



Fig. 11.6.1 Indirect method of vector control of an induction motor drive

# Vector Control Of Induction Motor

**Arturo Cuomo**



## **Vector Control Of Induction Motor:**

**Vector Control of Three-Phase AC Machines** Nguyen Phung Quang, Jörg-Andreas Dittrich, 2008-12-11 The book deals with the problem area of the vector control of the three phase AC machines like that one of the induction motor with squirrel cage rotor IMSR the permanent magnet excited synchronous motor PMSM and that one of the doubly fed induction machine DFIM from the view of the practical development It is primarily about the use of the IMSR as well as the PMSM in the electrical drive systems at which the method of the field oriented control has been successful in the practice and about the use of the grid voltage oriented controlled DFIM in the wind power plants After a summary of the basic structure of a field oriented controlled three phase AC drive the main points of the design and of the application are explained The detailed description of the design rules forms the main emphasis of the book The description is expanded and made understandable by numerous formulae pictures and diagrams Using the basic equations first the continuous and then the discrete machine models of the IMSR as well as of the PMSM are derived The vectorial two dimensional current controllers which are designed with help of the discrete models are treated in detail in connection with other essential problems like system boundary condition and control variable limitation Several alternative controller configurations are introduced The voltage vector modulation the field orientation and the coordinate transformations are treated also from the view of the practical handling The problems like the parameter identification parameter adaptation and the management of machine states which are normally regarded as abstract are so represented that the book reader does not receive only attempts but also comprehensible solutions for his system The practical style in the description of the design rules of the drive systems are also continued consistently for the wind power systems using the DFIM The represented control concept is proven practically and can be regarded as pioneering for new developments The introduced control structures of the three machine types have led to a relatively mature stage of development in the practice Some disadvantages have nevertheless remained at these linear control concepts which have to be cleared only with nonlinear controllers Going out from the structural nonlinearity of the machines the suitable nonlinear models are derived After that nonlinear controllers are designed on the basis of the method of the exact linearization which proves to be the most suitable in comparison with other methods like backstepping based or passivity based designs

**Vector Control of Induction Motor Using MATLAB** Langsi Yao, 2012-05 Nowadays vector control of induction motor drives are increasingly employed in industrial drive systems motor works on best performance at certain voltage and frequency for certain loads This project describes a generalized model of the three phase induction motor by using vector control method and its computer simulation using MATLAB SIMULINK it presents the advances made in vector control as applied to high performance AC motor drives By using this application it can achieve speed control by controlling the reference speed value and torque value to keep the electromagnetic torque at a constant value Machine models in d q representation implementation issues with AC induction motor inverters and converters parameter effects for

induction motor vector control are dealt with and simulation results from the project are presented and discussed by computational calculation and graphs to support this theory. The large scope in this model can lead the algorithm designers to direct their efforts to the promising areas and avoid impossible tasks. From this project, the readers can approximately understand the principle of vector control in three phase AC induction motor drive.

*Vector Control of AC Drives* Ion Boldea, Syed A. Nasar, 2017-11-22

Alternating current AC induction and synchronous machines are frequently used in variable speed drives with applications ranging from computer peripherals, robotics and machine tools to railway traction, ship propulsion and rolling mills. The notable impact of vector control of AC drives on most traditional and new technologies, the multitude of practical configurations proposed and the absence of books treating this subject as a whole with a unified approach were the driving forces behind the creation of this book. *Vector Control of AC Drives* examines the remarkable progress achieved worldwide in vector control from its introduction in 1969 to the current technology. The book unifies the treatment of vector control of induction and synchronous motor drives using the concepts of general flux orientation and the feed forward indirect and feedback direct voltage and current vector control. The concept of torque vector control is also introduced and applied to all AC motors. AC models for drive applications developed in complex variables space phasors both for induction and synchronous motors are used throughout the book. Numerous practical implementations of vector control are described in considerable detail followed by representative digital simulations and test results taken from the recent literature. *Vector Control of AC Drives* will be a welcome addition to the reference collections of electrical and mechanical engineers involved with machine and system design.

