

Industrial Power Control by Integral Cycle Switching without Generating Harmonics

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Abstract: *The project is designed to achieve integral cycle switching, a method to remove whole cycle, cycles or portions of cycles of an AC signal. It is a well-known and old method of controlling AC power, especially across linear loads such as heaters used in electric furnace. However the concept of achieving the cycle switching of voltage waveform by use of aurdino can be very precise as per the program written in assembly language so that the actual time-average voltage or current experienced at the load is proportionately lower than the whole signal if applied to the load. In place of a linear load to be used in the output, a series motor or lamp can be used to verify the output. One side effect of utilizing this scheme is an imbalance in the input current or voltage waveform as the cycles are switched on and off across the load. In this project we are using comparator for zero crossing detection which is fed as an interrupt to aurdino. Here the aurdino delivers the output based on the interrupt received as the reference for generating triggering pulses. Using these pulses, we drive the opto-isolators for triggering the triac to achieve integral cycle control as per the input switches interfaced to the aurdino. A lamp is provided in this project in place of a motor for demonstration purpose. Further this project can be enhanced by using feedback mechanism to automatically maintain desired output to the load by appropriate cycle switching.*

Keywords: solid-state relay, Aurdino, DSo

1. Introduction

The paper is designed to achieve integral cycle switching, a method to remove whole cycle, cycles or portions of cycles of an AC signal. It is a well-known and old method of controlling AC power, especially across linear loads such as heaters used in electric furnace. However the concept of achieving the cycle switching of voltage waveform by use of aurdino can be very precise as per the program written in assembly language so that the actual time-average voltage or current experienced at the load is proportionately lower than the whole signal if applied to the load. In place of a linear load to be used in the output, a series motor or lamp can be used to verify the output. One side effect of utilizing this scheme is an imbalance in the input current or voltage waveform as the cycles are switched on and off across the load.

In this paper we are using comparator for zero crossing detection which is fed as an interrupt to aurdino. Here the aurdino delivers the output based on the interrupt received as the reference for generating triggering pulses. Using these pulses, we drive the opto-isolators for triggering the triac to achieve integral cycle control as per the input switches interfaced to the aurdino. A lamp is provided in this project in place of a motor for demonstration purpose. Further this project can be enhanced by using feedback mechanism to automatically maintain desired output to the load by appropriate cycle switching.

2. What Is Integral Cycle Switching?

This project is intended to attain vital cycle switching – a technique to get rid of complete cycle, cycles or fractions of cycles of an AC signal. It is a renowned and aged technique of managing AC power, principally across linear loads for

instance heaters brought into play in electric oven. However, the concept of achieving the cycle switching of voltage waveform by the use of aurdino can be very precise as per the program written in assembly language so that the actual time-average voltage or current experienced at the load is proportionately lower than the whole signal if applied to the load.

In this project, we are using a comparator for zero crossing detection which is fed as an interrupt to the aurdino. Here, the aurdino delivers the output based on the interrupt received as the reference for generating triggering pulses. Using these pulses, we drive the opto-isolators for triggering the triac to achieve integral cycle control as per the input switches interfaced to the aurdino. In place of a linear load to be used in the output, a series motor or lamp can be used to verify the output. One side effect of utilizing this scheme is an imbalance in the input current or voltage waveform as the cycles are switched on and off across the load. A lamp is provided in this project in place of a motor for demonstration purpose. The project output with a lamp appears to be a simple project of lamp flickering.

3. Which devices are used?

Aurdino is a programmable micro controller for prototyping electromechanical devices. You can connect Digital and Analog electronic signals Sensors (Gyroscopes, GPS Locators, accelerometers).

Arduino is an open-source platform used for building projects. Arduino consists of both a physical programmable circuit board and a piece of Integrated Development Environment. The Arduino platform has become quite popular with people just starting out with electronics, and for good reason. Unlike most previous programmable circuit

International Journal of Science and Research (IJSR)

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boards, the Arduino does not need a separate piece of hardware in order to load new code onto the board, you can simply use a USB cable. Finally, Arduino provides a standard form factor that breaks out the functions of the micro-controller into a more accessible package.

Solid state relay:

A solid-state relay (SSR) is an electronic switching device that switches on or off when a small external voltage is applied across its control terminals. The relay may be designed to switch either AC or DC to the load. It serves the same function as an electromechanical relay, but has no moving parts.

Relays are switches that open and close circuits electromechanically or electronically. Relays control one electrical circuit by opening and closing contacts in another circuit. When a relay contact is Normally Closed (NC), there is a closed contact when the relay is not energized.

4. Block Diagram

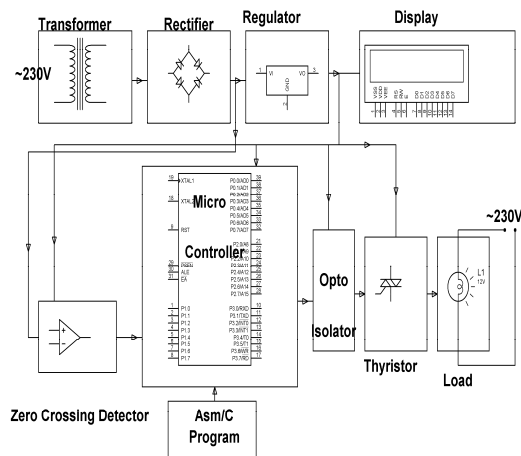


Figure 1: Block diagram

5. Result

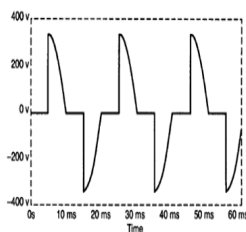


Figure 2: output waveform

Advantages:

- [1]It reduces harmonics.
- [2]It is more efficient than convention firing angle modulation method.
- [3]Load operates safely.
- [4]This method is easy and less costly.

[5]This method is more in many small and large applications

Disadvantages:

[1]Power can be delivered with percentages 20% 60% 80% and 100% in between power delivering required modification on the circuit.

Application:

- [1]This method is used in industry for controlling power.
- [2]This method is also used in house such as fan, motor, water pumping etc.
- [3]It is used to controlling the power in linear loads.
- [4]Where we have to control the speed, intensity and power then this method is applicable.

Conclusion

In this way, we can control the power by using integral cycle switching. We understand how to remove cycle from main input. We get output without any distortion. We can see our output on CRO with integral cycle switching.

References

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