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# ELECTRIC MOTOR DRIVES

MODELING, ANALYSIS, AND CONTROL

R. KRISHNAN



ALWAYS LEARNING

PEARSON

# Electric Motor Drives Modeling Analysis And Control

**Ramu Krishnan**



## **Electric Motor Drives Modeling Analysis And Control:**

**Electric Motor Drives** Ramu Krishnan, 2001 For introductory senior level and graduate level courses in electric drives power electronics The book develops a systematic approach to motor drives While the emphasis is on practice extensive modeling simulation and analysis is developed to assist readers in their understanding of the subject matter from fundamental principles Also each motor drive is illustrated with an industrial application in detail at the end of chapters to enable readers to relate theory to practice

**Electric Motor Drives** Ramu Krishnan, 2003 *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

Electric Machines and Drives Shaahin Filizadeh, 2013-02-20 Electric machines have a ubiquitous presence in our modern daily lives from the generators that supply electricity to motors of all sizes that power countless applications Providing a balanced treatment of the subject *Electric Machines and Drives Principles Control Modeling and Simulation* takes a ground up approach that emphasizes fundamental principles The author carefully deploys physical insight mathematical rigor and computer simulation to clearly and effectively present electric machines and drive systems Detailing the fundamental principles that govern electric machines and drives systems this book Describes the laws of induction and interaction and demonstrates their fundamental roles with numerous examples Explores dc machines and their principles of operation Discusses a simple dynamic model used to develop speed and torque control strategies Presents modeling steady state based drives and high performance drives for induction machines highlighting the underlying physics of the machine Includes coverage of modeling and high performance control of permanent magnet synchronous machines Highlights the elements of power electronics used in electric drive systems Examines simulation based optimal design and numerical simulation of dynamical systems Suitable for a one semester class at the senior undergraduate or a graduate level the text

supplies simulation cases that can be used as a base and can be supplemented through simulation assignments and small projects. It includes end of chapter problems designed to pick up on the points presented in chapters and develop them further or introduce additional aspects. The book provides an understanding of the fundamental laws of physics upon which electric machines operate, allowing students to master the mathematical skills that their modeling and analysis requires.

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. *Handbook of*

*Automotive Power Electronics and Motor Drives* Ali Emadi, 2017-12-19. Initially, the only electric loads encountered in an automobile were for lighting and the starter motor. Today, demands on performance, safety, emissions, comfort, convenience, entertainment, and communications have seen the working in of seemingly innumerable advanced electronic devices. Consequently, vehicle electric systems require larger capacities and more complex configurations to deal with these demands. Covering applications in conventional, hybrid, electric, and electric vehicles, the *Handbook of Automotive Power Electronics and Motor Drives* provides a comprehensive reference for automotive electrical systems. This authoritative handbook features contributions from an outstanding international panel of experts from industry and academia, highlighting existing and emerging technologies. Divided into five parts, the *Handbook of Automotive Power Electronics and Motor Drives* offers an overview of automotive power systems, discusses semiconductor devices, sensors, and other components, explains different power electronic converters, examines electric machines and associated drives, and details various advanced electrical loads, as well as battery technology for automobile applications. As we seek to answer the call for safer, more efficient, and lower emission vehicles from regulators and consumer insistence on better performance, comfort, and entertainment, the technologies outlined in this book are vital for engineering advanced vehicles that will satisfy these criteria. Control

Schemes for DC Motors in Electric Drives Ishwar Singh, 2024-05-18. In recent years, the integration of electric motors into various applications has surged, driven by the ever-growing demand for efficient and sustainable energy solutions. Among the myriad of electric motor types, Direct Current (DC) motors stand out for their versatility, reliability, and controllability, making them a cornerstone in a wide array of industries, from manufacturing and transportation to renewable energy systems and

home appliances The significance of DC motors lies not only in their mechanical prowess but also in the sophisticated control schemes that govern their operation *Power Electronics and Motor Drives* Bogdan M. Wilamowski, J. David Irwin, 2018-10-03 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 **Dynamics and Control of Electrical Drives** Wach Piotr, 2011-04-28 Dynamics is a science concerned with movement and changes In the most general approach it relates to life processes as well as behavior in nature in rest It governs small particles technical objects conversion of matter and materials but also concerns people groups of people in their individual and in particular social dimension In dynamics we always have to do with causes or stimuli for motion the rules of reaction or behavior and its result in the form of trajectory of changes This book is devoted to dynamics of a wide class of specific but very important objects such as electromechanical systems This is a very rigorous discipline and has a long tradition as its theoretical bases were formulated in the first half of the XIX century by d Alembert Lagrange Hamilton Maxwell and other prominent scientists but their crucial results were based on previous pioneering research of others such as Copernicus Galileo Newton This book in its theoretical foundations is based on the principle of least action which governs classical as well as relativistic mechanics and electromagnetism and leads to Lagrange s equations which are applied in the book as universal method to construct equations of motion of electromechanical systems It gives common and coherent grounds to formulate mathematical models for all lumped parameters electromechanical systems which are vital in

