SIMULATION OF SINGLE PHASE CYCLOCONVETER FOR INDUSTRIAL APPLICATION

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ABSTRACT – *The variable frequency power electronic system design is having a great importance in various types of industrial applications. To fulfill those requirements of variable frequency, cycloconverters are widely used. Cycloconverter is a power electronics device which converts input power at one frequency into output power at different frequency.*

The firing angles are carefully timed to regulate the output frequency. Thyristors are used as the switching devices in the cycloconverter. Thyristors are triggered to control the output waveform. The output voltage waveform, frequency, and magnitude can be observed as the model changes the firing angles and load conditions.

***Key Words*: Converter, Single phase cycloconverter, Simulation, power electronic circuit, variable frequency converter, waveforms, Parameters for R load**

1.INTRODUCTION

A cycloconverter converts a constant voltage, constant frequency AC waveform to another AC waveform of a lower frequency by synthesizing the output waveform from segments of the AC supply without an intermediate DC Link**.**
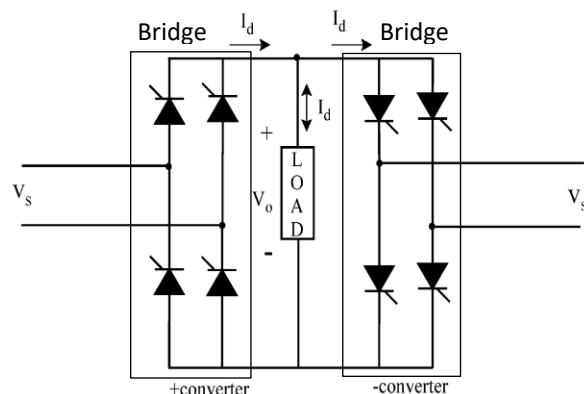
Fig. 1: 1ϕ Cycloconverter

1.1: TYPES OF CYCLOCONVERTERS

There are two main types of cycloconverters:

1)Blockingmodetype
2)Circulatingmodetype

When the load current is positive, the positive converter supplies the required voltage, and the negative converter is blocked. Suppose if the load current is negative, then the negative converter supplies the voltage and the positive converter is blocked. This operation is called blocking mode operation.

By chance, if both converters are enabled, then the supply will be short-circuited. To avoid this, an intergroup reactor (IGR) must be connected between the converters. If both the converters are enabled, then a circulating current is produced. This is unidirectional because the thyristors allow the current to flow in only one direction. The cyclo converters using this approach are called circulating current converters.

2: SIMULATION

In the below circuit we are using different blocks such as Power Gui, AC Voltage source, Frequency control , Logical controller, Input Voltage, Universal Bridge P converter and N converter, R Load, Voltage measurement, Root mean square(RMS),Scope,Display.

GUI stands for Graphical User Interface. This block stores the equivalent Simulink circuit that represents the state space equations of the model. By using **AC Voltage source** supply we can supply AC power to the circuit. Here we are using 230v,50 Hz supply. **Frequency Control** is important for maintain the frequency of the voltage and power balance. **NOT Gate** is used as Logical operator in this circuit. It is act like as a switch. **Universal Bridge** block is the important block in the circuit. The universal bridge block implements a universal three-phase power converter that consist of up to six power switches connected in a bridge configuration. The **RMS** block stands for Root Mean Square value of each row or column of the input, or along vectors of a specified dimension of the input. We are using R load in this circuit.

Scope is used to observe the output of a given circuit and the **Display** can show the reading of the circuit.
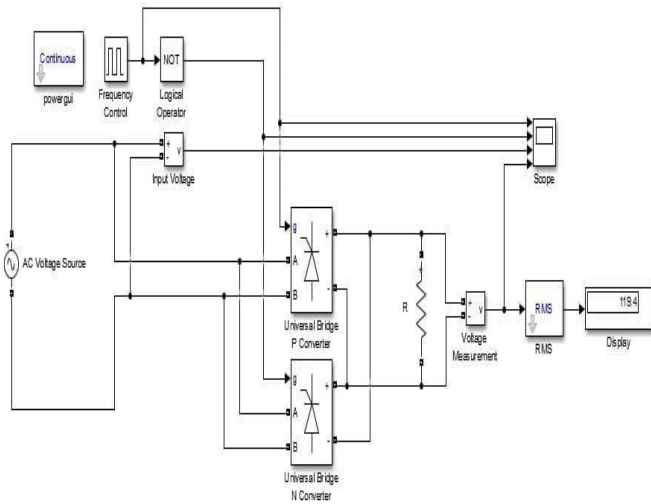
Fig 2: Simulation Of 1 Φ Cycloconveter

Simulated of single phase cycloconverter by using simulation tool is shown in Fig 2. Two universal bridge converters has been connected in anti parallel named `P' converter and `N' converter with a common load.

