This is a reprint in book form of the Energies MDPI Journal Special Issue, entitled “Energy Storage Systems and Power Conversion Electronics for E-Transportation and Smart Grid”. The Special Issue was managed by two Guest Editors from Italy and Norway: Professor Sergio Saponara from the University of Pisa and Professor Lucian MIHET-POPA from Østfold University College, in close cooperation with the Editors from Energies. The papers published in this SI are related to the emerging trends in energy storage and power conversion electronic circuits and systems, with a specific focus on transportation electrification, and on the evolution from the electric grid to a smart grid. An extensive exploitation of renewable energy sources is foreseen for the smart grid, as well as a close integration with the energy storage and recharging systems of the electrified transportation era. Innovations at the levels of both algorithmic and hardware (i.e., power converters, electric drives, electronic control units (ECU), energy storage modules and charging stations) are proposed. Research and technology transfer activities in energy storage systems, such as batteries and super/ultra-capacitors, are essential for the success of electric transportation, and to foster the use of renewable energy sources. Energy storage systems are the key technology to solve these issues, and to increase the adoption of renewable energy sources in the smart grid.

Sensorless Speed Control of Permanent Magnet-assisted Synchronous Reluctance

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Motor (PMa-synRM)

Sensorless Speed Estimation of an AC Induction Motor by Using an Artificial Neural Network Approach

Control of Permanent Magnet Synchronous Motors

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.

Sensorless AC Electric Motor Control

This book gathers selected research papers presented at the International Conference on Recent Trends in Machine Learning, IOT, Smart Cities & Applications (ICMISC 2020), held on 29–30 March 2020 at CMR Institute of Technology, Hyderabad, Telangana, India. Discussing current trends in machine learning, Internet of things, and smart cities applications, with a focus on multi-disciplinary research in the area of artificial intelligence and cyber-physical systems, this book is a valuable resource for scientists, research scholars and PG students wanting formulate their research ideas and find the future directions in these areas. Further, it serves as a reference work anyone wishing to understand the latest technologies used by practicing engineers around the globe.

Technological Developments in Education and Automation

Investigation of Sensorless Flux and Speed Estimation for Direct Torque Control of PMSM

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.

On Sensorless Control of Induction Motor Drives

The proceedings covers advanced and multi-disciplinary research on design of smart computing and informatics. The theme of the book broadly focuses on various innovation paradigms in system knowledge, intelligence and sustainability that may be applied to provide realistic solution to varied problems in society, environment and industries. The volume publishes quality work pertaining to the scope of the conference which is extended towards deployment of emerging computational and knowledge transfer approaches, optimizing solutions in varied disciplines of science, technology and
Energy Storage Systems and Power Conversion Electronics for E-Transportation and Smart Grid

This book collects the latest theoretical and technological concepts in the design and control of various linear machines and drive systems. Discussing advances in the new linear machine topologies, integrated modeling, multi-objective optimization techniques, and high-performance control strategies, it focuses on emerging applications of linear machines in transportation and energy systems. The book presents both theoretical and practical/experimental results, providing a consistent compilation of fundamental theories, a compendium of current research and development activities as well as new directions to overcome critical limitations.

T-Source Inverter-Based Sensorless Speed Control for Permanent Magnet Synchronous Motor

