Analysis On Different Types Of Converters

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Abstract:

In nature two types of electrical signals AC and DC. But different types loads are available nature which works on AC and DC. But in the universe only AC available and some loads operate on DC. Due to these conditions there are some conversions derived high power applications so that conversions called as converters. These converters classified like rectifiers, Inverters, Choppers, AC voltage controllers and cycloconverters etc. Main advantage of these converters is these used for high power applications.

Key words: Rectifiers, Choppers, Inverters, AC voltage controller, Cyclo-converters.

1. Introduction

1.1 Rectifiers

Generally,AC power can be transfer from one place to other place through transformers. But AC signal can't be stored because signal changes continuously as time changes[1]. DC signal can be stored but can't transfer from one place to other place[2]. Because of these conditions AC signal can be changes to DC signal by using rectifier and these useful in high power applications like HVDC, motor drives etc[3].

Rectifiers are classified as below

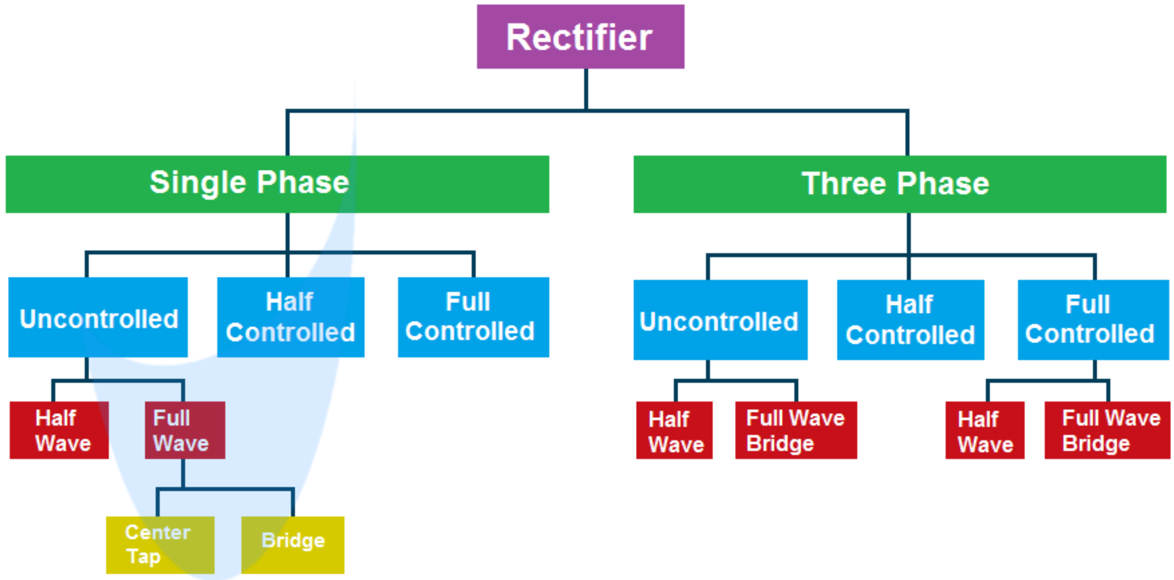


Fig1. Classification of rectifiers

1.2 Choppers

These are DC-DC converters which are useful regulated power supplies[4 -5]. Choppers convert high power DC supply to low power DC supply and this low power DC which is used in regulators these DC-DC converters are classified as below[6 - 8].