This simulation is performed to Fixed input frequency into varied frequency. Hence in order to obtain desired output frequency, the circuit is designed in such a way that for During the Positive half-cycle of the input waveform, the Universal Bridge P Converter operates by Leading the firing of its thyristors, producing an output at a frequency Higher than the input frequency.

During the negative half-cycle of the input waveform, the Universal Bridge N Converter operates by delaying the firing of its thyristors, producing an output at a frequency lower than the input frequency.

The combined output of these converters, when connected to the load, results in an output voltage with a frequency different from the input frequency. The load can be a motor or any device that requires variable frequency control.

By controlling the firing angles of the thyristors in the Universal Bridge P and N Converters, you can vary the output frequency and control the speed or other characteristics of the connected load.

This basic model showcases the concept of cycloconversion by manipulating the firing angles of thyristors during each half-cycle of the input AC waveform. In practice, more advanced control circuits and feedback systems are used to achieve precise frequency control and regulation.

Table -1: Parameters

| Input Source	1 φ,230 Volts
Source Frequency	50 Hz
Load	R=10ohms
Peak Amplitude	169.7V
Snubber Resistance (Rs)	1e5
Snubber Capacitance (Cs)	Inf

3.OUTPUT

If we observe at the scope we can get four outputs. Those are Input supply, output supply, output from Universal bridge P converter and Universal Bridge N converter.

The input supply voltage at 230 Volts(rms) at 50Hz has been converted. The supply voltage waveform of 50 Hz for R load is shown in Fig.3.

For 10 Ω purely resistive load (R Load), current flowing through it has been 23 amperes. Since current is in phase with voltage for resistive load, an identical wave shapes of current and voltage waveforms except their magnitudes has been obtained. highlights the output voltage and current waveforms respectively for R load at the output frequency.
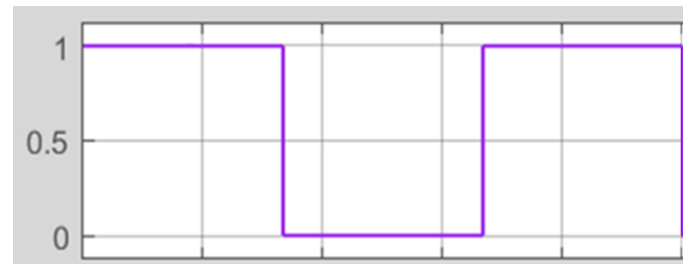
Fig 3: Output Waveform of P Converter
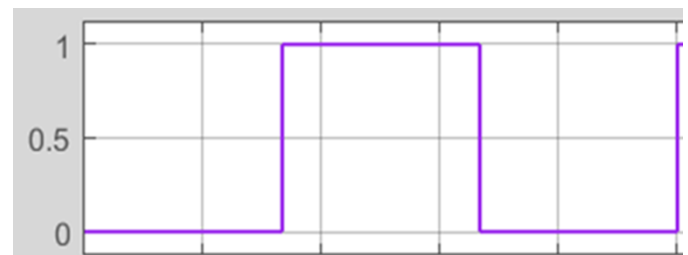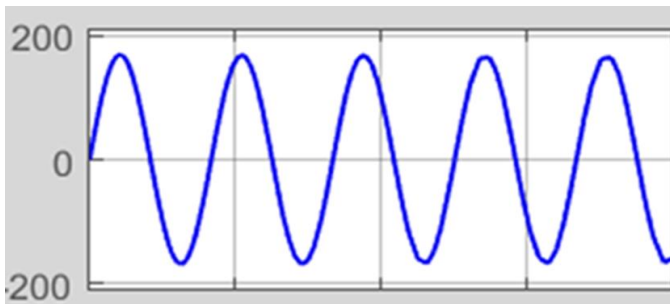