Este trabalho propõe uma análise comparativa do desempenho de técnicas de controle e estimação de velocidade, com realização discreta no tempo, aplicadas a motores de indução trifásicos, utilizando plataforma com base em um processador digital de sinais de ponto-fixo. Algumas modificações em algoritmos existentes na literatura são propostas para melhorar o desempenho das técnicas em estudo. Inicialmente, uma revisão histórica sobre a evolução dos sistemas de acionamento para motores de corrente alterna e uma revisão bibliográfica das principais técnicas de estimação de velocidade implementadas em DSP são realizadas. Em seguida, são obtidos diferentes modelos para o motor de indução trifásico representados em referenciais semi-estacionários. A partir do modelo da máquina foram projetados dois controladores de velocidade: um controlador clássico e amplamente utilizado no meio industrial (PI), e, com o objetivo de compensar distúrbios e dinâmicas não modeladas, um controlador adaptativo robusto por modelo de referência (RMRAC) é implementado. Para o projeto de servomecanismos sensorless de alto desempenho, duas técnicas de estimação de velocidade baseadas no modelo de MI foram selecionadas. Uma delas é amplamente difundida no meio acadêmico e industrial, sendo fundamentada em um sistema adaptativo por modelo de referência (MRAS) e outra tem base em um algoritmo de mínimos quadrados recursivos modificado (MRLS) e é apresentada como uma alternativa de alto desempenho. No desenvolvimento deste trabalho, resultados de simulações utilizando o software Matlab®, simulações em tempo-real em plataforma DSP, e por fim, resultados experimentais são apresentados. A partir destes resultados, parte-se para avaliação para determinar quais dos controladores sensorless analisados apresentam resposta dinâmica satisfatória em uma larga faixa de velocidade, inclusive em condições de velocidade baixa e nula, e também diante de situações de variação de carga e de parâmetros.

SENSORLESS DIRECT FIELD ORIENTED CONTROL OF INDUCTION MACHINE BY FLUX AND SPEED ESTIMATION USING MODEL REFERENCE ADAPTIVE SYSTEM.

Advanced Linear Machines and Drive Systems

Over the past decades, fault diagnosis (FDI) and fault tolerant control strategies (FTC) have been proposed based on different techniques for linear and nonlinear systems. Indeed a considerable attention is deployed in order to cope with diverse damages resulting in faults occurrence.

STATE ESTIMATION TECHNIQUES FOR SPEED SENSORLESS FIELD ORIENTED CONTROL OF INDUCTION MOTORS.

In high - demanding ac drives as for example traction applications, usually, an encoder or speed sensor is needed on the rotorshaft. Replacing this sensor with speed estimation may result in lower costs and maintenance demands due to one less critical component in the system. By estimating the speed instead of measuring it is called sensorless control. The topic in this book is sensorless control adopted on the induction machine (IM). Research in the area sensorless control is wide and especially control problems at low speed has been an interesting problem to solve. In this
book the focusing topic is 0 Hz crossover problems, which occurs as the machine alters between motoring and regenerating drive. As sensorless control method a rotorflux estimator is adopted in a vector controlled scheme by the so-called voltage model (VM). The VM design is used for estimating the frequency by measured stator voltages and currents. The analysis here mainly considers parameter variations and instability problems, which are two important reasons for control problems at low speed. The proposed final method shows good performance both by linear and nonlinear analysis methods.

**Sensorless Speed Estimation in Wound Rotor Induction Machines Drives**

This monograph shows the reader how to avoid the burdens of sensor cost, reduced internal physical space, and system complexity in the control of AC motors. Many applications fields—electric vehicles, wind- and wave-energy converters and robotics, among them—will benefit. Sensorless AC Electric Motor Control describes the elimination of physical sensors and their replacement with observers, i.e., software sensors. Robustness is introduced to overcome problems associated with the unavoidable imperfection of knowledge of machine parameters—resistance, inertia, and so on—encountered in real systems. The details of a large number of speed- and/or position-sensorless ideas for different types of permanent-magnet synchronous motors and induction motors are presented along with several novel observer designs for electrical machines. Control strategies are developed using high-order, sliding-mode and quasi-continuous-sliding-mode techniques and two types of observer-controller schemes based on backstepping and sliding-mode techniques are described. Experimental results validate the performance of these observer and controller configurations with test trajectories of significance in difficult sensorless-AC-machine problems. Control engineers working with AC motors in a variety of industrial environments will find the space-and-cost-saving ideas detailed in Sensorless AC Electric Motor Control of much interest. Academic researchers and graduate students from electrical, mechanical and control-engineering backgrounds will be able to see how advanced theoretical control can be applied in meaningful real systems.