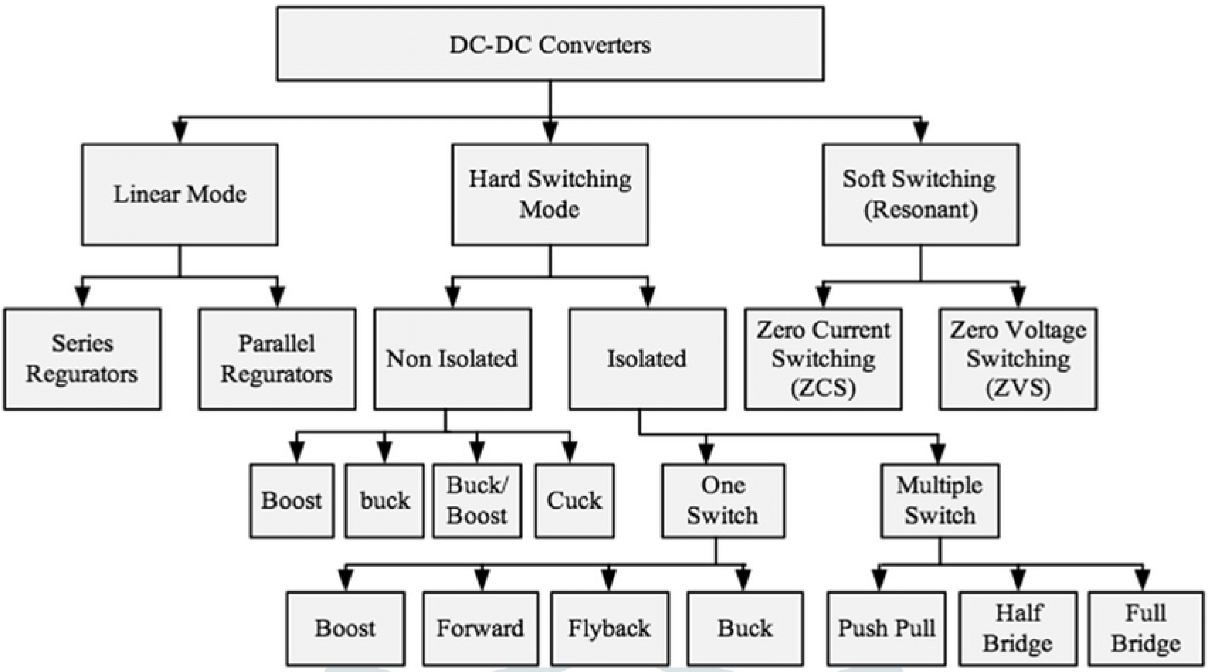


Fig2. Classification of choppers

1.3 Inverters

Generally, inverters converts fixed input DC signal to variable AC signal now a days these converters useful high power applications for that multilevel inverters derived mainly used for HVDC applications. Inverters classified as below[9 - 13].

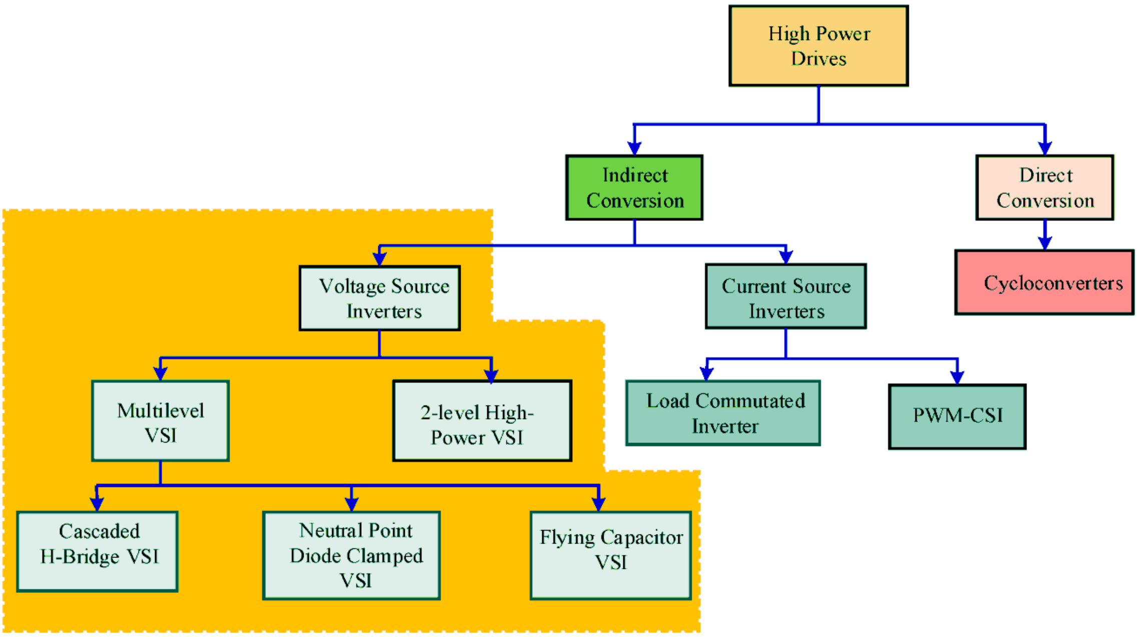


Fig3. Classification of Inverters

1.4 AC-AC converters

These Converters converts fixed AC signal to variable AC signal. These converters are divided into two parts like AC voltage controller, cyclo-converters. In AC voltage controller output signal magnitude can be changed but frequency constant. In cyclo-converter both magnitude and frequency can be changed. These converters are classified as below[8], [11], [14–17].

