



Fig 1. Conventional DTC of Induction motor.

# Induction Motor Torque Control

**Lauren Gardner**



## **Induction Motor Torque Control:**

*Design of Direct Torque Control of an Induction Motor in FPGA* Kumar B P Santosh,2014-12-22 Direct torque control or DTC is a very latest ac drive technology which can replace traditional PWM drives of open or closed loop control method DTC describes the control of torque of a motor directly based on the electromagnetic state of the motor as similar to a dc drive DTC allows the motor's torque and stator flux to be used as the primary control variables which are obtained directly from the motor by using advanced motor theory The major problems faced by Direct Torque control of an induction machine are the production of the high torque ripples present in the output of the induction motor The torque ripple is caused by the use of the three level hysteresis comparator for torque comparison This ripple can be reduced by using a special controller for torque comparison By proper selection of the torque controller parameters the torque ripple can be reduced The objective of the thesis is to model and simulate the direct torque control of the induction motor with this technique using MATLAB simulink package and show its feasibility by comparing it with the available DTC method The models are developed from the various mathematical equations governing the system

**Induction Motors** Bahram Amin,2001-11-20 This book provides a thorough approach for mastering the behavior and operation of induction motors an essential device in the modern industrial world Its way of presentation renders this book suitable for selfteaching by students engineers and researchers in the field of electrical engineering It covers the modern theory of induction motor applications and control methods The transient analysis of both three phase and single phase induction motors as well as that of the double cage motors are developed The principles of such modern control methods as Field Oriented Control Direct Torque Control and Computed Torque Acceleration Method are clearly treated in this monograph Numerous equations simulations and figures are presented

**Direct Torque Control of Induction Motor Drive** Chenggang Mei,2000 **Torque Control** Moulay Tahar Lamchich,2011-02-10 This book is the result of inspirations and contributions from many researchers a collection of 9 works which are in majority focalised around the Direct Torque Control and may be comprised of three sections different techniques for the control of asynchronous motors and double feed or double star induction machines oriented approach of recent developments relating to the control of the Permanent Magnet Synchronous Motors and special controller design and torque control of switched reluctance machine [Direct Torque Control Strategies of Electrical Machines](#) Fatma Ben Salem,2021-01-20 This book deals with the design and analysis of Direct Torque Control DTC It introduces readers to two major applications of electrical machines speed drive and position control and gives the readers a comprehensive overview of the field of DTC dedicated to AC machines It includes new DTC approaches with and without control of commutation frequency It also covers DTC applications using artificial intelligence The book combines theoretical analysis simulation and experimental concepts To make the content as accessible as possible the book employs a clear proposal in each chapter moving from the background to numerical development and finally to case studies and illustrations The book is a wide

ranging reference source for graduate students researchers and professors from related fields and it will benefit practicing engineers and experts from the industry      **Vector Control and Direct Torque Control of Induction Motors** ,2002

*Advances in Motor Torque Control* Mukhtar Ahmad,2011-09-22 Electric motors are widely used in industries to convert electrical energy into mechanical form Control techniques are designed to improve the performance and efficiency of the drive so that large amounts of electrical energy can be saved This book is primarily written with the objective of providing necessary information on use of electric motors for various applications in industries During the last ten years a number of methods of control of electric drives have emerged Some of these methods are described in this book The reader will be able to understand the new methods of control used in drives e g direct and sensorless control Also the application of motor control in dentistry the effect of human reaction and improvement of the efficiency of drives with control have been

described      Direct Flux and Torque Control for Dual-three Phase Induction Motor Drives Francesco Farina (ingegnere elettrico),2005      **Electrical Engineer's Reference Book** M. A. Laughton,D.F. Warne,2002-09-27 For ease of use this edition has been divided into the following subject sections general principles materials and processes control power electronics and drives environment power generation transmission and distribution power systems sectors of electricity use New chapters and major revisions include industrial instrumentation digital control systems programmable controllers electronic power conversion environmental control hazardous area technology electromagnetic compatibility alternative energy sources alternating current generators electromagnetic transients power system planning reactive power plant and FACTS controllers electricity economics and trading power quality An essential source of techniques data and principles for all practising electrical engineers Written by an international team of experts from engineering companies and universities Includes a major new section on control systems PLCs and microprocessors      **Principles of Induction Motors and**

**Simulation of Direct Torque Control Using Space Vector Modulation** Kristeine Maxman,2019-05-22 This book explains how to control the Induction Motor through Direct Torque Control So as to mitigate uneven voltage levels like voltage imbalance interruptions and harmonic problems To study the motor Characteristics without consuming power Also helps you how to use MAT lab software to check the characteristics      **Advances in Electrical Control and Signal Systems**

