

## A COMPARISON OF PI CURRENT CONTROLLERS IN FIELD ORIENTED INDUCTION MOTOR DRIVE

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**Abstract.** The PID controller is by far the most common algorithm. Most feedback loops are controlled by this algorithm or minor variations of it. Traditionally the PI controller has been widely used, while some other types of PID controller have been applied in some applications. In this article, the modified PI controller which has the feedforward term is introduced. In order to achieve desired performance criteria such as quick response, reference tracking, steady state error, system bandwidth and disturbance rejection capability, an optimization procedure for classical PI and modified PI controller is introduced with experimental results. The characteristic of current control loop of vector controlled induction machine with classical PI and modified PI controllers is also discussed along with experimental results.

**Keywords:** ac drives, vector control, current control, PI controller

### 1. Introduction

PI(D) controllers are found in large numbers in all industries. They come in many different forms. PI(D) controllers are also embedded in all kinds of special purpose control system. They have survived many changes in technology ranging from pneumatics to integrated circuits and microprocessors [1].

These controllers have several important functions: they provide feedback, they have the ability to eliminate steady state error through the integral action, they can anticipate the future through the derivative action, and they can cope with the actuator saturation [1]. PI(D) controllers are also sufficient for many control problems, particularly in cases where modest performance requirements are needed. They are thus important components in the control engineer's toolbox [1].

The microprocessor has had a dramatic effect on PI(D) controllers as on other types of industrial electronics, and a large number of those manufactured today are based on microprocessors.

Although PI(D) controllers are common and well known, they are often poorly tuned. Evidence for this can be found in the control rooms of any industry. For example, 20 % of control loops are improperly designed, 15 % are

not installed correctly, 30 % of control loops have out of sense tuning parameters, 85 % are not tuned well [2].

This article deals with tuning current controller in field oriented vector controlled induction machine drive. In motion control applications a classical multi loop structure has been widely used and each loop is controlled by appropriate controller. The multi loop structure is still favored because of simplicity in control and the natural hierarchy of bandwidth requirements [3]. The first step is to select correct algorithm. Each algorithm uses a different set of mathematical equations to determine controller action. PID controller has been very popular due to its simple structure and relatively easy tuning procedures with acceptable performance [3]. But, there are few different PID algorithms. Selecting the right one algorithm requires understanding of the process to be controlled. Although not as popular as PID, some modified PID controllers have been proposed and used in some applications. In this article the characteristic of current control loop of vector controlled induction machine with classical PI and modified PID controllers is discussed along with experimental results.

The next step that is performed is to choose correct tuning algorithm for current controller. Traditional control techniques based on modeling and design are revealed, but there are also special methods for direct tuning based on simple process

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**Scott C. Dulebohn**



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## **Table of Contents A Comparison Of Pi Current Controllers In Field Oriented**

1. Understanding the eBook A Comparison Of Pi Current Controllers In Field Oriented
  - The Rise of Digital Reading A Comparison Of Pi Current Controllers In Field Oriented
  - Advantages of eBooks Over Traditional Books
2. Identifying A Comparison Of Pi Current Controllers In Field Oriented
  - Exploring Different Genres
  - Considering Fiction vs. Non-Fiction
  - Determining Your Reading Goals
3. Choosing the Right eBook Platform
  - Popular eBook Platforms
  - Features to Look for in an A Comparison Of Pi Current Controllers In Field Oriented
  - User-Friendly Interface
4. Exploring eBook Recommendations from A Comparison Of Pi Current Controllers In Field Oriented
  - Personalized Recommendations
  - A Comparison Of Pi Current Controllers In Field Oriented User Reviews and Ratings
  - A Comparison Of Pi Current Controllers In Field Oriented and Bestseller Lists
5. Accessing A Comparison Of Pi Current Controllers In Field Oriented Free and Paid eBooks
  - A Comparison Of Pi Current Controllers In Field Oriented Public Domain eBooks
  - A Comparison Of Pi Current Controllers In Field Oriented eBook Subscription Services

- A Comparison Of Pi Current Controllers In Field Oriented Budget-Friendly Options
- 6. Navigating A Comparison Of Pi Current Controllers In Field Oriented eBook Formats
  - ePub, PDF, MOBI, and More
  - A Comparison Of Pi Current Controllers In Field Oriented Compatibility with Devices
  - A Comparison Of Pi Current Controllers In Field Oriented Enhanced eBook Features
- 7. Enhancing Your Reading Experience
  - Adjustable Fonts and Text Sizes of A Comparison Of Pi Current Controllers In Field Oriented
  - Highlighting and Note-Taking A Comparison Of Pi Current Controllers In Field Oriented
  - Interactive Elements A Comparison Of Pi Current Controllers In Field Oriented
- 8. Staying Engaged with A Comparison Of Pi Current Controllers In Field Oriented
  - Joining Online Reading Communities
  - Participating in Virtual Book Clubs
  - Following Authors and Publishers A Comparison Of Pi Current Controllers In Field Oriented
- 9. Balancing eBooks and Physical Books A Comparison Of Pi Current Controllers In Field Oriented
  - Benefits of a Digital Library
  - Creating a Diverse Reading Collection A Comparison Of Pi Current Controllers In Field Oriented
- 10. Overcoming Reading Challenges
  - Dealing with Digital Eye Strain
  - Minimizing Distractions
  - Managing Screen Time
- 11. Cultivating a Reading Routine A Comparison Of Pi Current Controllers In Field Oriented
  - Setting Reading Goals A Comparison Of Pi Current Controllers In Field Oriented
  - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of A Comparison Of Pi Current Controllers In Field Oriented
  - Fact-Checking eBook Content of A Comparison Of Pi Current Controllers In Field Oriented
  - Distinguishing Credible Sources
- 13. Promoting Lifelong Learning
  - Utilizing eBooks for Skill Development
  - Exploring Educational eBooks
- 14. Embracing eBook Trends

- Integration of Multimedia Elements
- Interactive and Gamified eBooks

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