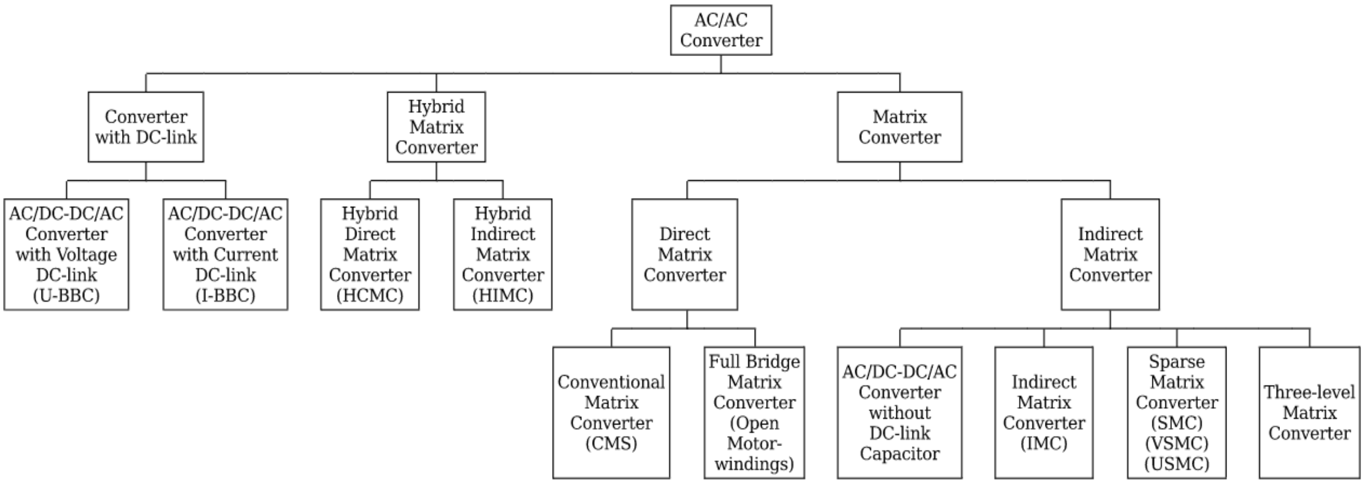


Fig4. Classification of AC-AC converters

2. Principle of Operation of different converters

2.1 Principle operation of rectifiers

Generally, all the converters operate in four quadrants. These rectifiers operate in 1st and 4th quadrants. 1st quadrant converters operate as rectifiers means power supplied from source to load whereas 4th quadrant converters operate inverters means power supplied from load to source. Based on this condition these single-phase converters convert single phase AC supply to unidirectional DC. Three phase rectifiers converts Three phase AC supply to 6 pulse unidirectional DC. All the rectifier circuits as shown below.