**Sensorless Speed Estimation of an Induction Motor**

Abstract: The focus of this research is the development of novel techniques for estimation and control of sensorless induction motor drives. In a sensorless drive, the speed must be estimated from the system measurements. Depending on the objective of the control (speed or torque control), the speed estimate must be used in one or more areas of the control scheme. This idea and the main techniques for speed estimation are explored. The dissertation investigates the issues related to low-speed flux estimation when a Voltage Model observer is used. Pure integration cannot be implemented due to offsets in the measured signals and integrators must be replaced by low pass filters. At low speed, the flux estimates are incorrect in both magnitude and angle; consequently, the rotor position obtained by the DFO method is incorrect. An improved Voltage Model observer that corrects the errors is developed based on a Programmable Low Pass Filter and a vector rotator. The method requires estimation of the stator frequency and this is done by a Phase Locked Loop synchronized with the voltage vector. The traditional rotor flux MRAS method can be used for speed estimation, however, under non-ideal integration the dynamics of the speed estimate exhibits right-hand side plane zeros. Additionally, system tuning is difficult and may yield under damped responses. Two novel Sliding Mode MRAS observers are designed and implemented and their features are used for speed estimation. The d-q rotational frame currents of an induction machine are not decoupled. Decoupling can be achieved by canceling the cross-coupled terms in the equations of the synchronous frame currents. This approach is both inconvenient and inaccurate. A novel approach for decoupling is presented: an Integral Sliding Mode controller complements a traditional controller that acts on a simulated plant. The use of the Integral SM controller guarantees that the currents in the real plant will track those of the simulated model. The additional controller compensates for the cross-terms and for variations of the machine parameters. The method is also valuable for allowing fast and efficient tuning of the current controllers.

**Nature-Inspired Computation and Machine Learning**

**Speed Sensorless Induction Motor Drives for Electrical Actuators: Schemes, Trends**
and Tradeoffs

This thesis presents different state estimation techniques for speed sensorless field oriented control of induction motors. The theoretical basis of each algorithm is explained in detail and its performance is tested with simulations and experiments individually. First, a stochastical nonlinear state estimator, Extended Kalman Filter (EKF) is presented. The motor model designed for EKF application involves rotor speed, dq-axis rotor fluxes and dq-axis stator currents. Thus, using this observer the rotor speed and rotor fluxes are estimated simultaneously. Different from the widely accepted use of EKF, in which it is optimized for either steady-state or transient operations, here using adjustable noise level process algorithm the optimization of EKF has been done for both states.

Industrial Engineering, Machine Design And Automation (Iemda 2014) - Proceedings Of The 2014 Congress & Computer Science And Application (Ccsa 2014) - Proceedings Of The 2nd Congress

The complexity of AC motor control lies in the multivariable and nonlinear nature of AC machine dynamics. Recent advancements in control theory now make it possible to deal with long-standing problems in AC motors control. This text expertly draws on these developments to apply a wide range of model-based control design methods to a variety of AC motors. Contributions from over thirty top researchers explain how modern control design methods can be used to achieve tight speed regulation, optimal energetic efficiency, and operation reliability and safety, by considering online state variable estimation in the absence of mechanical sensors, power factor correction, machine flux optimization, fault detection and isolation, and fault tolerant control. Describing the complete control approach, both controller and observer designs are demonstrated using advanced nonlinear methods, stability and performance are analysed using powerful techniques, including implementation considerations using digital computing means. Other key features: [] Covers the main types of AC motors including triphase, multiphase, and doubly fed induction motors, wound rotor, permanent magnet, and interior PM synchronous motors [] Illustrates the usefulness of the advanced control methods via industrial applications including electric vehicles, high speed trains, steel mills, and more [] Includes special focus on sensorless nonlinear observers, adaptive and robust nonlinear controllers, output-feedback controllers, fault detection and isolation algorithms, and fault tolerant controllers This comprehensive volume provides researchers and designers and R&D engineers with a single-source reference on AC motor system drives in the automotive and transportation industry. It will also appeal to advanced students in automatic control, electrical, power systems, mechanical engineering and robotics, as well as mechatronic, process, and applied control system engineers.

