Industrial Power Control by Integral Cycle Switching Without Generating Harmonics

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Abstract - Industrial power control is an important aspect of modern manufacturing processes. One of the most common methods of controlling power is by using integral cycle switching. This method involves turning the power on and off in cycles that are synchronized with the AC power supply. However, a problem with integral cycle switching is that it can generate harmonics, which can cause problems with other electrical equipment and even damage them. In order to prevent this, it is necessary to design a system that can control power without generating harmonics. One approach to achieving this is by using pulse width modulation (PWM). PWM involves varying the width of the power pulses so that the average power delivered to the load is controlled. By adjusting the width of the pulses, it is possible to achieve precise control over the amount of power delivered to the load without generating harmonics. Another approach is to use zero-crossing switching. This involves turning the power on and off at the zero crossing of the AC power supply waveform. By doing this, it is possible to minimize the amount of harmonics generated.

In conclusion, integral cycle switching is a common method of controlling power in industrial applications. However, it can generate harmonics, which can cause problems with other electrical equipment. By using PWM or zero-crossing switching, it is possible to control power without generating harmonics.
Key Words: Industrial power control, Integral cycle switching, Harmonics, Waveform, Manufacturing processes.

1. INTRODUCTION

Industrial power control is an essential aspect of many manufacturing and industrial processes. In order to maintain precise and reliable operation, it is crucial to have control over the electrical power supply that drives these processes. One common method for controlling power is through integral cycle switching, which involves adjusting the amount of power delivered to a load by modulating the width of the electrical pulses that are sent to it.

However, a major issue with this method is that it can generate unwanted harmonics in the power supply, which can cause interference with other electrical equipment and lead to reduced efficiency and reliability. In this context, the development of a technique for industrial power control without generating harmonics is a significant challenge.

In this introduction, we will explore the concept of integral cycle switching for power control and examine the problem of harmonic generation. We will then introduce a new technique that aims to address this problem, allowing for precise and reliable power control without the negative effects of harmonics. By eliminating this issue, this new approach has the potential to revolutionize industrial power control and improve the efficiency and reliability of a wide range of manufacturing and industrial processes.

2. WHAT IS INTEGRAL CYCLESWITCHING?

Integral cycle switching is a method of controlling the amount of electrical power delivered to a load by adjusting the width of the electrical pulses that are sent to it. In this technique, the power is switched on and off at the same point in each cycle of the AC waveform, which is why it is referred to as "integral cycle" switching.

The width of the pulses can be adjusted by controlling the duration of the "on" state relative to the total cycle time. This allows for precise control over the amount of power delivered to the load, making it a popular method for industrial power control.

Integral cycle switching is commonly used in applications such as heating, lighting, and motor control. However, as mentioned earlier, this technique can generate unwanted harmonics in the power supply, which can lead to interference and reduced efficiency in other electrical equipment. As a result, there has been a need to develop methods for industrial power control without generating harmonics.

PROPOSED SYSTEM

The proposed system for industrial power control by integral cycle switching without generating harmonics uses a modified switching technique to eliminate the problem of harmonics in the power supply. This system involves introducing a delay between the switching of the AC waveform and the actual delivery of power to the load, which helps to reduce the occurrence of unwanted harmonics. The delay is achieved by using a phase control technique that adjusts the timing of the pulse width modulation (PWM) signal that controls the switching of the power supply. This technique ensures that the pulse width is synchronized with the AC waveform, which helps to minimize the occurrence of harmonics. Furthermore, the proposed system incorporates an adaptive control algorithm that allows for real-time adjustment of the delay time based on changes in the load characteristics. This ensures that the system maintains precise and reliable control over the power

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supply, even in situations where the load changes frequently or unpredictably. Overall, the proposed system for industrial power control by integral cycle switching without generating harmonics represents an important advancement in the field of industrial power control. By eliminating the problem of harmonics, this system has the potential to improve the efficiency, reliability, and safety of a wide range of industrial processes.