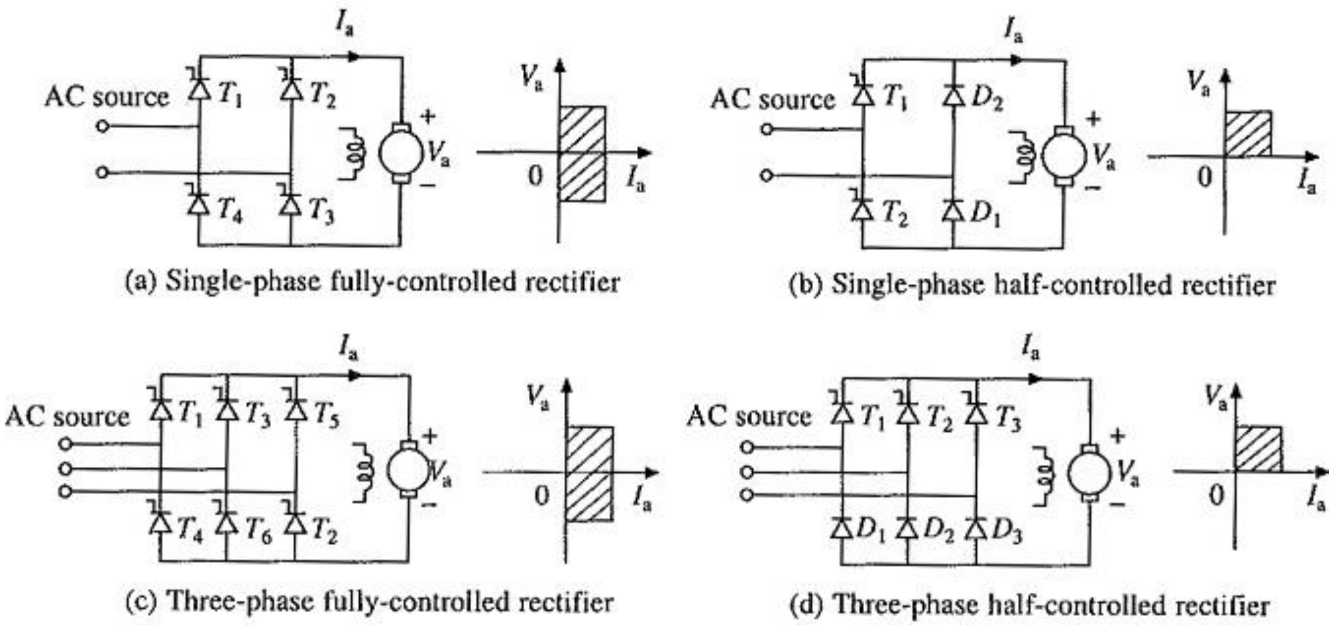


Fig5. Basic rectifier circuits

2.2 Principle operation of choppers

All the chopper circuits works based on the charging and discharging conditions of inductor and capacitor. These circuits operates as like LC filter means inductor reduces the current ripples and capacitor reduces the ripple voltage across the load. Both inductor and capacitor make the continuous conduction. Chopper circuit diagrams as shown in below fig.

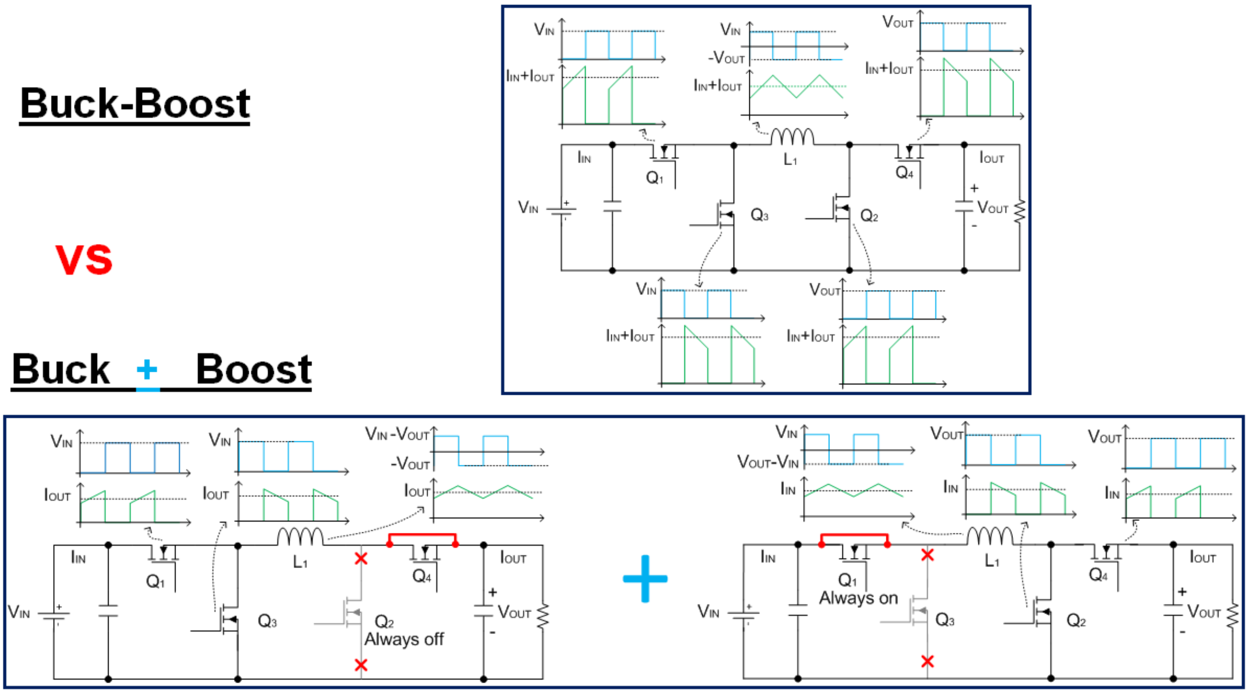


Fig6. Basic chopper circuits

2.3 Principle operation of inverters

Inverters converts fixed DC signal to variable AC signal with changing of switching on and off control the output power at the load. Pair of electronic switches operates in positive direction and another pair devices operates in negative cycle based on this conditions output voltage is in inversion form. Single phase and three phase inverter circuit diagrams as shown below.