Gayadhar Pradhan,Stella Morris,Niranjan Nayak,2020-07-01 This book presents select proceedings of the International Conference on Advances in Electrical Control and Signal Systems AECSS 2019 The focus is on the current developments in control and signal systems in electrical engineering and covers various topics such as power systems energy systems micro grid smart grid networks fuzzy systems and their control The book also discusses various properties and performance of signal systems and their applications in different fields The contents of this book can be useful for students researchers as well as professionals working in power and energy systems and other related fields      Hybrid Systems: Computation and

Control Manfred Morari,2005-03-04 This book constitutes the refereed proceedings of the 8th International Workshop on

Hybrid Systems Computation and Control HSCC 2005 held in Zurich Switzerland in March 2005 The 40 revised full papers presented together with 2 invited papers and the abstract of an invited talk were carefully reviewed and selected from 91 submissions The papers focus on modeling analysis and implementation of dynamic and reactive systems involving both discrete and continuous behaviors Among the topics addressed are tools for analysis and verification control and optimization modeling engineering applications and emerging directions in programming language support and implementation

**Control Techniques Drives and Controls Handbook** Bill Drury, 2001 Annotation A comprehensive guide to the technology underlying drives motors and control units this title contains a wealth of technical information for the practising drives and electrical engineer

DSP Based Speed/torque Control of an Induction Motor Yongzhong Shen, 2000 **Design of Adaptive Controller for Direct Torque Control of Induction Motor** Maher Saadallah Sidani, 2006 This thesis discusses one of the most popular methods for high performance industrial drive application Direct Torque Control In DTC the motor parameters are required for robust control Torque control is modeled based on values of current and flux which depend on motor parameters They are affected greatly by the parameter change so both the torque and flux calculations will be inaccurate and the motor will not operate at maximum efficiency DTC of induction machines presents a good tracking for both electromagnetic torque and stator flux This control scheme depends only on stator measurements The measurement of the stator flux is very difficult to achieve and DTC performance depends mostly on the accuracy used to measure these fluxes This problem can be overcome by the use of an observer to identify both the stator flux and electromagnetic torque The simplest observer is implemented using the machine equations to estimate the q and d axis components of the stator flux Then from these components the electromagnetic torque and the stator flux magnitude and angle are determined The effectiveness of the observer depends upon the accuracy used to measure the stator resistance The stator resistance can change up to 180% of its nominal value over operation The resistance actually changes with the operational conditions of the motor such as temperature and frequency rises Now under these circumstances a parameter identifier is needed to account for the resistance changes In this thesis the identification of the stator resistance changes is done using a PI controller applied for DTC scheme Load Torque represents the task required from the motor We studied the effect of varying the load torque with the adaptive controller in action and noticed its effect on the machine performance Limitations of the designed controller are investigated based on simulation examples

*Model Predictive Control of High Power Converters and Industrial Drives* Tobias Geyer, 2016-09-12 In this original book on model predictive control MPC for power electronics the focus is put on high power applications with multilevel converters operating at switching frequencies well below 1 kHz such as medium voltage drives and modular multilevel converters Consisting of two main parts the first offers a detailed review of three phase power electronics electrical machines carrier based pulse width modulation optimized pulse patterns state of the art converter control methods and the principle of MPC The second part is an in depth treatment of MPC

methods that fully exploit the performance potential of high power converters. These control methods combine the fast control responses of deadbeat control with the optimal steady state performance of optimized pulse patterns by resolving the antagonism between the two MPC. It is expected to evolve into the control method of choice for power electronic systems operating at low pulse numbers with multiple coupled variables and tight operating constraints. Model Predictive Control of High Power Converters and Industrial Drives will enable the reader to learn how to increase the power capability of the converter, lower the current distortions, reduce the filter size, achieve very fast transient responses, and ensure the reliable operation within safe operating area constraints. Targeted at power electronic practitioners working on control related aspects as well as control engineers, the material is intuitively accessible and the mathematical formulations are augmented by illustrations, simple examples, and a book companion website featuring animations. Readers benefit from a concise and comprehensive treatment of MPC for industrial power electronics, enabling them to understand, implement, and advance the field of high performance MPC schemes.

