

Sensorless Position Estimation Of Permanent Magnet

The purpose of the project is to achieve a robust SENSORLESS control of a Permanent Magnet assisted Synchronous Reluctance Motor. It is a part of an industrial project call CICYT, carried out at MCIA research group in UPC. This thesis concentrates on a special electrical control method called Field Oriented Control (FOC). Computer simulations of machine fed with a two levels voltage source inverter were performed. Analisis of the robustnes of most usual sensorless methods have been performed, and results corroborate that general sensorless observers methods are more insensitive to the gaussian noise.

Sensorless Position Estimation in Sinusoidal Permanent Magnet Synchronous MotorReal Time Implementation of Sensorless Position Estimation in a Permanent Magnet Synchronous Motor Using DSP TMS320C24XPosition Sensorless Control Techniques for Permanent Magnet Synchronous Machine DrivesSpringer Nature

The book focuses on position sensorless control for PMSM drives, addressing both basic principles and experimental evaluation. It provides an in-depth study on a number of major topics, such as model-based sensorless control, saliency-based sensorless control, position estimation error ripple elimination and acoustic noise reduction. Offering a comprehensive and systematic overview of position sensorless control and practical issues it is particularly suitable for readers interested in the sensorless control techniques for PMSM drives. The book is also a valuable resource for researchers, engineers, and graduate students in fields of ac motor drives and sensorless control.

The Industrial Electronics Handbook, Second Edition combines traditional and newer, more specialized knowledge that will help industrial electronics engineers develop practical solutions for the design and implementation of high-power applications. Embracing the broad technological scope of the field, this collection explores fundamental areas, including analog and digital circuits, electronics, electromagnetic machines, signal processing, and industrial control and communications systems. It also facilitates the use of intelligent systems—such as neural networks, fuzzy systems, and evolutionary methods—in terms of a hierarchical structure that makes factory control and supervision more efficient by addressing the needs of all production components. Enhancing its value, this fully updated collection presents research and global trends as published in the IEEE Transactions on Industrial Electronics Journal, one of the largest and most respected publications in the field. Power Electronics and Motor Drives facilitates a necessary shift from low-power electronics to the high-power varieties used to control electromechanical systems and other industrial applications. This volume of the handbook: Focuses on special high-power semiconductor devices Describes various electrical machines and motors, their principles of operation, and their limitations Covers power conversion and the high-efficiency devices that perform the necessary switchover between AC and DC Explores very specialized electronic circuits for the efficient control of electric motors Details other applications of power electronics, aside from electric motors—including lighting, renewable energy conversion, and automotive electronics Addresses power electronics used in very-high-power electrical systems to transmit energy Other volumes in the set: Fundamentals of Industrial Electronics Control and Mechatronics Industrial Communication Systems Intelligent Systems

The first book of its kind, Power Converters and AC Electrical Drives with Linear Neural Networks systematically explores the application of neural networks in the field of power electronics, with particular emphasis on the sensorless control of AC drives. It presents the classical theory based on space-vectors in identification, discusses control of electrical drives and power converters, and examines improvements that can be attained when using linear neural networks. The book integrates power electronics and electrical drives with artificial neural networks (ANN). Organized into four parts, it first deals with voltage source inverters and their control. It then covers AC electrical drive control, focusing on induction and permanent magnet synchronous motor drives. The third part examines theoretical aspects of linear neural networks, particularly the neural EXIN family. The fourth part highlights original applications in electrical drives and power quality, ranging from neural-based parameter estimation and sensorless control to distributed generation systems from renewable sources and active power filters. Simulation and experimental results are provided to validate the theories. Written by experts in the field, this state-of-the-art book requires basic knowledge of electrical machines and power electronics, as well as some familiarity with control systems, signal processing, linear algebra, and numerical analysis. Offering multiple paths through the material, the text is suitable for undergraduate and postgraduate students, theoreticians, practicing engineers, and researchers involved in applications of ANNs.