Speed Estimation Techniques for Induction Motor Using Digital Signal Processing

Sensors, widely used in electric drives, degrade the system reliability and require special attention to electrical noise in addition to extra expenses involved. Further, drive performance is affected by unknown rotor resistance variation which causes incorrect decoupling of flux and torque currents leading to deterioration of its performance. This book focusses on the development of high performance sensorless induction motor drive. Sensorless vector control is realized by developing rotor flux and speed estimation algorithms using only the measurable stator terminal quantities: the current and voltage. Whereas, in another approach, sensorless control is realized by developing simultaneous speed and rotor resistance estimation algorithm without requiring any external signal injection. Reduced order observers are used for implementing estimation algorithms to reduce computational burden. This work can be a good resource and reference for researchers and graduate students interested in the area of sensorless induction motor drive and control theory applications. The work will also be useful to undergraduate students wishing to have an overall idea of induction motor drive control.

Flux and Speed Estimation Techniques for Sensprless Control of Induction Motors

Sensorless speed detection of an induction motor is an attractive area for researchers to enhance the reliability of the system and to reduce the cost of the components. This paper presents a simple method of estimating a rotational speed by utilizing an artificial neural network (ANN) that would be
Get Free Sensorless Speed Estimation Of An Induction Motor In A

fed by a set of stator current frequencies that contain some saliency harmonics. This approach allows operators to detect the speed in induction motors such an approach also provides reliability, low cost, and simplicity. First, the proposed method is based on converting the stator current signals to the frequency domain and then applying a tracking algorithm to the stator current spectrum in order to detect frequency peaks. Secondly, the ANN has to be trained by the detected peaks; the training data must be from very precise data to provide an accurate rotor speed. Moreover, the desired output of the training is the speed, which is measured by a tachometer simultaneously with the stator current signal. The databases were collected at many different speeds from two different types of AC induction motors, wound rotor and squirrel cage. They were trained and tested, so when the difference between the desired speed value and the ANN output value reached the wanted accuracy, the system does not need to use the tachometer anymore. Eventually, the experimental results show that in an optimal ANN design, the speed of the wound rotor induction motor was estimated accurately, where the testing average error was 1 RPM. The proposed method has not succeeded to predict the rotor speed of the squirrel cage induction motor precisely, where the smallest testing average error that was achieved was 5 RPM.

High Performance Sensorless Induction Motor Drive

ABSTRACT SENSORLESS DIRECT FIELD ORIENTED CONTROL OF INDUCTION MACHINE BY FLUX AND SPEED ESTIMATORS USING MODEL REFERENCE ADAPTIVE SYSTEM This work focuses on an observer design which will estimate flux-linkage and speed for induction motors in its entire speed control range. The theoretical base of the algorithm is explained in detail and its both open-loop, and closed-loop performance is tested with experiments, measuring only stator current and voltage. Theoretically, the field-oriented control for the induction motor drive can be mainly categorized into two types.

AETA 2013: Recent Advances in Electrical Engineering and Related Sciences


Artificial Intelligence and Renewables Towards an Energy Transition

Electrical drives lie at the heart of most industrial processes and make a major contribution to the comfort and high quality products we all take for granted. They provide the controller power needed at all levels, from megawatts in cement production to milliwatts in wrist watches. Other examples are legion, from the domestic kitchen to public utilities. The modern electrical drive is a complex item, comprising a controller, a static converter and an electrical motor. Some can be programmed by the user. Some can communicate with other drives. Semiconductor switches have improved, intelligent power modules have been introduced, all of which means that control techniques can be used now that were unimaginable a decade ago. Nor has the motor side stood still: high-energy permanent magnets, semiconductor switched reluctance motors, silicon micromotor technology, and soft magnetic materials produced by powder technology are all revolutionising the industry. But the electric drive is an enabling technology, so the revolution is rippling throughout the whole of industry.