Enhanced Direct Torque Control for High Dynamic Performance Induction Motor Drives Ian Gerard Bird, 1998

*Torque-angle Based Analysis and Control of Induction Machines* Guoliang Zhang, 2006

Volts per hertz control, field oriented control (FOC), and direct torque control are the most popular induction motor control methods. One common feature that is shared by these control methods is to regulate the amplitude of the flux in the induction motor. There are numerous techniques to improve the steady state and dynamic performance by applying more complex algorithms to these controls. My goal is to provide a view of the induction machine and its control from the perspective of torque angle. It will be shown that a torque angle based control can be linked to traditional control methods such as constant slip control and maximum torque per ampere control, and to specific objectives such as optimal efficiency or power factor control, etc. It is possible to use torque angle as a control variable or set it as a constant in order to achieve a simplified control of an induction motor. The dynamic performance of such control is comparable to that of indirect FOC. A controller based on torque angle would be a good alternative to fixed flux level controllers in this energy craving era.

*Vector Control and Direct Torque Control of Induction Motors, IEE Colloquium on*, 1995

*Direct Torque Control of an Induction Machine Using Multi-layer Preception Neural Network* Adithya Chandrashekhara, 2014

In conventional direct torque control scheme of induction motor, Proportional Integral Controller is used as the speed controller. PI controller is more suitable in steady state condition and for linear system, but both DTC and IM are mostly nonlinear. Multi Layer perception neural network controller is more suitable and performs better than PI controller. The switching table of the conventional DTC is replaced by the MLPNN controller. The MLPNN inputs are the magnitude of the stator flux, torque, and the voltage sectors. Levenberg Marquardt back propagation technique has been used to train the MLPNN. The output of the MLPNN are the gate signals to the inverter which switch to produce the required voltage vectors. The Hysteresis band for torque is 1 per cent and the hysteresis band for the flux is 0.5 per cent. The advantage of using MLPNN is that in classical DTC, look up table is used to

select switching states thus size requirement will increase with some advanced control MLPNN will take less memory and is more reliable Despite the fact that the proposed scheme does not eliminate the torque flux and current ripples to a great extent the dropping of the stator flux due to the sector changes is eliminated Also a faster stator flux and Torque response is achieved in the transient state

## Reviewing **Induction Motor Torque Control**: Unlocking the Spellbinding Force of Linguistics

In a fast-paced world fueled by information and interconnectivity, the spellbinding force of linguistics has acquired newfound prominence. Its capacity to evoke emotions, stimulate contemplation, and stimulate metamorphosis is really astonishing. Within the pages of "**Induction Motor Torque Control**," an enthralling opus penned by a very acclaimed wordsmith, readers embark on an immersive expedition to unravel the intricate significance of language and its indelible imprint on our lives. Throughout this assessment, we shall delve in to the book is central motifs, appraise its distinctive narrative style, and gauge its overarching influence on the minds of its readers.

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### **Table of Contents Induction Motor Torque Control**

1. Understanding the eBook Induction Motor Torque Control
  - The Rise of Digital Reading Induction Motor Torque Control
  - Advantages of eBooks Over Traditional Books
2. Identifying Induction Motor Torque Control
  - 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 Induction Motor Torque Control
  - User-Friendly Interface
4. Exploring eBook Recommendations from Induction Motor Torque Control
  - Personalized Recommendations
  - Induction Motor Torque Control User Reviews and Ratings

- Induction Motor Torque Control and Bestseller Lists
- 5. Accessing Induction Motor Torque Control Free and Paid eBooks
  - Induction Motor Torque Control Public Domain eBooks
  - Induction Motor Torque Control eBook Subscription Services
  - Induction Motor Torque Control Budget-Friendly Options
- 6. Navigating Induction Motor Torque Control eBook Formats
  - ePub, PDF, MOBI, and More
  - Induction Motor Torque Control Compatibility with Devices
  - Induction Motor Torque Control Enhanced eBook Features
- 7. Enhancing Your Reading Experience
  - Adjustable Fonts and Text Sizes of Induction Motor Torque Control
  - Highlighting and Note-Taking Induction Motor Torque Control
  - Interactive Elements Induction Motor Torque Control
- 8. Staying Engaged with Induction Motor Torque Control
  - Joining Online Reading Communities
  - Participating in Virtual Book Clubs
  - Following Authors and Publishers Induction Motor Torque Control
- 9. Balancing eBooks and Physical Books Induction Motor Torque Control
  - Benefits of a Digital Library
  - Creating a Diverse Reading Collection Induction Motor Torque Control
- 10. Overcoming Reading Challenges
  - Dealing with Digital Eye Strain
  - Minimizing Distractions
  - Managing Screen Time
- 11. Cultivating a Reading Routine Induction Motor Torque Control
  - Setting Reading Goals Induction Motor Torque Control
  - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Induction Motor Torque Control
  - Fact-Checking eBook Content of Induction Motor Torque Control
  - 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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