This book includes the original, peer-reviewed research papers from the 9th Frontier Academic Forum of Electrical Engineering (FAFEE 2020), held in Xi'an, China, in August 2020. It gathers the latest research, innovations, and applications in the fields of Electrical Engineering. The topics it covers including electrical materials and equipment, electrical energy storage and device, power electronics and drives, new energy electric power system equipment, IntelliSense and intelligent equipment, biological electromagnetism and its applications, and insulation and discharge computation for power equipment. Given its scope, the book benefits all researchers, engineers, and graduate students who want to learn about cutting-edge advances in Electrical Engineering.

This book constitutes the refereed proceedings of the 6th International Conference on Geo-informatics in Sustainable Ecosystem and Society, GSES 2018, held in Handan, China, in September 2018. The 46 papers presented in this volume were carefully reviewed and selected from 153 submissions and focus on spatial data acquisition, processing and management, modeling and analysis, and recent applications in the context of building healthier ecology and resource management using advanced remote sensing technology and spatial data modeling and analysis.

Axial Flux Permanent Magnet (AFPM) brushless machines are modern electrical machines with a lot of advantages over their conventional counterparts. This timeless and revised second edition deals with the analysis, construction, design, control and applications of AFPM machines. The authors present their own research results, as well as significant research contributions made by others.

Energy Science and Applied Technology includes contributions on a wide range of topics:- Technologies in geology, mining, oil and gas exploration and exploitation of deposits- Energy transfer and conversion, materials and chemical technologies- Environmental engineering and sustainable development- Electrical and electronic technology, power system

The modern world hungers for electricity. Traditionally, this hunger was sated with predominantly constant-speed-regulated, synchronous generators. However, new demands require the stable, quick, and efficient delivery and control offered by variable-speed generators. Surveying all of the technologies used to satisfy the world's demand for o Industrial electronics systems govern so many different functions that vary in complexity—from the operation of relatively simple applications, such as electric motors, to that of more complicated machines and systems, including robots and entire fabrication processes. The Industrial Electronics Handbook, Second Edition combines traditional and new The 2015 International Conference on Applied System Innovation (ICASI 2015) was held May 22-27, 2015 in Osaka, Japan and provided a unified communication platform for researchers active in a wide range of research fields. Professionals from industry, academia and government were encouraged to discourse on research and development, professional practice, business and management in the information, innovation, communication and engineering fields. This conference enabled interdisciplinary collaboration between science and engineering technologists in the academic and industry fields as well as networking internationally. The conference received 1063 submitted papers, whereby 421 papers were selected by the committees to be presented at the ICASI 2015 conference. These papers were divided into 13 Regular Sessions and 13 Invited Sessions, and presented in several parallel sessions. The ICASI 2015 committees selected 226 excellent papers for publication in this proceedings volume, covering topics ranging from information technology, innovation design, communication science and engineering, industrial design, creative design, applied mathematics, computer science, design theory and cultural and creative research to electrical and electronic engineering, mechanical and automation engineering, green technology and architecture engineering and material science, among others.

This book presents ongoing research activities of currently available renewable energy technologies and the approaches towards clean technology for enabling a socio-economic model for the present and future generations to live in a clean and healthy environment. The book provides chapter wise implementation of research works in the area of green energy technologies with proper methods used with solution strategies and energy efficiency approaches by combining theory and practical applications. Readers are introduced to practical problems of green computation and hybrid resources optimization with solution based approaches from the current research outcomes. The book will be of use to researchers, professionals, and policy-makers alike.

This book features the manuscripts accepted for the Special Issue “Applications in Electronics Pervading Industry, Environment and Society—Sensing Systems and Pervasive Intelligence” of the MDPI journal Sensors. Most of the papers come from a selection of the best papers of the 2019 edition of the “Applications in Electronics Pervading Industry, Environment and Society” (APPLEPIES) Conference, which was held in November 2019. All these papers have been significantly enhanced with novel experimental results. The papers give an overview of the trends in research and development activities concerning the pervasive application of electronics in industry, the environment, and society. The focus of these papers is on cyber physical systems (CPS), with research proposals for new sensor acquisition and ADC (analog to digital converter) methods, high-speed communication systems, cybersecurity, big data management, and data processing including emerging machine learning techniques. Physical implementation aspects are discussed as well as the trade-off found between functional performance and hardware/system costs.