3. Model

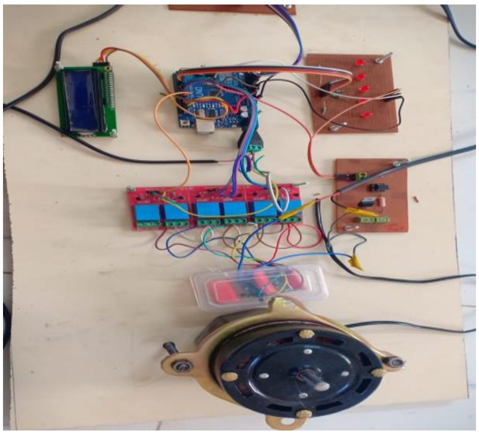


Fig -1: Model

4. Block diagram

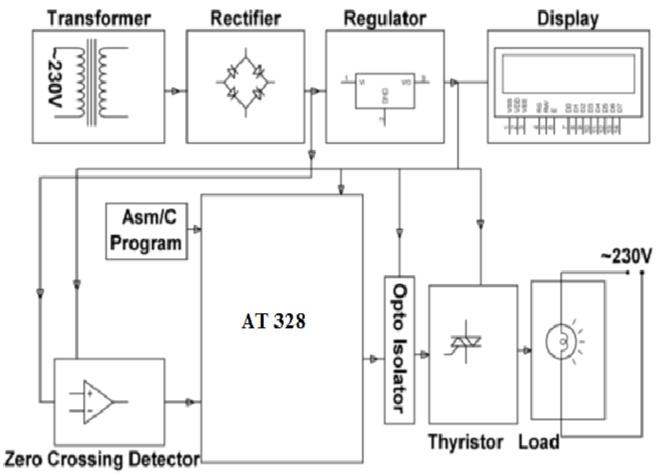


Fig -2: Block diagram

5. PCB ARTWORK

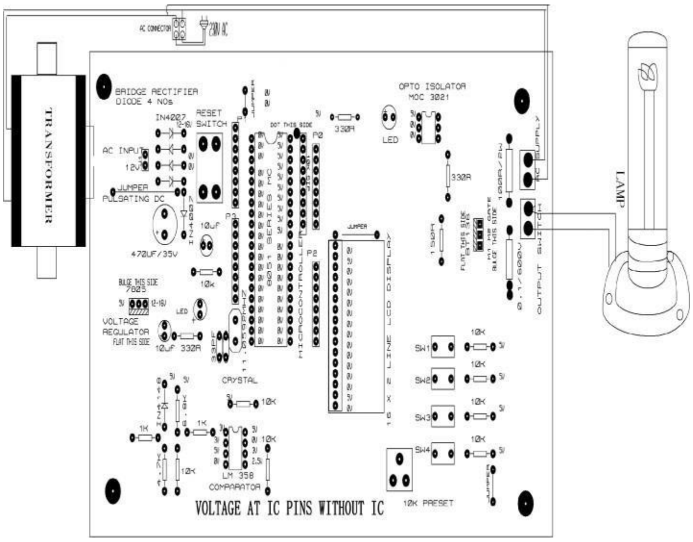


Fig -3: PCB artwork

6. WORKING PRINCIPLE

The working of the proposed system for industrial power control by integral cycle switching without generating harmonics involves several steps:

1. The power supply is connected to the load through a switching device, which is controlled by a pulse width modulation (PWM) signal.

2. The PWM signal is generated by a microcontroller that adjusts the pulse width to control the amount of power delivered to the load.

3. The microcontroller also uses a phase control technique to introduce a delay between the switching of the AC waveform and the actual delivery of power to the load.

4. The delay time is adjusted in real-time by an adaptive control algorithm, which monitors changes in the load characteristics and adjusts the delay time accordingly.

