WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Controlling Industrial Power by Using Integral Cycle Switching

N. S. Jadhav*[1], M. S. Mulla*[2], S. P. Nikam*[3], V. S. Kadam*[4], M. S. Shinge*[5]

*[1]Lecturer/Department of electrical engineering, Sanjay Ghodawat Polytechnic, Atigre
*[2]Student/Department of Electrical Engineering, Sanjay Ghodawat Polytechnic, Atigre
*[3]Student/Department of Electrical Engineering, Sanjay Ghodawat Polytechnic, Atigre
*[4]Student/Department of Electrical Engineering, Sanjay Ghodawat Polytechnic, Atigre
*[5]Student/Department of Electrical Engineering, Sanjay Ghodawat Polytechnic, Atigre

ABSTRACT

Implementing vital cycle switching, a method for controlling AC power by deleting particular AC signal cycles, cycles, or fractions of cycles, is the aim of this project.

In handling linear loads, such as electric oven heaters, this strategy has been widely used.

To achieve cycle theft of the voltage waveform in this project, an Arduino microcontroller is used. This enables exact control of the time-average voltage given to the load. on order to generate triggering pulses on the Arduino, interrupts are triggered by zero crossing detection, which is done using a comparator. Following the usage of these pulses to drive opto-isolators, which subsequently trigger the TRIAC for integral cycle control based on input switches interfaced to the microcontroller, these pulses are utilised to drive opto-isolators.

A succession of loads should be used in place of a linear one.To check the output, a motor or bulb might be employed. It's vital to keep in mind that this method could lead to an imbalance in the input current or voltage waveform because of the on/off cycling across the load. While a light is utilised in this project as a demonstrative tool, the main goal is to test whether the load turns on at the waveform's zero crossing even when switching occurs randomly. To deliver a controlled +5V DC supply for the microcontroller and other components, the project's power supply consists of a step-down transformer, bridge rectifier, capacitive filter, and voltage regulator 7805. To maintain the desired output to the load automatically during the appropriate cycle, a feedback mechanism can also be added.

Keywords: *integral cycle switching, power control ,industrial power control*

I. INTRODUCTION

The goal of the study is integral cycle switching, a technique for removing an AC signal's entire cycle, cycles, or portions of cycles. It is a well-known and established technique for managing AC power, particularly when applied to linear loads like electric furnace heaters.

However, the idea of switching the voltage waveform's cycle with the help of an Arduino can be executed with extreme precision thanks to a programme written in assembly language, resulting in a time-average voltage or current at the load that is proportionately lower than the signal as a whole. A series motor or lamp can be used to test the output in place of the linear load that will be employed in the output.

When using this method, the input current or voltage waveform may become unbalanced when the cycles are cycled on and off throughout the load. For zero crossing detection in this paper, a comparator is used, and the output is given to Arduino as an interrupt.

Here, the interrupt that was received by the Arduino served as a reference for producing triggering pulses. We drive the opto-isolators with these pulses to start the trial and obtain integral cycle control in accordance with the input switches connected to the Arduino. For demonstration purposes, a bulb is given in this project in place of a motor. This project can be improved further by utilising a feedback mechanism that will automatically maintain the desired output to the load by employing the control over the load's average voltage or current over time.

A series motor or lamp can be used to check the output instead of a linear load. An imbalance in the input current or voltage waveform caused by the on/off switching of cycles across the load is one possible adverse outcome of this strategy, though. In this study, the Arduino receives an interrupt from a comparator that detects zero crossings. The Arduino then provides the output in accordance with the received interrupt, acting as the benchmark for producing triggering pulses. Opto-isolators are driven by these pulses,

We use input switches connected to the Arduino to activate the TRIAC in order to obtain integral cycle control. For demonstration purposes, a bulb is utilised in this project in place of a motor.

Incorporating a feedback mechanism to automatically maintain the desired output to the load through proper cycle switching will also improve the project's functionality.

II. NECESSITY

For the regulation of industrial electricity without the production of harmonics. The technique used to regulate industrial power and the amount of voltage input to the system for regulating linear loads in industry is integral cycle switching. the process of harmonic creation

This technique is used for power regulation in order to reduce harmonic generation because it causes overheating, vibrations, and other system failures.

III. OBJECTIVE

Our main goal is to show how integral cycle switching is used to control industrial electricity in industrial facilities. We have been working on a piece of hardware to show how this works. Instead of utilising a linear system to check the output, we use a lamp.

Despite the fact that there won't be any difference because the change in output can be observed here, the intensity of the lamp's output will be seen as output if the load is an induction motor for affordability and convenience

IV. INTEGRAL CYCLE SWITCHING

Integral cycle switching, a method for selectively removing full cycles, cycles, or portions of cycles from an AC signal, is what the project attempts to put into practise. This method has historically been used to manage AC power in linear loads like heaters. However, by utilising Arduino to vary the voltage waveform's cycle, programming in assembly language can provide fine control, allowing the time-average voltage or current experienced at the load to be proportionately lower than the overall system.