The Industrial Electronics Handbook, Second Edition combines traditional and newer, more specialized knowledge that will help industrial electronics engineers develop practical solutions for the design and implementation of high-power applications. Embracing the broad technological scope of the field, this collection explores fundamental areas, including analog and digital circuits, electronics, electromagnetic machines, signal processing, and industrial control and communications systems. It also facilitates the use of intelligent systems—such as neural networks, fuzzy systems, and evolutionary methods—in terms of a hierarchical structure that makes factory control and supervision more efficient by addressing the needs of all production components. Enhancing its value, this fully updated collection presents research and global trends as published in the IEEE Transactions on Industrial Electronics Journal, one of the largest and most respected publications in the field. Control and Mechatronics presents concepts of control theory in a way that makes them easily understandable and practically useful for engineers or students working with control system applications. Focusing more on practical applications than on mathematics, this book avoids typical theorems and proofs and instead uses plain language and useful examples to: Concentrate on control system analysis and design, comparing various techniques Cover estimation, observation, and identification of the objects to be controlled—to ensure accurate system models before production Explore the various aspects of robotics and mechatronics Other volumes in the set: Fundamentals of Industrial Electronics Power Electronics and Motor Drives Industrial Communication Systems Intelligent Systems

This helpful resource covers a large range of information regarding electrical actuators. In particular, robustness, a very problematic issue, is fully explored in a dedicated chapter. The text also deals with the estimate of non-measurable mechanical variables by examining the estimate of load moment, then observation of the positioning of a command without mechanical sensor. Finally, it examines the conditions needed to measure variables and real implementation of numerical algorithms. This is a key working resource for electrical engineers.

Despite two decades of massive strides in research and development on control strategies and their subsequent implementation, most books on permanent magnet motor drives still focus primarily on motor design, providing only elementary coverage of control and converters. Addressing that gap with information that has largely been disseminated only in journals and at conferences, Permanent Magnet

Synchronous and Brushless DC Motor Drives is a long-awaited comprehensive overview of power electronic converters for permanent magnet synchronous machines and control strategies for variable-speed operation. It introduces machines, power devices, inverters, and control, and addresses modeling, implementation, control strategies, and flux weakening operations, as well as parameter sensitivity, and rotor position sensorless control. Suitable for both industrial and academic audiences, this book also covers the simulation, low cost inverter topologies, and commutation torque ripple of PM brushless DC motor drives. Simulation of the motor drives system is illustrated with MATLAB® codes in the text. This book is divided into three parts—fundamentals of PM synchronous and brushless dc machines, power devices, inverters; PM synchronous motor drives, and brushless dc motor drives. With regard to the power electronics associated with these drive systems, the author: Explores use of the standard three-phase bridge inverter for driving the machine, power factor correction, and inverter control Introduces space vector modulation step by step and contrasts with PWM Details dead time effects in the inverter, and its compensation Discusses new power converter topologies being considered for low-cost drive systems in PM brushless DC motor drives This reference is dedicated exclusively to PM ac machines, with a timely emphasis on control and standard, and low-cost converter topologies. Widely used for teaching at the doctoral level and for industrial audiences both in the U.S. and abroad, it will be a welcome addition to any engineer's library.

1 Static Power Converters 2 Power Devices, Passive Components and System Integrations 3 Modeling, Simulation, EMI and Reliability 4 Electric Machines, Actuators and Sensors 5 Motor Control and Drives 6 Motion Control and Robotics 7 Conversion Technologies for Renewable Energy and Energy Saving 8 Power Electronics Applied to Transmission, Smart Grid, DC grid and Distribution Systems 9 Power Electronics and Drives Applied to Railway Systems 10 Power Electronics and Drives Applied to Electric and Hybrid Vehicles 11 Power Supply Technologies for Information and Communication Systems 12 Power Electronics and Drives Applied to Home Appliance 13 Power Electronics and Drives for Industrial Applications 14 Education in Power Electronics and Electrical Engineering 15 Other Related Topics The volume LNCS 8866 constitutes the refereed proceedings of the 11th International Symposium on Neural Networks, ISSN 2014, held in Hong Kong and Macao, China on November/ December 2014. The 71 revised full papers presented were carefully reviewed and selected from 119 submissions. These papers cover all major topics of the theoretical research, empirical study and applications of neural networks research as follows. The focus is on following topics such as analysis, modeling, and applications.