Fig 4: Output Waveform of N Converter
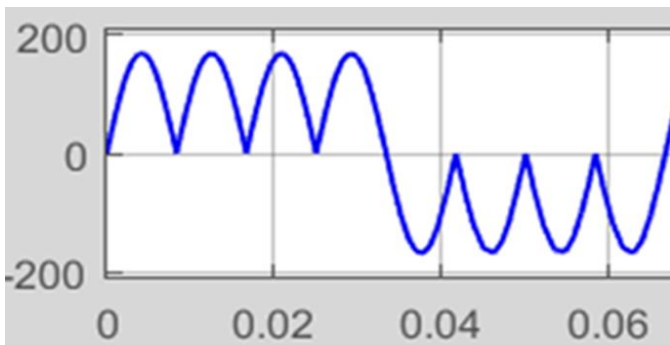
Fig 5: Input Waveform
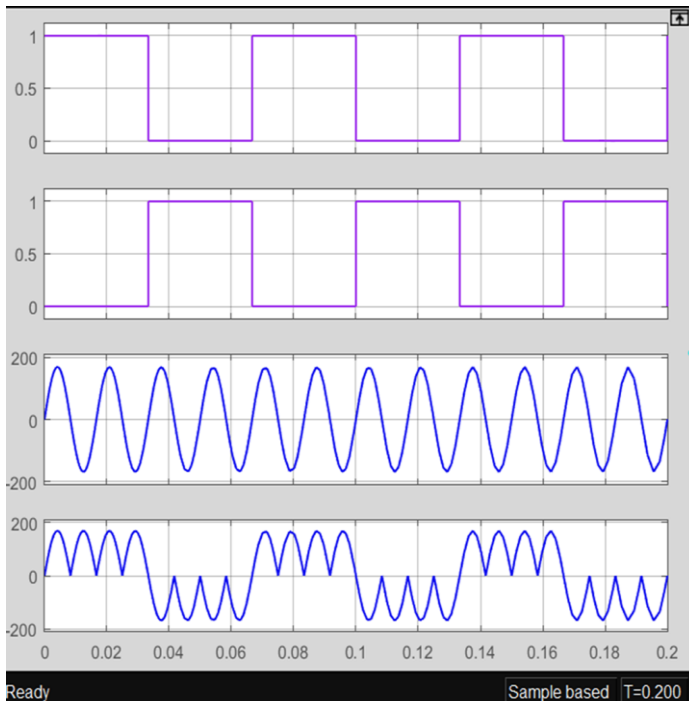
Fig 6: Output Waveform for R Load

Fig 7: Output Waveform for R Load

The above fig 3,4,5,6,7 show the output which are connected to the scope. Fig 3 shows the output of Universal bridge P converter during the positive half cycle Frequency control supplies additional frequency to the universal bridge P converter by using logical operator Not gate. Here Not gate works like an inverter or switch. During positive half it is in

on condition and supply frequency control supply to Universal bridge P converter hence we can get high frequency than the input frequency.

Fig 4 shows the output of N converter during the negative Universal bridge N converter is on state and P converter is Off state and logical operator is also in off state. The output of N converter is less than the input frequency

Fig 5 shows the Input supply here we are using 230v, 50 Hz, AC supply and the peak amplitude is 162.2.

Fig 6 shows the Output waveform of Cycloconverter we can get this output by combining the output of universal bridge P converter and universal bridge N converter output to R load by using R load we can get our required output power at different frequency. We can observe the output at scope and the reading at display.

4.APPLICATIONS

The most important industrial applications of cycloconverters are listed below.

- Cement mill drives
- Rolling mills
- Ship propulsion drivers
- Water pumps
- Washing machines
- Mine winders
- Industries

5. CONCLUSIONS

A 1ɸ cycloconverter has been successfully simulated using Universal 'P' bridge Converter & `N' Bridge converter configuration which has generated an output voltage at a frequency than the input frequency for both R Load as desired. The hardware implementation of 1 Phase cyloconverters is proposed to validate the simulated results. The several vital applications of the cycloconverter circuit configurations for industrial need have been studied and discussed. The simulation results highlighting voltage and current waveforms found satisfactory.

6.REFERENCES

1) D. Kornack and P. Rakic, "Cell Proliferation without Neurogenesis in Adult Primate Neocortex," Science, vol.294,Dec.2001,pp.2127-2130,doi:10.1126/ science.1065467

2) M. Young, The Technical Writer's Handbook. Mill Valley, CA: University Science, 1989.

3) capitalized," J. Name Stand. Abbrev., in press.

4) K. Elissa, "Title of paper if known," unpublished.