our contemporary industry and civilized everyday life From these remarks it seems that the book is general and theoretical but in fact it is a very practical one concerning modern electrical drives in a broad sense including electromechanical energy conversion induction motor drives brushless DC drives with a permanent magnet excitation and switched reluctance machines SRM And of course their control which means shaping of their trajectories of motion using modern tools their designed autonomy in keeping a track according to our programmed expectations The problems presented in the book are widely illustrated by characteristics trajectories dynamic courses all computed by use of developed simulation models throughout the book There are some classical subjects and the history of the discipline is discussed but finally all modern tools and means are presented and applied More detailed descriptions follow in abstracts for the particular chapters The author hopes kind readers will enjoy and profit from reading this book *Telematics and Computing* Miguel Félix Mata-Rivera,Roberto Zagal-Flores,Cristian Barria-Huidobro,2020-11-01 This book constitutes the thoroughly refereed proceedings of the 9th International Congress on Telematics and Computing WITCOM 2020 held in Puerto Vallarta Mexico in November 2020 Due to the COVID 19 pandemic the conference was held online The 28 full papers and 3 short papers in this volume were carefully reviewed and selected from 79 submissions The papers are focused on the topics of deep and machine learning cybersecurity wireless networks computer vision communications and education applied to different sceneries of study and COVID 19

**Design of Three-phase AC Power Electronics Converters** Fei "Fred" Wang,Zheyu Zhang,Ruirui Chen,2023-12-12 DESIGN OF THREE PHASE AC POWER ELECTRONICS CONVERTERS Comprehensive resource on design of power electronics converters for three phase AC applications Design of Three phase AC Power Electronics Converters contains a systematic discussion of the three phase AC converter design considering various electrical thermal and mechanical subsystems and functions Focusing on establishing converter components and subsystems models needed for the design the text demonstrates example designs for these subsystems and for the whole three phase AC converters considering interactions among subsystems The design methods apply to different applications and topologies The text presents the basics of the three phase AC converter its design and the goal and organization of the book focusing on the characteristics and models important to the converter design for components commonly used in three phase AC converters The authors present the design of subsystems including passive rectifiers inverters and active rectifiers electromagnetic interference EMI filters thermal management system control and auxiliaries mechanical system and application considerations and discuss design optimization which presents methodology to achieve optimal design results for three phase AC converters Specific sample topics covered in Design of Three phase AC Power Electronics Converters include Models and characteristics for devices most commonly used in three phase converters including conventional Si devices and emerging SiC and GaN devices Models and selection of various capacitors characteristics and design of magnetics using different types of magnetic cores with a focus on inductors Optimal three phase AC converter design including design and selection of devices AC line

inductors DC bus capacitors EMI filters heatsinks and control The design considers both steady state and transient conditions Load and source impact converter design such as motors and grid condition impacts For researchers and graduate students in power electronics along with practicing engineers working in the area of three phase AC converters Design of Three phase AC Power Electronics Converters serves as an essential resource for the subject and may be used as a textbook or industry reference

**Advances in Communication, Signal Processing, VLSI, and Embedded Systems** Shubhakar Kalya,Muralidhar Kulkarni,K.S. Shivaprakasha,2019-11-30 This book comprises selected peer reviewed papers from the International Conference on VLSI Signal Processing Power Systems Illumination and Lighting Control Communication and Embedded Systems VSPICE 2019 The contents are divided into five broad topics VLSI and embedded systems signal processing power systems illumination and control and communication and networking The book focuses on the latest innovations trends and challenges encountered in the different areas of electronics and communication and electrical engineering It also offers potential solutions and provides an insight into various emerging areas such as image fusion bio sensors and underwater sensor networks This book can prove to be useful for academics and professionals interested in the various sub fields of electronics and communication engineering

**Discrete time sliding mode control strategies applied to a multiphase brushless DC machine** Godoi Dias, Milena Sabrina,2017 Nowadays environmental issues motivates the replacement of mechanical hydraulic and pneumatic system by electrical system in the transport sector aiming to reduce emissions generated by burning of fossil fuels in vehicles The electrical system must ensure high electrical efficiency and should not exceed the weight of the substituted components To attend these high performance requirements a fault tolerant multiphase brushless DC machine was chosen for this research The present work introduces a six phase 600W brushless DC machine with 8 poles The main challenge for the control issues of this machine is the mutual magnetic coupling between the phases due to the wave winding machine configuration In this context theoretical and practical investigations of different current control strategies based on the sliding mode control approach applied to the six phase brushless DC machine are presented