Collection of selected, peer reviewed papers from the 2013 International Conference on Vehicle & Mechanical Engineering and Information Technology (VMEIT 2013), August 17-18, 2013, Zhengzhou, Henan, China. The 1094 papers are grouped as follows: Chapter 1: Design and Researches in Area of Vehicle and General Mechanical Engineering; Chapter 2: Mechatronics, Automation and Control; Chapter 3: Measurement and Instrumentation, Monitoring and Detection Technologies, Fault Diagnosis; Chapter 4: Computation Methods and Algorithms for Modeling, Simulation and Optimization, Data Mining and Data Processing; Chapter 5: Information Technologies, WEB and Networks Engineering, Information Security, Software Application and Development; Chapter 6: Power and Electric Systems, Electronics and Microelectronics, Embedded and Integrated Systems; Chapter 7: Communication, Signal and Image Processing, Data Acquisition, Identification and Recognition Technologies; Chapter 8: Information Technologies in Urban and Civil Engineering, Medicine and Biotechnology; Chapter 9: Material Science and Manufacturing Technology; Chapter 10: Information Technology in Management Engineering, Logistics, Economics, Finance, Assessment; Chapter 11: Related Themes.

The development and availability of very high energy permanent magnet materials has contributed to an increased use of the permanent magnet synchronous motor (PMSM) in high performance underwater applications. The PMSM offers advantages such as increased efficiency, superior torque to volume and power to volume ratios, and quiet operation. These advantages have resulted in the Navy considering a switch from its present induction motor technology to the PMSM. In order to individually control stator current and angle and thus fully exploit the characteristics of the PMSM, high resolution rotor angle information is required. An encoder or resolver attached to the shaft of the motor normally provides this rotor position information. Such devices add length, size, and inertia to the machine, raise system cost, and present reliability issues in harsh underwater environments. The drawbacks of the rotor position sensor have led to an intense interest in rotor position sensorless operation of the PMSM. This study develops a sensorless electric drive strategy suitable to the PMSM. The proposed sensorless strategy is implemented in hardware and tested on several permanent magnet machine types. The implementation of the sensorless drive is discussed, and the performance of the developed system is evaluated. Experimental results show that the rotor position estimation strategy performs well under various steady state and transient conditions.

The book reports on the latest advances and applications of nonlinear control systems. It consists of 30 contributed chapters by subject experts who are specialized in the various topics addressed in this book. The special chapters have been brought out in the broad areas of nonlinear control systems such as robotics, nonlinear circuits, power systems, memristors, underwater vehicles, chemical processes, observer design, output regulation, backstepping control, sliding mode control, time-delayed control, variables structure control, robust adaptive control, fuzzy logic control, chaos, hyperchaos, jerk systems, hyperjerk systems, chaos control, chaos synchronization, etc. Special importance was given to chapters offering practical solutions, modeling and novel control methods for the recent research problems in nonlinear control systems. This book will serve as a reference book for graduate students and researchers with a basic knowledge of electrical and control systems engineering. The resulting design procedures on the nonlinear control systems are emphasized using MATLAB software.

This Special Issue deals with improvements in the energy efficiency of electric devices, machines, and drives, which are achieved through improvements in the design, modelling, control, and operation of the system. Properly sized and placed coils of a welding transformer can reduce the required iron core size and improve the efficiency of the welding system operation. New structures of the single-phase field excited flux switching machine improve its performance in terms of torque, while having higher back-EMF and unbalanced electromagnetic forces. A properly designed rotor notch reduces the torque ripple and cogging torque of interior permanent magnet motors for the drive platform of electric vehicles, resulting in lower vibrations and noise. In the field of modelling, the torque estimation of a Halbach array surface permanent magnet motor with a non-overlapping winding layout was improved by introducing an analytical two-dimensional subdomain model. A general method for determining the magnetically nonlinear two-axis dynamic models of rotary and linear synchronous reluctance machines and synchronous permanent magnet machines is introduced that considers the effects of slotting, mutual interaction between the slots and permanent magnets, saturation, cross saturation, and end effects. Advanced modern control solutions, such as neural network-based model reference adaptive control, fuzzy control, senseless control, torque/speed tracking control derived from the 3D non-holonomic integrator, including drift terms, maximum torque

per ampere, and maximum efficiency characteristics, are applied to improve drive performance and overall system operation.