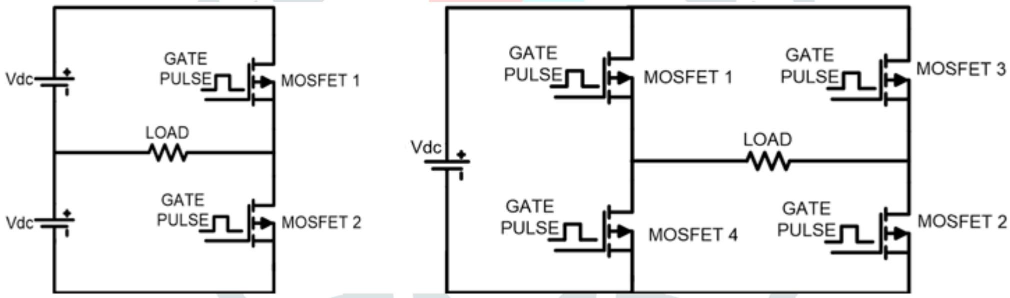


Fig7. Basic Single-phase inverter circuits

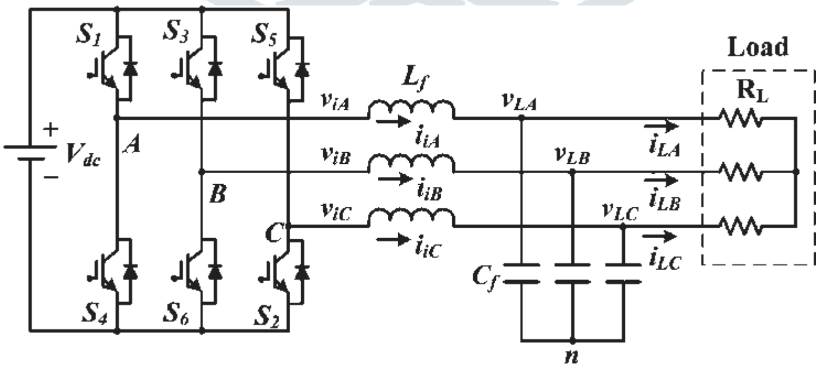


Fig7. Basic Three-phase inverter circuit

2.4 Principle operation of AC-AC converters

AC-AC converters converts fixed AC voltage to variable AC voltage. But these are two types one is converter which changes the magnitude of output with change of switching sequences and the other is changes both magnitude as well as frequency, circuit diagrams as shown below.