Sensorless Speed Estimation of an Induction Motor

This proceedings volume contains selected revised and extended research articles written by researchers who participated in the World Congress on Engineering and Computer Science 2015, held in San Francisco, USA, 21-23 October 2015. Topics covered include engineering mathematics, electrical engineering, circuits, communications systems, computer science, chemical engineering, systems engineering, manufacturing engineering, and industrial applications. The book offers the reader an overview of the state of the art in engineering technologies, computer science, systems
Get Free Sensorless Speed Estimation Of An Induction Motor In A

engineering and applications, and will serve as an excellent reference work for researchers and graduate students working in these fields.

AC Electric Motors Control

Development of Adaptive Speed Observers for Induction Machine System Stabilization

Transactions on Engineering Technologies

High performance sensorless position control of induction motors (IMs) calls for estimation and control schemes which offer solutions to parameter uncertainties as well as to difficulties involved with accurate flux and velocity estimation at very low and zero speed. In this thesis, novel control and estimation methods have been developed to address these challenges. The proposed estimation algorithms are designed to minimize estimation error in both transient and steady-state over a wide velocity range, including very low and persistent zero speed operation. To this aim, initially single Extended Kalman Filter (EKF) algorithms are designed to estimate the flux, load torque, and velocity, as well as the rotor, $R_r'$ or stator, $R_s$ resistances. The temperature and frequency related variations of these parameters are well-known challenges in the estimation and control of IMs, and are subject to ongoing research. To further improve estimation and control performance in this thesis, a novel EKF approach is also developed which can achieve the simultaneous estimation of $R_r'$ and $R_s$ for the first time in the sensorless IM control literature. The so-called Switching and Braided EKF algorithms are tested through experiments conducted under challenging parameter variations over a wide speed range, including under persistent operation at zero speed. Finally, in this thesis, a sensorless position control method is also designed using a new sliding mode controller (SMC) with reduced chattering. The results obtained with the proposed control and estimation schemes appear to be very compatible and many times superior to existing literature results for sensorless control of IMs in the very low and zero speed range. The developed estimation and control schemes could also be used with a variety of the sensorless speed and position control applications, which are challenged by a high number of parameter uncertainties.

Smart Intelligent Computing and Applications

Permanent magnet synchronous motors (PMSM) are used commonly in numerous industrial applications, for instance, in mechatronics, vacuum pumps, energy storage flywheels, automotive, centrifugal compressors, and robotics. Nowadays, the sensorless speed control of PMSM is getting more attention, and several studies are progressing because of its low cost and reliable features. Normally, the speed control methods in PMSM are achieved with the help of sensors for position or speed estimation and control. But, these sensors are easily prone to breakage. Also, the flexibility towards parameter variations is poor in the conventional speed control methods. So, a sensorless T-source inverter-based PMSM drive that integrates the Proportional Integral (PI) controller with an adaptive mechanism to cope with the time-varying system parameters is proposed in this article. A sensorless module, namely, a model reference adaptive system (MRAS), is employed to estimate the rotor position of PMSM based on its performance characteristics. Simulation results are illustrated to investigate the performance of the proposed method with different speeds under no load and loaded conditions. Moreover, the proposed approach not only minimizes the cost and size of the motor but also maximizes the reliability and accuracy.