**Control of Induction Motor Using Vector Control** Abdullah Ahmed Farag Badyah, 2009

*Vector Control of AC Drives* Ion Boldea, Syed A. Nasar, 2017-11-22

Alternating current AC induction and synchronous machines are frequently used in variable speed drives with applications ranging from computer peripherals, robotics and machine tools to railway traction, ship propulsion and rolling mills. The notable impact of vector control of AC drives on most traditional and new technologies, the multitude of practical configurations proposed and the absence of books treating this subject as a whole with a unified approach were the driving forces behind the creation of this book. *Vector Control of AC Drives* examines the remarkable progress achieved worldwide in vector control from its introduction in 1969 to the current technology. The book unifies the treatment of vector control of induction and synchronous motor drives using the concepts of general flux orientation and the feed forward indirect and feedback direct voltage and current vector control. The concept of torque vector control is also introduced and applied to all AC motors. AC models for drive applications developed in complex variables space phasors both for induction and synchronous motors are used throughout the book. Numerous practical implementations of vector control are described in considerable detail followed by representative digital simulations and test results taken from the recent literature. *Vector Control of AC Drives* will be a welcome addition to the reference collections of electrical and mechanical engineers involved with machine and system

design     **Vector Control and Dynamics of AC Drives** D. W. Novotny, T. A. Lipo, 1996 Electric drive systems is an area of great change and increasing commercial importance in industry today Written by experts in the field this book takes account of recent developments These have been due largely to the advances in power electronics and computer control in turn they have made possible the implementation of a c drive systems in place of d c Topics include inverter machine dynamics constant speed behavior and the development of conventional equivalent circuits vector controlled systems and current regulators     **Artificial Intelligence: Methodology, Systems, and Applications** Darina Dicheva, 2010 The 14th

International Conference on Artificial Intelligence Methodology Systems Applications AIMS A 2010 was held in Varna Bulgaria during September 8 10 2010 The AIMS A conference series has provided a biennial forum for the presentation of artificial intelligence research and development since 1984 The conference covers the full range of topics in artificial intelligence AI and related disciplines and provides an ideal forum for international scientific exchange between Central Eastern Europe and the rest of the world The 2010 AIMS A edition continued this tradition For AIMS A 2010 we decided to place special emphasis on the application and leverage of AI technologies in the context of knowledge societies where knowledge creation accessing acquiring and sharing empower individuals and communities A number of AI techniques play a key role in responding to these challenges AI is tensively used in the development of systems for effective management and flexible and personalized access to large knowledge bases in the Semantic Web technologies that enable sharing and reuse of and reasoning over semantically annotated resources in the emerging social Semantic Web applications that aid humans to collaboratively build semantics in the construction of intelligent environments for supporting human and agent learning etc In building such intelligent applications AI techniques are typically combined with results from other disciplines such as the social sciences distributed systems databases digital libraries information retrieval service oriented applications etc

Control of Induction Motors Andrzej Trzynadlowski, 2001 This is a reference source for practising engineers specializing in electric power engineering and industrial electronics It begins with the basic dynamic models of induction motors and progresses to low and high performance drive systems     **Vector Control of Induction Machines** Benoît Robyns, Bruno Francois, Philippe Degobert, Jean Paul Hautier, 2012-02-06 After a brief introduction to the main law of physics and fundamental concepts inherent in electromechanical conversion Vector Control of Induction Machines introduces the standard mathematical models for induction machines whichever rotor technology is used as well as several squirrel cage induction machine vector control strategies The use of causal ordering graphs allows systematization of the design stage as well as standardization of the structure of control devices Vector Control of Induction Machines suggests a unique approach aimed at reducing parameter sensitivity for vector controls based on a theoretical analysis of this sensitivity This analysis naturally leads to the introduction of control strategies that are based on the combination of different controls with different robustness properties through the use of fuzzy logic supervisors Numerous applications and experiments confirm the validity