AC Motor Control and Electrical Vehicle Applications provides a guide to the control of AC motors with a focus on its application to electric vehicles (EV). It describes the rotating magnetic flux, based on which dynamic equations are derived. The text not only deals with the induction motor, but covers the permanent magnet synchronous motors (PMSM). Additionally, the control issues are discussed by taking into account the limitations of voltage and current. The latest edition includes more experimental data and expands upon the topics of inverter, pulse width modulation methods, loss minimizing control, and vehicle dynamics. Various EV motor design issues are also reviewed, while comparing typical types of PMSMs. Features Considers complete dynamic modeling of induction and PMSM in the rotating frame. Provides various field-oriented controls, while covering advanced topics in PMSM high speed control, loss minimizing control, and sensorless control. Covers inverter, sensors, vehicle dynamics, driving cycles, etc., not just motor control itself. Offers a comparison between BLDC, surface PMSM, and interior PMSM. Discusses how the motor produces torque and is controlled based on consistent mathematical treatments.

The procedure followed in the project begins with a brief introduction of the features that the studied motor, a permanent magnet synchronous motor (PMSM), has. The fact that the motor is synchronous permanent magnet has to do with its greater efficiency in comparison with the induction motor, which is the most used nowadays. Then, the project is conducted in two steps. The first one is the study of the PMSM mathematical modelling and the subsequent control method applied. The second one is the study of a sensorless control algorithm. Traditionally for speed dependent applications, some kind of sensor is used to read the motor speed and position and feed the value back to the controller. However, extra sensors require extra physical space in the application and it also introduces another source of failure in the system. Thus, with the additional purposes of reducing cost and maintenance needs, the sensor can be replaced by an estimator that mathematically estimates the speed or position of the rotor. All these implementations have been simulated with MATLAB/Simulink based on the mathematical models. To design a controlled drive, the stability characteristics of PMSM under open-loop control (without having any feedback for speed) are analysed. The analysis shows that the PMSM becomes unstable after exceeding a certain applied speed. After tuning the controllers, it has been analysed that the maximum speed that the closed-loop can control with a reasonable settling time is 750 rpm. The more speed that the motor achieves, the more settling time appears. Thus, there is an upper limit for the speed. For all the simulations, an optimal speed of 550 rpm has been used. The control structure and the design of the controllers are described. A rotor position estimation technique for sensorless operation is studied. The estimator uses predictor-corrector method where the difference between the estimated current and the measured current (current error) is used to correct a predicted rotor position. More investigations are still required for accurate rotor position estimation.

An advanced introduction to the simulation and hardware implementation of BLDC motor drives A thorough reference on the simulation and hardware implementation of BLDC motor drives, this book covers recent advances in the control of BLDC motor drives, including intelligent control, sensorless control, torque ripple reduction and hardware implementation. With the guidance of the expert author team, readers will understand the principle, modelling, design and control of BLDC motor drives. The advanced control methods and new achievements of BLDC motor drives, of interest to more advanced readers, are also presented. Focuses on the control of PM brushless DC motors, giving readers the foundations to the topic that they can build on through more advanced reading Systematically guides readers through the subject, introducing basic operational principles before moving on to advanced control algorithms and implementations Covers special issues, such as sensorless control, intelligent control, torque ripple reduction and hardware implementation, which also have applications to other types of motors Includes presentation files with lecture notes and Matlab 7 coding on a companion website for the book

Electrical machines are used in the process of energy conversion in the generation, transmission and consumption of electric power. In addition to this, electrical machines are considered the main part of electrical drive systems. Electrical machines are the subject of advanced research. In the development of an electrical machine, the design of its different structures is very important. This design ensures the robustness, energy efficiency, optimal cost and high reliability of the system. Using advanced techniques of control and new technology products has brought electrical machines into their optimal functioning mode. Different techniques of control can be applied depending on the goals considered. The aim of this book is to present recent work on the design, control and applications of electrical machines.