A comparator is used in this project to detect zero crossings, which causes an interrupt to be sent from the Arduino. In order to provide integral cycle control based on input switches interfaced with the Arduino, the Arduino then creates triggering pulses as a reference for driving opto- isolators, which in turn drive the triac. For demonstrations, a bulb is utilised in place of a linear load. It's important to note that this method can cause the input current or voltage waveform to be imbalanced , due to constant switching.

V. COMPONENTS USED

Sr no	**Components**	**Rating**
1	Transformer	1:3, 240V ,1-ph
2	Capacitive filter	In microfarads
3	Voltage regulators	IC-7816
4	Rectifiers	Bridge (A-D)
5	Arduino UNO	28 pins , 5V
6	LCD	16 pins , 5V
7	Opto oscillators	L1319, MOC3021
8	Diodes	IN4007
9	Resistors	327 ohms

The above table shows the components used with their ratings

VI. BLOCK DIAGRAM (electrosal , n.d.)

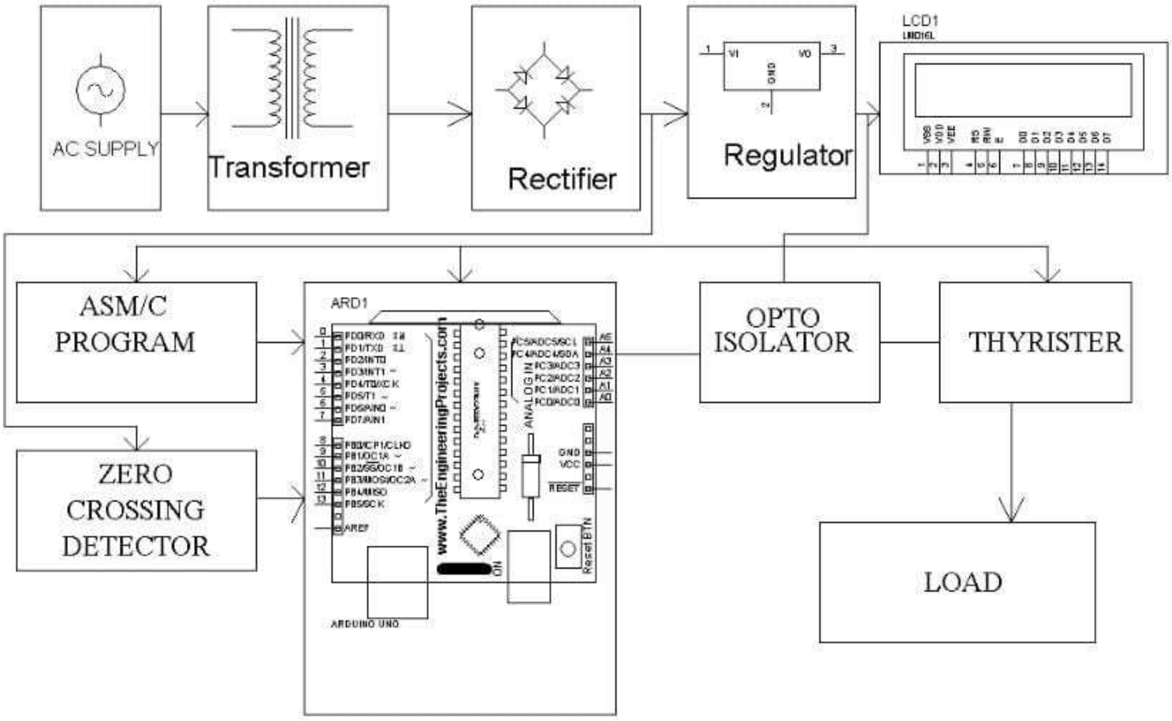

Fig : block diagram of power control using integral cycle switching

In the block diagram above, the integral cycle switching technique used for power regulation is displayed.

Transformer receives an AC supply, which is then transformed into a DC supply by a rectifier.this DC source is fed to the zero crossing detector as well before being given to the arduiono. The LCD is connected to the regulator and receives the regulator's output. the regulator optocoupler's output signal, followed by a transistor and a load.

VII. WORKING

Integral cycle controllers are converters that can switch directly without experiencing any losses. Without the need for intermediate AC to DC and DC to AC conversion steps, the technique transfers AC to AC immediately.