of this simple solution which is both reproducible and applicable to other complex systems Vector Control of Induction Machines is written for researchers and postgraduate students in electrical engineering and motor drive design *The Field Orientation Principle in Control of Induction Motors* Andrzej M. Trzynadlowski, 2013-11-27 The Field Orientation Principle was first formulated by Haase in 1968 and Blaschke in 1970 At that time their ideas seemed impractical because of the insufficient means of implementation However in the early eighties technological advances in static power converters and microprocessor based control systems made the high performance a c drive systems fully feasible Since then hundreds of papers dealing with various aspects of the Field Orientation Principle have appeared every year in the technical literature and numerous commercial high performance a c drives based on this principle have been developed The term vector control is often used with regard to these systems Today it seems certain that almost all d c industrial drives will be ousted in the foreseeable future to be in major part superseded by a c drive systems with vector controlled induction motors This transition has already been taking place in industries of developed countries Vector controlled a c drives have been proven capable of even better dynamic performance than d c drive systems because of higher allowable speeds and shorter time constants of a c motors It should be mentioned that the Field Orientation Principle can be used in control not only of induction asynchronous motors but of all kinds of synchronous motors as well Vector controlled drive systems with the so called brushless d c motors have found many applications in high performance drive systems such as machine tools and industrial robots *Vector Control of Induction Motor Based on DSP* Jianmin Fang, Hong Kong Polytechnic University. Department of Electrical Engineering, 2011 *High Performance AC Drives* Mukhtar Ahmad, 2010-09-08 Variable speed is one of the important requirements in most of the electric drives Earlier dc motors were the only drives that were used in industries requiring operation over a wide range of speed with step less variation or requiring fine accuracy of speed control Such drives are known as high performance drives AC motors because of being highly coupled non linear devices can not provide fast dynamic response with normal controls However recently because of ready availability of power electronic devices and digital signal processors ac motors are beginning to be used for high performance drives Field oriented control or vector control has made a fundamental change with regard to dynamic performance of ac machines Vector control makes it possible to control induction or synchronous motor in a manner similar to control scheme used for the separately cited dc motor Recent advances in artificial intelligence techniques have also contributed in the improvement in performance of electric drives This book presents a comprehensive view of high performance ac drives It may be considered as both a text book for graduate students and as an up to date monograph It may also be used by R D professionals involved in the improvement of performance of drives in the industries The book will also be beneficial to the researchers pursuing work on sensorless and direct torque control of electric drives as up to date references in these topics are provided **Vector Control of Induction Motors Considering Magnetic Saturation** Ahmed Abdel-Hamid Zaki Diab, Ahmed Mohamed El-Sawy, Yehia Sayed

Mohamed,2012-06 In this study a mathematical dynamic model of an induction motor as influenced by magnetic circuit saturation is developed Moreover a modified structure of indirect vector controller scheme is proposed which involves the saturated value of the magnetizing inductance In order to overcome the disadvantages of the vector control drive system such as speed sensor and parameter sensitivity two proposed control systems have been developed In the first system a simultaneous stator resistance and motor speed estimation based on a modified Model Reference Adaptive System MRAS has been used to obtain accurate estimation for motor speed taking the effect of magnetic flux saturation into account Online magnetizing inductance estimation has been presented to consider the effect of saturation in the proposed system In the second system an effective online method for rotor resistance estimation based on a modified MRAS to achieve high precise control in a wide range of motor speed taking the effect of magnetic circuit saturation into account Power Electronics Handbook

Muhammad H. Rashid,2010-07-19 Power electronics which is a rapidly growing area in terms of research and applications uses modern electronics technology to convert electric power from one form to another such as ac dc dc dc dc ac and ac ac with a variable output magnitude and frequency Power electronics has many applications in our every day life such as air conditioners electric cars sub way trains motor drives renewable energy sources and power supplies for computers This book covers all aspects of switching devices converter circuit topologies control techniques analytical methods and some examples of their applications 25% new content Reorganized and revised into 8 sections comprising 43 chapters Coverage of numerous applications including uninterruptable power supplies and automotive electrical systems New content in power generation and distribution including solar power fuel cells wind turbines and flexible transmission