Electric Generators Handbook, Second Edition: Two-Volume Set supplies state-of-the-art tools necessary to design, validate, and deploy the right power generation technologies to fulfill tomorrow's complex energy needs. The first volume, Synchronous Generators, explores large- and medium-power synchronous generator topologies, steady state, modeling, transients, control, design, and testing. Numerous case studies, worked-out examples, sample results, and illustrations highlight the concepts. Fully revised and updated to reflect the last decade's worth of progress in the field, the Second Edition adds coverage of high-power wind generators with fewer or no PMs, PM-assisted DC-excited salient pole synchronous generators, autonomous synchronous generators' control, line switching parameter identification for isolated grids, synthetic back-to-back load testing with inverter supply, and more. The second volume, Variable Speed Generators, provides extensive coverage of variable speed generators in distributed generation and renewable energy applications around the world. Numerous design and control examples illustrate the exposition. Fully revised and updated to reflect the last decade's worth of progress in the field, the Second Edition adds material on doubly fed induction generator control under unbalanced voltage sags and nonlinear loads, interior permanent magnet

claw-pole-alternator systems, high power factor Vernier PM generators, PM-assisted reluctance synchronous motors/generators for electric hybrid vehicles, and more.

This proceedings book emphasizes adopting artificial intelligence-based and sustainable energy efficiency integrated with clear objectives, to involve researchers, students, and specialists in their development and implementation adequately in achieving objectives. The integration of artificial intelligence into renewable energetic systems would allow the rapid development of a knowledge-based economy suitable to the energy transition, while fully integrating the renewables into the global economy. This is how artificial intelligence has hand in by conceptualizing this transition and above all by saving time. The knowledge economy is valued within the smart cities, which are fast becoming the favorite places where the energy transition will take place efficiently and intelligently by implementing integrated approaches to energy saving and energy supply and integrated urban approaches that go beyond individual interventions in buildings or transport modes using information and communication technologies.

ICMRA is a four day event comprising of keynote speeches by both leading researchers and industrial experts, focused symposiums, technical oral presentations and updates by industrial presenters This event provides a platform to disseminate the latest research results and exchange views on the future research directions of Mechatronics, Robotics and Automation We hope to be able to achieve the following goals 1 Forge links between nations and build bridges between the academic and non academic community and between government and non governmental organizations 2 Encourage exchange and sharing of knowledge and ideas to boost growth in the mechatronics, robotics and automation industry

Permanent magnet synchronous (PMS) motors stand at the forefront of electric motor development due to their energy saving capabilities and performance potential. The motors have been developed in response to mounting environmental crises and growing electricity prices, and they have enabled the emergence of motor drive applications like those found in electric and hybrid vehicles, fly by wire, and drones. Control of Permanent Magnet Synchronous Motors is a timely advancement along that path as the first comprehensive, self-contained, and thoroughly up-to-date book devoted solely to the control of PMS motors. It offers a deep and extended analysis, design, implementation, and performance evaluation of major motor control methods, including Vector, Direct Torque, Predictive, Deadbeat, and Combined Control, in a systematic and coherent manner. All major Sensorless Control and Parameter Estimation methods are also studied. The book places great emphasis on energy saving control schemes.

This book presents papers covering a wide spectrum of theory and practice, deeply rooted in engineering problems at a high practical and theoretical level. The contents explore theory, control systems and applications, the heart of the matter in electrical drives.

Artificial intelligence is increasingly finding its way into industrial and manufacturing contexts. The prevalence of AI in industry from stock market trading to manufacturing makes it easy to forget how complex artificial intelligence has become. Engineering provides various current and prospective applications of these new and complex artificial intelligence technologies.

Applications of Artificial Intelligence in Electrical Engineering is a critical research book that examines the advancing developments in artificial intelligence with a focus on theory and research and their implications. Highlighting a wide range of topics such as evolutionary computing, image processing, and swarm intelligence, this book is essential for engineers, manufacturers, technology developers, IT specialists, managers, academicians, researchers, computer scientists, and students.

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