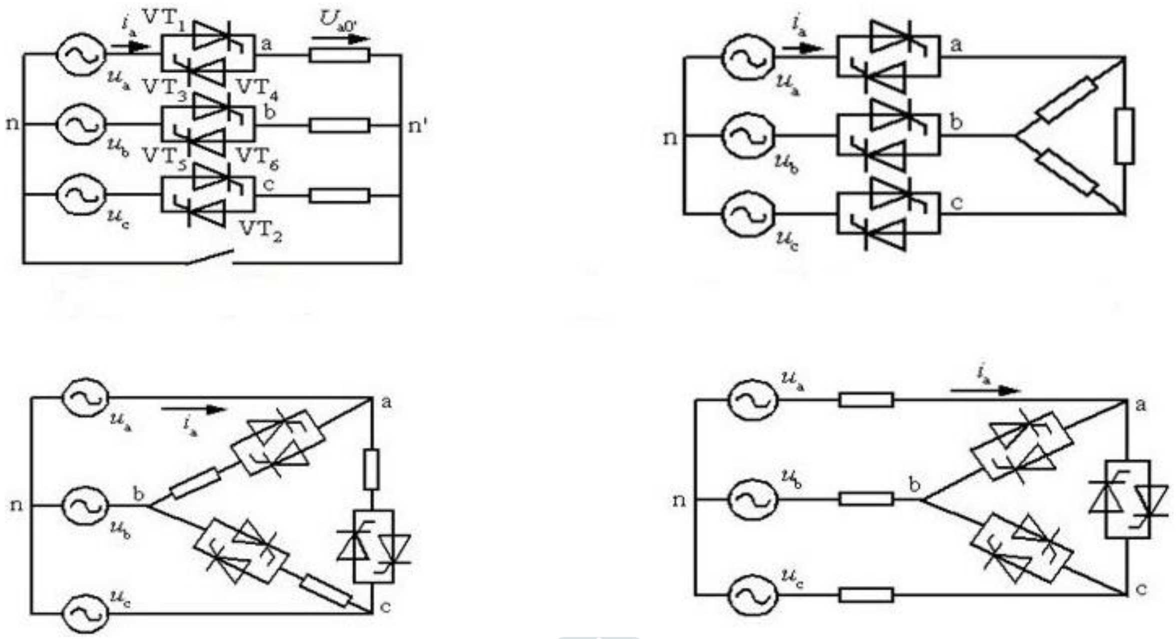


Fig8. Basic single phase and three phase AC voltage controllers

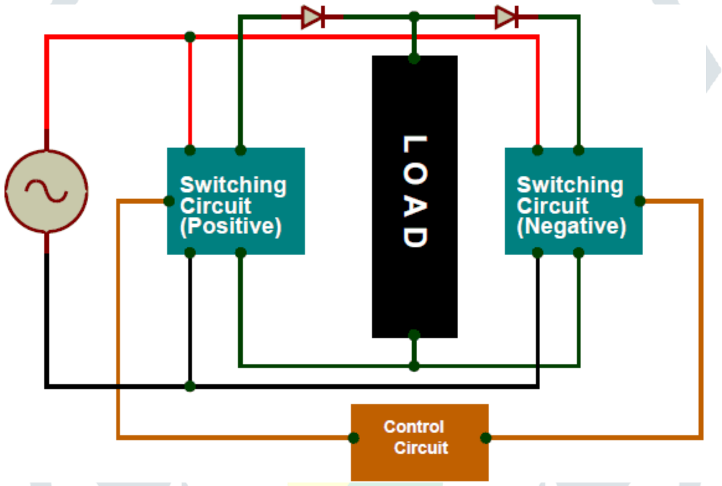
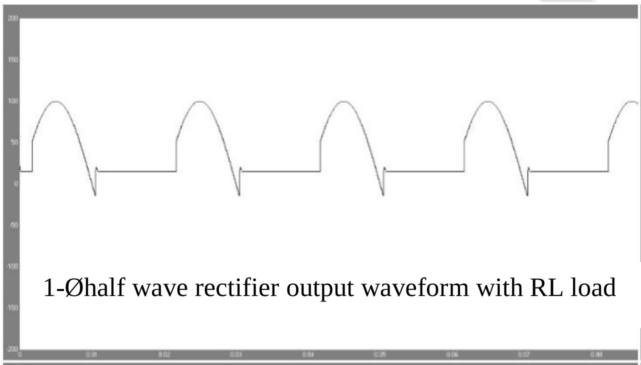


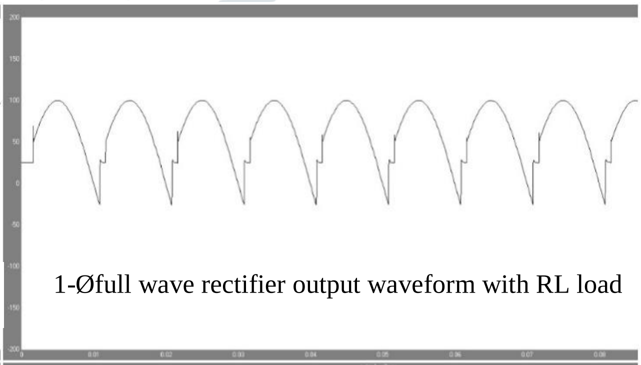
Fig9. Basic cyclo-converters circuit

3. Results

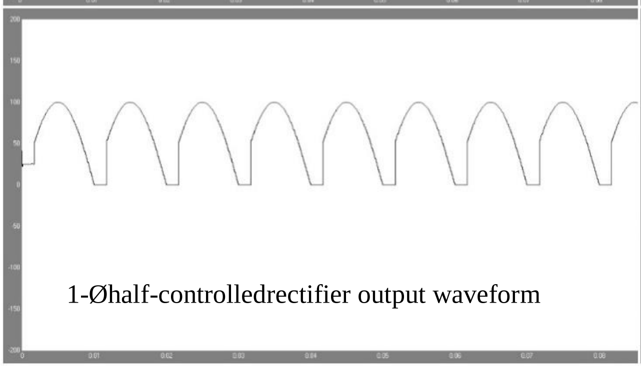
3.1 Output results of rectifier circuits