Sensorless Speed Estimation of an Induction Motor

Speed estimation is one of the methods of speed sensor-less control for three phase induction motors. With the advancement of the power electronics switching devices and digital technologies, the developments of speed estimation methods have been intensively implemented from many researchers. Thus, this field of research has become more interested to investigate. Speed sensor-less control techniques can make the hardware simple and improve the reliability of the motor without the introducing the feedback sensor and it becomes more important in the modern AC servo drive. It is one of the attracting research directions in the high-precision servo control field because
of its robust characteristics, simple realization and excellent dynamic response. Several common
rotor speed estimation was introduced in the thesis. The model must accurately represent both the
electrical and electromagnetic interactions within the machine and associated mechanical systems.
In this Thesis, the neural networks controller for speed estimation has been developed approach to
induction motor that has been implemented in digital signal processing controller (DSP) and gave
the control signal to IGBT for run three phase induction motor. Analysis of speed estimation
nonlinear characteristics is carried out and makes a comparison with traditional linear method
speed sensor less method. First, the simulation of the proposed control system is performed by
using the MATLAB software and then the real time implementation is performed by using the
MATLAB and the hardware. According to the mathematical model of the induction motor, the
simulation of model and hardware implementation of speed sensor-less induction motor had been
successfully implemented. The design and implementation of the speed estimation system for three-
phase induction motor and the experimental research is presented in this Thesis. Finally, this Thesis
shows the implementation of the speed estimation using DSP controller and the design of hardware
and software for speed sensorless of induction motor. The experiment is completed at different
speed and experiment results show that artificial neural network controller obtained a good
response when compared to conventional methods.

Sensorless Speed Detection of PWM-fed Asynchronous Machines Using Spectral Estimation Techniques

This work focuses on speed estimation techniques for sensorless closed-loop speed control of an
induction machine based on direct field-oriented control technique. Details of theories behind the
algorithms are stated and their performances are verified by the help of simulations and
experiments. The field-oriented control as the vector control technique is mainly implemented in
two ways: indirect field oriented control and direct field oriented control. The field to be oriented
may be rotor, stator, or airgap flux-linkage. In the indirect field-oriented control no flux estimation
exists. The angular slip velocity estimation based on the measured or estimated rotor speed is
required, to compute the synchronous speed of the motor. In the direct field oriented control the
synchronous speed is computed with the aid of a flux estimator. Field Oriented Control is based on
projections which transform a three phase time and speed dependent system into a two co-ordinate
time invariant system. These projections lead to a structure similar to that of a DC machine control.
The flux observer used has an adaptive structure which makes use of both the voltage model and
the current model of the machine. The rotor speed is estimated via Kalman filter technique which
has a recursive state estimation feature. The flux angle estimated by flux observer is processed
taking the angular slip velocity into account for speed estimation. For closed-loop speed control of
system, torque, flux and speed producing control loops are tuned by the help of PI regulators. The
performance of the closed-loop speed control is investigated by simulations and experiments.
TMS320F2812 DSP controller card and the Embedded Target for the TI C2000 DSP tool of Matlab are
utilized for the real-time experiments.

Comparison of speed sensorless control techniques applied to induction motors in a dsp platform

Motor speed estimation with sensorless vectorial control, employing an extended kalman filter with estimation of the covariance of the noises

This proceedings put together 68 selected articles from the joint conferences of 2014 Congress on Industrial Engineering, Machine Design and Automation (IEMDA2014) and the 2nd Congress on Computer Science and Application (CCSA2014), held in Sanya, China during December 12 - 14, 2014. The conference program of IEMDA 2014 focused on areas of Industrial Engineering, Machine Design and Automation, while the CCSA 2014 program provided the platform for Computer Science and Applications. Collected together the latest research results and applications on industrial engineering, machine design, automation, and computer science and other related Engineering topics. All submitted papers to this proceedings were subjected to strict peer-reviewing by 2-4 expert referees, to ensure that all articles selected are of highest standard and are relevance to the conference.
Modern Electrical Drives

Technological Developments in Education and Automation includes set of rigorously reviewed world-class manuscripts dealing with the increasing role of technology in daily lives including education and industrial automation. Technological Developments in Education and Automation contains papers presented at the International Conference on Industrial Electronics, Technology & Automation and the International Conference on Engineering Education, Instructional Technology, Assessment, and E-learning which were part of the International Joint Conferences on Computer, Information and Systems Sciences and Engineering.