*Applied Intelligent Control of Induction Motor Drives* Tze Fun Chan,Keli Shi,2011-01-19 Induction motors are the most important workhorses in industry They are mostly used as constant speed drives when fed from a voltage source of fixed frequency Advent of advanced power electronic converters and powerful digital signal processors however has made possible the development of high performance adjustable speed AC motor drives This book aims to explore new areas of induction motor control based on artificial intelligence AI techniques in order to make the controller less sensitive to parameter changes Selected AI techniques are applied for different induction motor control strategies The book presents a practical computer simulation model of the induction motor that could be used for studying various induction motor drive operations The control strategies explored include expert system based acceleration control hybrid fuzzy PI two stage control neural network based direct self control and genetic algorithm based extended Kalman filter for rotor speed estimation There are also chapters on neural network based parameter estimation genetic algorithm based optimized random PWM strategy and experimental investigations A chapter is provided as a primer for readers to get started with simulation studies on various AI techniques Presents major artificial intelligence techniques to induction motor drives Uses a practical simulation approach to get interested readers started on drive development Authored by experienced scientists with over 20 years of experience in

the field Provides numerous examples and the latest research results Simulation programs available from the book s Companion Website This book will be invaluable to graduate students and research engineers who specialize in electric motor drives electric vehicles and electric ship propulsion Graduate students in intelligent control applied electric motion and energy as well as engineers in industrial electronics automation and electrical transportation will also find this book helpful Simulation materials available for download at [www.wiley.com/go/chanmotor](http://www.wiley.com/go/chanmotor)

**Induction Motor Control Design** Riccardo Marino, Patrizio Tomei, Cristiano M. Verrelli, 2010-08-20 This book provides the most important steps and concerns in the design of estimation and control algorithms for induction motors A single notation and modern nonlinear control terminology is used to make the book accessible although a more theoretical control viewpoint is also given Focusing on the induction motor with the concepts of stability and nonlinear control theory given in appendices this book covers speed sensorless control design of adaptive observers and parameter estimators a discussion of nonlinear adaptive controls containing parameter estimation algorithms and comparative simulations of different control algorithms The book sets out basic assumptions structural properties modelling state feedback control and estimation algorithms then moves to more complex output feedback control algorithms based on stator current measurements and modelling for speed sensorless control The induction motor exhibits many typical and unavoidable nonlinear features

*Sensorless Vector Control for Induction Motors* Zaining Zhang, 1998

Vector Control of AC Machines Peter Vas, 1990 Vector control has become a powerful and frequently adopted technique in recent years This book discusses in detail the various forms of vector control of smooth air gap and salient pole electrical machines supplied by impressed stator voltages or currents or impressed rotary currents

*Vector Control of Three-Phase AC Machines* Nguyen Phung Quang, Jörg-Andreas Dittrich, 2010-10-22 The book deals with the problem area of the vector control of the three phase AC machines like that one of the induction motor with squirrel cage rotor IMSR the permanent magnet excited synchronous motor PMSM and that one of the doubly fed induction machine DFIM from the view of the practical development It is primarily about the use of the IMSR as well as the PMSM in the electrical drive systems at which the method of the field oriented control has been successful in the practice and about the use of the grid voltage oriented controlled DFIM in the wind power plants After a summary of the basic structure of a field oriented controlled three phase AC drive the main points of the design and of the application are explained The detailed description of the design rules forms the main emphasis of the book The description is expanded and made understandable by numerous formulae pictures and diagrams Using the basic equations first the continuous and then the discrete machine models of the IMSR as well as of the PMSM are derived The vectorial two dimensional current controllers which are designed with help of the discrete models are treated in detail in connection with other essential problems like system boundary condition and control variable limitation Several alternative controller configurations are introduced The voltage vector modulation the field orientation and the coordinate transformations are treated also from the view of the practical



handling The problems like the parameter identification parameter adaptation and the management of machine states which are normally regarded as abstract are so represented that the book reader does not receive only attempts but also comprehensible solutions for his system The practical style in the description of the design rules of the drive systems are also continued consistently for the wind power systems using the DFIM The represented control concept is proven practically and can be regarded as pioneering for new developments The introduced control structures of the three machine types have led to a relatively mature stage of development in the practice Some disadvantages have nevertheless remained at these linear control concepts which have to be cleared only with nonlinear controllers Going out from the structural nonlinearity of the machines the suitable nonlinear models are derived After that nonlinear controllers are designed on the basis of the method of the exact linearization which proves to be the most suitable in comparison with other methods like backstepping based or passivity based designs     High Performance Sensorless Vector Control of Induction Motor Drives Ramon Blasco Gimenez, 1995

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