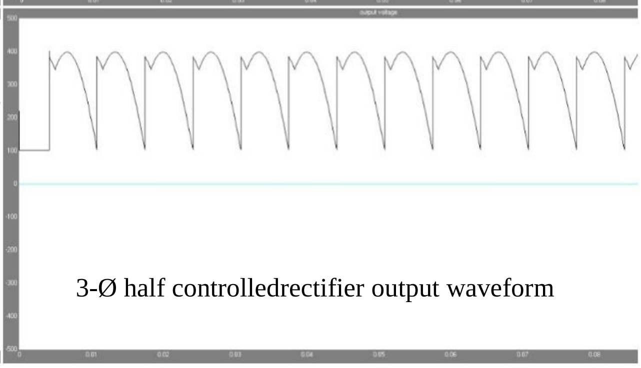
1-Øhalf wave rectifier output waveform with RL load



1-Øfull wave rectifier output waveform with RL load

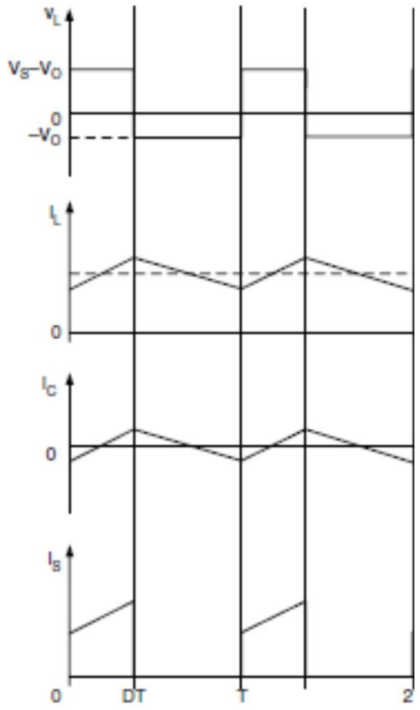


1-Øhalf-controlledrectifier output waveform

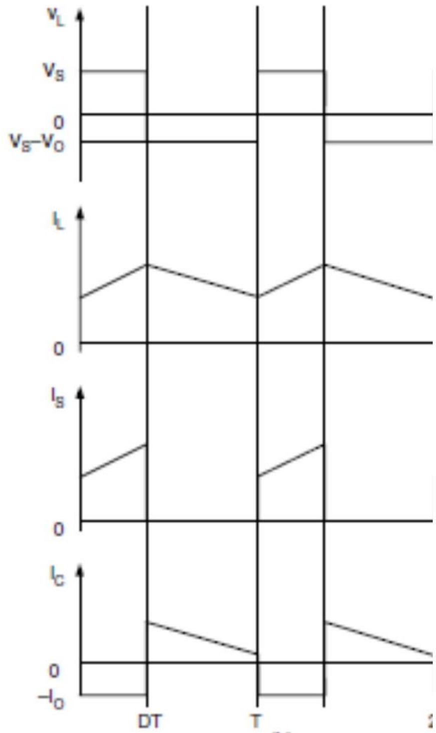


3-Ø half controlledrectifier output waveform

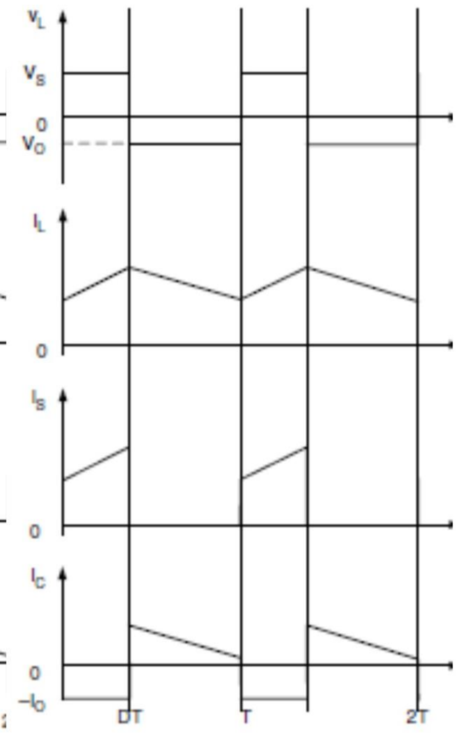
3.2 Output results of chopper circuits



Buck chopper output wave forms

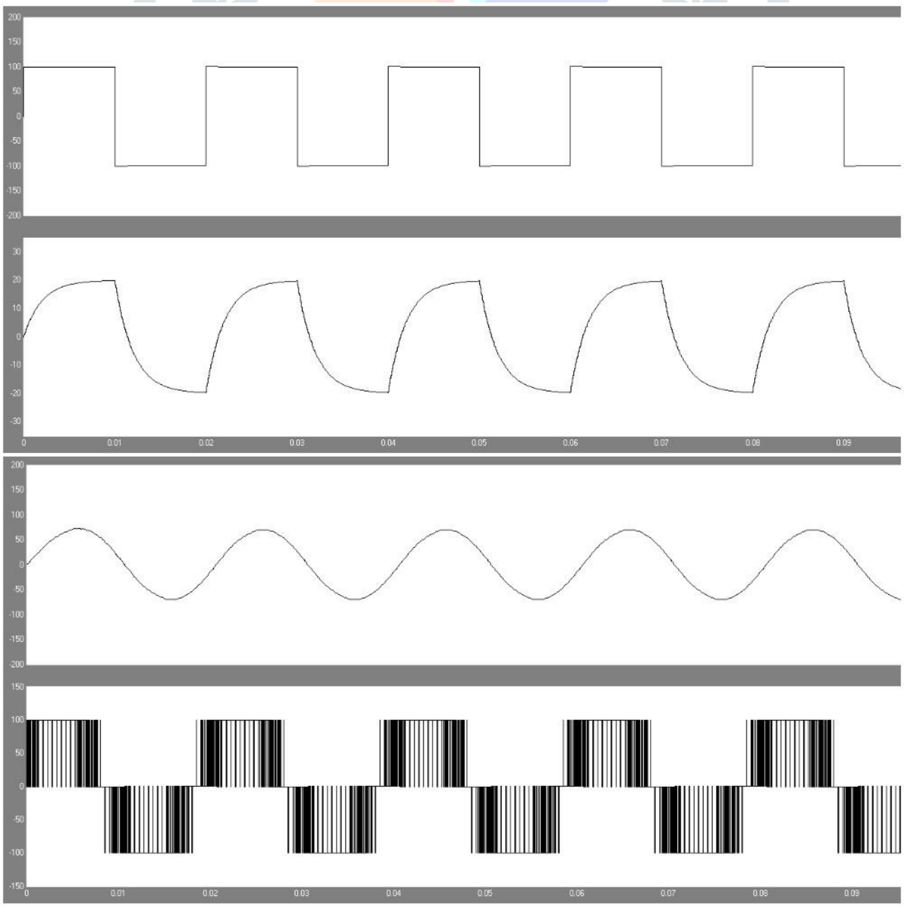


Boost chopper output wave forms

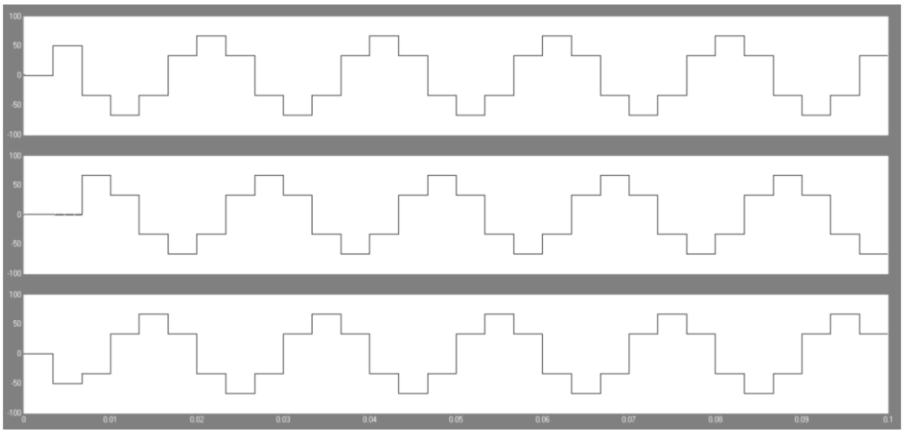


Buck-boost chopper output wave forms

3.3 Output results of inverter circuits



Basic single-phase inverter output waveform



Basic three-phase inverter output waveform

4. Conclusion:

In this paper explained about the different types of converters. These converters behaviour at different loads as shown in the result. Based on the operation of theses converters used in som many high-power applications like DC drives, HVDC applications, high power applications, regulator supplies etc.

5. References

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