Elektrische Antriebe - Regelung von Antriebssystemen

SPEED ESTIMATION TECHNIQUES FOR SENSORLESS VECTOR CONTROLLED INDUCTION MOTOR DRIVE.

Speed-sensorless Estimation and Position Control of Induction Motors for Motion Control Applications

Este trabalho apresenta uma solução para a estimação da velocidade do motor de indução quando é aplicado um controle vetorial sem sensor sensorless, utilizando o filtro estendido de Kalman com um filtro secundário, inovador, que proporciona os valores ótimos das matrizes de covariância e pode trabalhar em forma on-line.

Simulation of MRAS Speed Sensorless Estimation Techniques for Induction Machine Drives Using MATLAB/SIMULINK

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.

Permanent Magnet Synchronous and Brushless DC Motor Drives

An interesting alternative for today's high efficiency variable speed drives is the Permanent Magnet-Assisted Synchronous Reluctance Motor drive, which belongs to the family of brushless synchronous AC motor drives. Generally, the reluctance torque of this motor is significant compared to the Permanent Magnet electrical torque. The advantage of increased reluctance torque is the decreased need of expensive permanent magnet (PM) material, which makes this solution thus...
cheaper than the respective permanent magnet motor. Also due to its synchronous operation, sensorless rotational control is possible along with higher power factor and better efficiency compared to the induction motor (IM). Therefore, this thesis first deals with the implementation of a vector control strategy for speed control of the PMa-synRM motor that can be applied to a washing machine application. The machine is supplied by a current controlled voltage source PWM inverter to control the instantaneous stator currents which are decided by the reference speed. Secondly, the thesis focuses on the sensorless speed operation of the PMa-SynRM to take advantage of the lower costs as well as increased system reliability which otherwise is not possible using the delicate speed or position sensors. The concept involves estimation of the rotor speed and/or position. There are several speed estimation techniques proposed by researchers and among them the observer based technique is proven and commonly used in the industry. The only requirements of the observer system are a very fast signal processor, specialized and optimized to perform complex mathematical calculations. The feasibility and effectiveness of the control techniques are verified using the experimental results, implemented using the Texas Instruments TMS320F2812 eZDSP controller board and the overall motor drive system in the laboratory.

**Adaptive State Filtering with Neural Networks for Sensorless Induction Motor Speed Estimation**

The two-volume set LNAI 8856 and LNAI 8857 constitutes the proceedings of the 13th Mexican International Conference on Artificial Intelligence, MICAI 2014, held in Tuxtla, Mexico, in November 2014. The total of 87 papers plus 1 invited talk presented in these proceedings were carefully reviewed and selected from 348 submissions. The first volume deals with advances in human-inspired computing and its applications. It contains 44 papers structured into seven sections: natural language processing, natural language processing applications, opinion mining, sentiment analysis, and social network applications, computer vision, image processing, logic, reasoning, and multi-agent systems, and intelligent tutoring systems. The second volume deals with advances in nature-inspired computation and machine learning and contains also 44 papers structured into eight sections: genetic and evolutionary algorithms, neural networks, machine learning, machine learning applications to audio and text, data mining, fuzzy logic, robotics, planning, and scheduling, and biomedical applications.

**Study and Application for Rotational Speed Estimation Method of a Sensorless Dc Motor Using Adaptive Filter**

This book describes the development of an adaptive state observer using a mathematical model to achieve high performance for sensorless induction motor drives. This involves first deriving an expression for a modified gain rotor flux observer with a parameter adaptive scheme to estimate the motor speed accurately and improve the stability and performance of sensorless vector-controlled induction motor drives. This scheme is then applied to the controls of a photovoltaic-motor water-pumping system, which results in improved dynamic performance under different operating conditions. The book also presents a robust speed controller design for a sensorless vector-controlled induction motor drive system based on H∞ theory, which overcomes the problems of the classical controller.

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