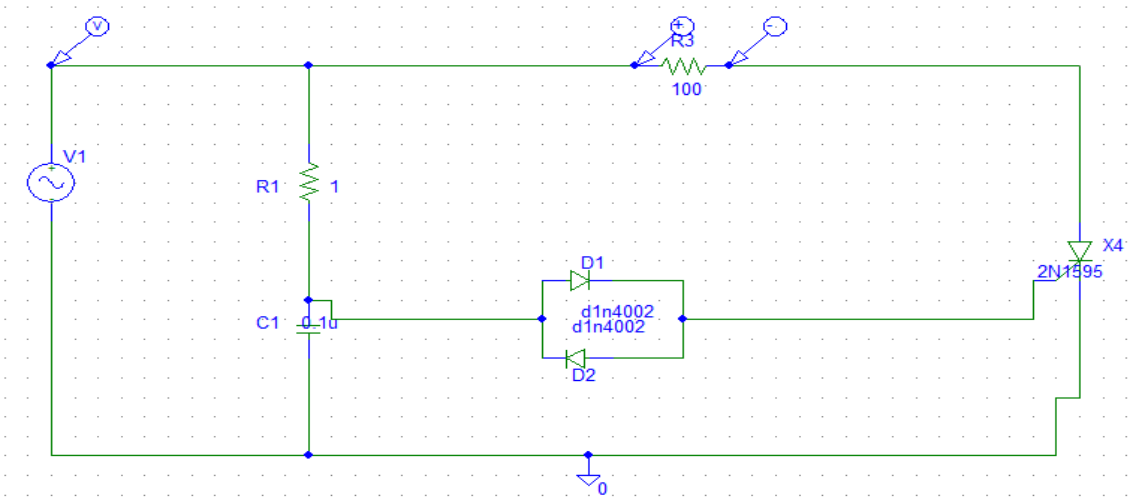
Configuration used in Project:



Components used:

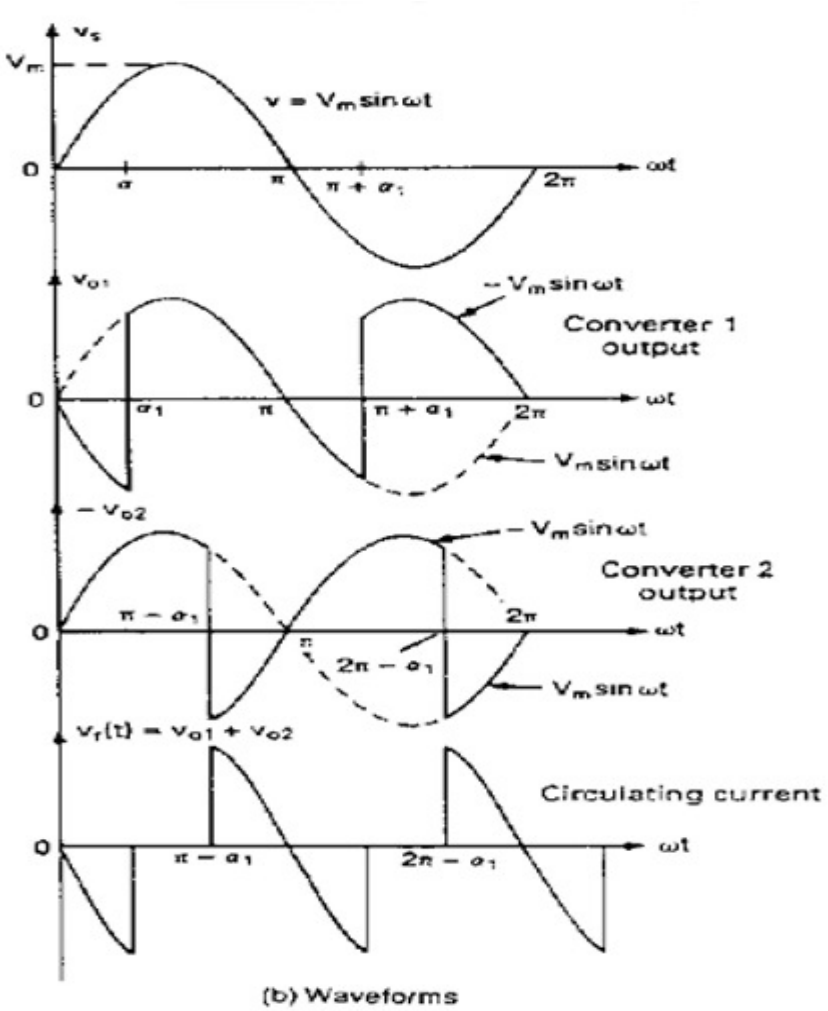
- BT151 SCR x 8
- DB3 DIAC x 8
- 1k ohms x 8 (Protection Resistor)
- 500k ohms potentiometer x 8
- .1uF Film capacitor x 8
- Vero board.
- Soldering wire
- Jumping wires
- 220V AC Supply x 2

Gate control Circuit:



By changing R1 we can change alpha.

Required Output Waveform:



(b) Waveforms

Application:

- Dual converters are normally used in high power variable speed drivers.
- Dual converters are used to control the direction and speed of dc motors.
- Used where reversible dc is required.
- Industrial variable speed dc drivers.

Advantage:

The major advantage of using dual converters is that No mechanical arrangement is required to change from inverter to converter and converter to inverter, which was required in earlier methods.