

IMPLEMENTATION OF SENSORLESS SPEED CONTROL FOR TWO-PHASE INDUCTION MOTOR DRIVE USING ISFOC STRATEGY*

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Abstract— This paper presents a new technique based on model reference adaptive system (MRAS) observer for sensorless speed control of Two-Phase Induction Motor (TPIM). The MRAS identification is performed by means of comparison of stator fluxes obtained from both stator and rotor equations with stator voltage and current measurements. Simulation and experimental results for a 1.1 kW TPIM set-up are presented and analysed using a dSpace system with a DS1104 controller board based on digital signal processor (DSP) TMS320F240. Simulation and experimental results at nominal, low and zero speeds confirm the effectiveness of the proposed sensorless speed controlled TPIM drive.

Keywords— Two-phase induction motor (TPIM), indirect stator-field-oriented control (ISFOC), model reference adaptive system (MRAS)

1. INTRODUCTION

Two-Phase Induction Motor (TPIM) is widely used in several industrial and domestic applications. In those applications the motor runs at constant frequency and is fed directly from the ac grid without any type of control strategy. The TPIM is found in air conditioners, washers, dryers, industrial machinery, fans, compressors, tools, blowers, vacuum cleaners, household appliances and many other applications. The reduction in the cost of the power electronic circuitry provides economically justifiable applications for adjustable speed Two-Phase Induction Motor Drives (TPIMD). In recent years, several methods that use inverters for the variable speed control of TPIM have been proposed [1]-[15]. An alternative approach is to use a 6 switch three phase Voltage-Source Inverter (VSI) bridge, connecting the two windings of the motor as an unbalanced load between the phases, as shown in Fig. 3. This is a more cost effective solution [1], [2], [9], [11], [16]. Recently, Stator Field Oriented Control (SFOC) of TPIMD has been gaining wide attention in literature [1]-[3]. In vector control, the flux linkage magnitude and the electromagnetic torque are controlled independently [14]-[15]. The SFOC represents a better solution to satisfy the industrial requirements. The field orientation is relatively straightforward in all operating conditions if the rotor speed is accurately known, which traditionally necessitates a sensor on the shaft of the motor. However, there are several reasons for preferring a system without the sensor. The cost of the speed sensor, at least for machines with ratings less than 10 kW, is in the same range as the cost of the motor itself. The

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Table of Contents Implementation Of Sensorless Speed Control For Induction

1. Understanding the eBook Implementation Of Sensorless Speed Control For Induction
 - The Rise of Digital Reading Implementation Of Sensorless Speed Control For Induction
 - Advantages of eBooks Over Traditional Books
2. Identifying Implementation Of Sensorless Speed Control For Induction
 - 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 Implementation Of Sensorless Speed Control For Induction
 - User-Friendly Interface
4. Exploring eBook Recommendations from Implementation Of Sensorless Speed Control For Induction
 - Personalized Recommendations
 - Implementation Of Sensorless Speed Control For Induction User Reviews and Ratings
 - Implementation Of Sensorless Speed Control For Induction and Bestseller Lists
5. Accessing Implementation Of Sensorless Speed Control For Induction Free and Paid eBooks
 - Implementation Of Sensorless Speed Control For Induction Public Domain eBooks
 - Implementation Of Sensorless Speed Control For Induction eBook Subscription Services
 - Implementation Of Sensorless Speed Control For Induction Budget-Friendly Options
6. Navigating Implementation Of Sensorless Speed Control For Induction eBook Formats

- ePub, PDF, MOBI, and More
 - Implementation Of Sensorless Speed Control For Induction Compatibility with Devices
 - Implementation Of Sensorless Speed Control For Induction Enhanced eBook Features
7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Implementation Of Sensorless Speed Control For Induction
 - Highlighting and Note-Taking Implementation Of Sensorless Speed Control For Induction
 - Interactive Elements Implementation Of Sensorless Speed Control For Induction
 8. Staying Engaged with Implementation Of Sensorless Speed Control For Induction
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Implementation Of Sensorless Speed Control For Induction
 9. Balancing eBooks and Physical Books Implementation Of Sensorless Speed Control For Induction
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Implementation Of Sensorless Speed Control For Induction
 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
 11. Cultivating a Reading Routine Implementation Of Sensorless Speed Control For Induction
 - Setting Reading Goals Implementation Of Sensorless Speed Control For Induction
 - Carving Out Dedicated Reading Time
 12. Sourcing Reliable Information of Implementation Of Sensorless Speed Control For Induction
 - Fact-Checking eBook Content of Implementation Of Sensorless Speed Control For Induction
 - 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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