The fundamental integral control cycle has a sinusoidal shape. It functions by adding and subtracting higher frequency half cycles from the AC input. Given that only full or half cycles are used, the controllers are typically ON or OFF during half cycles when the voltage input is zero. Because of this, integral cycle circuits can switch at zero voltage without the need for a resonant circuit. A different approach to direct conversion is integral cycle control. It is also referred to as cycle selection, zero switching, and on-off control. There are multiple years for

Integral cycle controllers are converters that can switch directly without experiencing any losses. Without the need for intermediate AC to DC and DC to AC conversion steps, the technique transfers AC to AC immediately.

The fundamental integral control cycle has a sinusoidal shape. It functions by adding and subtracting higher frequency half cycles from the AC input. Given that only full or half cycles are used, the controllers are typically ON or OFF during half cycles when the voltage input is zero. Because of this, integral cycle circuits can switch at zero voltage without the need for a resonant circuit. A different approach to direct conversion is integral cycle control. It is also referred to as cycle selection, zero switching, and on-off control. There are multiple years for starting at a low number, speed rises exponentially until it reaches its maximum at the conclusion of the nth cycle. It is stated to have a duty cycle of D=n/M if n is the number of full cycles passed per M cycles of the source voltage. The differential is the difference between the maximum temperature and the minimum temperature.

Due to the lowest harmonic frequency and lowest switching losses created in ICC, EMI and RFI issues will be reduced. ZVS will also result in decreased inrush current, however smooth voltage control and changing frequency in ICC make this impossible. Integral cycle control (ICC) regulates the flow of electricity to an AC load by allowing only a small number of full cycles to power the load, then a period of rest. This is cycled back and forth. The duty cycle is essentially an on-off control similar to that obtained using thermostatic switches, except that here an integral number of cycles is used. The duty cycle is regulated to change the output power.

Integral cycle control, often referred to as on-off control, zero switching, or cycle selection, is a direct conversion technique where the load is (irk) connected to the power source for a predetermined number of integral cycles before being detached for an additional predetermined number of integral cycles. This The duty cycle, denoted by the ratio of the number of cycles the power is ON (n) to the total number of cycles (M), is repeated frequently and is used to manage the output power. When a load is turned on and off, there is little temperature difference since this sort of control is frequently employed in applications where the mechanical or thermal time constant is many seconds. Integral cycle control lessens switching losses and harmonic generation Due to thyristors' zero voltage and zero current switching, there are less issues with electromagnetic interference (EMI), radio frequency interference (RFI), and inrush current as a result. But it might not offer smooth voltage regulation, and the ICC frequency might change

VII. CONCLUSION

And hereby we conclude that we have completed the project and it is ready to work under experimental conditions. We learned a lot about the workings of sign waves, power inputs made errors, and learned from them. We have tested the project in a variety of ways and have ensured it works as expected. We have monitored the power input and studied the sign waves to determine the most efficient use of power, and have made any necessary adjustments to the design. We believe we have created a project that is now ready to perform under the desired conditions. I believe this was one of the most beneficial in triggering our critical thinking, problem solving and creative thinking tasks throughout our career. The project guide provided us with guidance and support throughout the entire process and we would like to thank him for his assistance.

VIII. ADVANTAGES OF POWER CONTROL BY INTEGRAL CYCLE SWITCHING

1. Less generation of harmonics thereby reducing the ill effects of harmonic distortion and surges in the system
2. Minimal losses
3. Better control
4. Power factor control

IIX. DISADVANTAGES OF POWER CONTROL USING INTEGRAL CYCLE SWITCHING

1. It responds slowly to an error signal
2. Can cause system instability sometimes due to large deviation at the instant of error

IX. APPLICATIONS OF POWER CONTROL USING INTEGRAL CYCLE SWITCHING

1. Controlling heaters used in electric furnance

X. REFERENCES

1. •DV.Khakhkhar, " Design and Simulation of Novel Integral Switching Cycle Control for Heating
2. Load", International Journal of Emerging Trends in Electrical and Electronics (IJETEE – ISSN: 2320-
3. 9569) ,Vol. 5, Issue. 1, July- 2013 .
4. O.Oladepo,G.A. Adegboyega “MATLAB Simulation of Single-Phase SCR Controller for Harmonic Distortion and Effects in Electrical Power Systems, Associated Power Technologies.
5. Distortion in power system by Lundquist Johan. IEEE STD 519-1992, wikipedia.
6. Integralenergy power quality centre by Vic Smith.
7. Solid state relay user’s guide by Omron
8. Umar Farooq Siddiqui, Ajit Verma, and Shilpa Soni “Comparative Performance Analysis of
9. Induction Motor Using Semiconductor Devices in Terms of Firing Angle,”International Journal of Emerging Technology and Advanced Engineering, Vol. 4, Issue 2,February 2014.Industrial Power Control by Integral Cycle Switching
10. Research gates research paper
11. ee.web.com
12. tutorialspoint.com
13. ijarse.com