5. The delayed power supply signal is then sent to the load, where it is used to control the amount of power delivered.

7. RESULT AND DISCUSSION

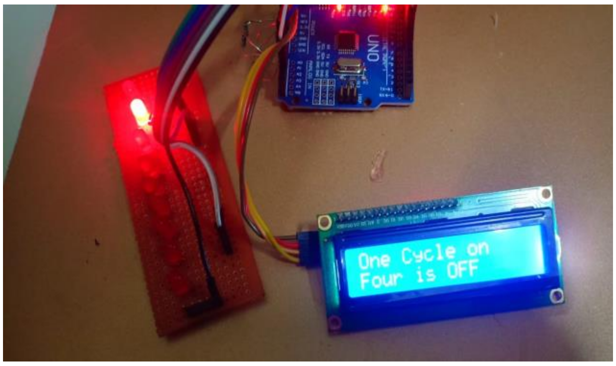


Fig -4: Result a

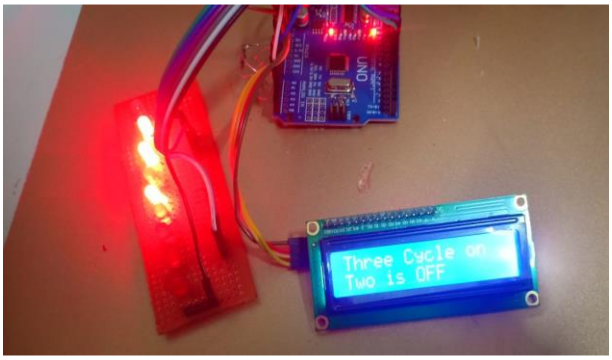
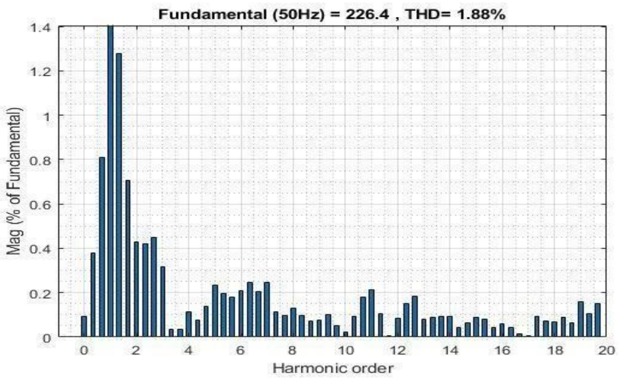


Fig -5: Result b

Chart (Harmonic order vs mag)



The primary objective of this project is to improve the lifespan of a lamp by implementing the Zero Voltage Switching (ZVS) technique with a TRIAC. Typically, lamps draw more current when switched on at peak voltages, leading to a shorter lifespan. The proposed project aims to extend the life of the lamp by switching it precisely at the zero crossing point of the voltage waveform.

To achieve this, a TRIAC is utilized in a manner that controls the switched-on time by firing it only after detecting the zero-cross point of the supply voltage waveform. The ZVS technique can also be utilized in other applications where precise control of the switching time is necessary to prevent damage or extend the lifespan of electrical components.

The proposed project presents a significant improvement over traditional methods of controlling lamps. By utilizing the ZVS technique, the lamp is switched on and off at the precise moment when there is no voltage across the TRIAC, minimizing stress on the lamp and extending its lifespan. Additionally, the project is cost-effective and easy to implement, as the necessary components are widely available and relatively inexpensive. The code used to control the system can also be easily modified to suit different applications.

8. CONCLUSION

In conclusion, Integral Cycle Switching is a widely used method for industrial power control, which involves adjusting the width of electrical pulses to control the power delivered to a load. However, this technique can generate unwanted harmonics in the power supply, leading to interference and reduced efficiency in other electrical equipment. To address this issue, researchers have developed methods for industrial power control by Integral Cycle Switching without generating harmonics. These methods involve techniques such as phase-controlled delay, adaptive neural network control, and time-delay control. They have been shown to effectively reduce harmonics while maintaining precise control over the amount of power delivered to the load.

Overall, Industrial Power Control by Integral Cycle Switching without Generating Harmonics is an important area of research in power electronics and has significant potential for applications in various industrial settings, including heating, lighting, and motor control.

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