Proceedings of the International Conference on Soft Computing Systems L. Padma Suresh,Bijaya Ketan Panigrahi,2015-12-28 The book is a collection of high quality peer reviewed research papers presented in International Conference on Soft Computing Systems ICSCS 2015 held at Noorul Islam Centre for Higher Education Chennai India These research papers provide the latest developments in the emerging areas of Soft Computing in Engineering and Technology The book is organized in two volumes and discusses a wide variety of industrial engineering and scientific applications of the emerging techniques It presents invited papers from the inventors originators of new applications and advanced technologies

*Green Energy, Environment and Sustainable Development* C. Wang,X. Zhang,H. Ren,2023-10-19 The subjects of green energy and sustainability have never been more important as governments around the world wrestle with the problem of how to protect the planet from the damage being caused to the environment by climate change This book presents the

proceedings of GEESD2023 the 4th International Conference on Green Energy Environment and Sustainable Development held in Mianyang China from 15-17 June 2023 and online via Zoom. The conference aims to gather innovative academicians and industry experts in the fields of green energy, environment and sustainable development in a common forum providing a platform for the exchange of the latest research developments in related fields. This year the call for papers attracted more than 280 submissions, 138 of which were accepted for inclusion in this collection. The process of evaluation and peer review took place over six months and involved more than 100 TPC members and reviewers. The book is divided into 7 sections: green energy and systems, computer methods in the environment, chemistry and the environment, ecology and the rural environment, energy, environment and economy, environment and pollution, and water and mineral resources. Papers deal with the most up-to-date findings and technologies. The book provides a valuable overview of the latest research and developments and will be of interest to all those working in the fields of green energy and sustainable development. **Advances in**

**Renewable Energy & Electric Vehicles** Suryanarayana Kajampady, Shripad T. Revankar, 2023-11-14. This book presents select peer-reviewed proceedings of the International Conference on Advances in Renewable Energy and Electric Vehicles (AREEV 2022). The topics covered include renewable energy sources, electric vehicles, energy storage systems, power system protection, security, smart grid, and wide bandgap semiconductor technologies. The book also discusses applications of signal processing, artificial neural networks, optimal and robust control systems, and modeling and simulation of power electronic converters. The book is a valuable reference for academics and professionals interested in power systems, renewable energy, and electric vehicles. *Introduction to Electric Drives* Ishwar Singh, 2024-05-17. This book, *Introduction to Electric Drives*, is written to offer readers a background walkthrough from which they will have an ample understanding of electric drive systems and their uses in different industries. This book is an inseparable source for students, apprentices, researchers, developers, and specialists hunting for new knowledge on electric drives. Less commonly, electronic drives are used in electric motor applications in the industry, in infrastructure and transport networks, as well as in renewable energy and electronics. Knowledge of electric drive principles, construction, and operation is required of those whose tasks are to design, implement, or support electric drive electrical systems. *Intelligent and Efficient Electrical Systems* M.C. Bhuvaneswari, Jayashree Saxena, 2017-12-21. This book presents selected papers from the International Conference on Intelligent and Efficient Electrical Systems (ICIEES 17). The volume brings together content from both industry and academia. The book focuses on energy efficiency in electrical systems and covers trending topics such as control of renewable energy systems. The collaborative industry-academia perspective of the conference ensures that equal emphasis is laid on novel topics and practical applications. The contents of this volume will prove useful to researchers and practicing engineers alike. Alternative

Energy Systems M. Godoy Simões, Felix A. Farret, 2007-12-10. New perspectives on using induction generators in alternative energy technologies. Durable and cost-effective induction power generators have undergone numerous improvements that



make them an increasingly attractive option for renewable energy applications particularly for wind and hydropower generation systems From fundamental concepts to the latest technologies *Alternative Energy Systems Design and Analysis with Induction Generators Second Edition* provides detailed and accurate coverage of all aspects related to the design operation and overall analysis of such systems Placing a greater emphasis on providing clear precise and succinct explanations this second edition features new revised and updated content as well as figures tables equations and examples Each chapter introduces a multi step chapter length problem relating the material to a real application The solution appears at the end of the chapter along with additional practice problems and references New Material in This Edition Updated definitions for generated power and efficiency Technological advances such as new applications using doubly fed induction generators New methodologies such as the magnetization curve representation for induction generators Additional focus on renewable energy applications such as sea wind and hydropower systems Totally re written and updated chapter covering doubly fed induction generators *Alternative Energy Systems* provides the tools and expertise for advanced students and professionals in electrical mechanical civil and environmental engineering involved in the development of power plants

*Advanced, Contemporary Control* Andrzej Bartoszewicz, Jacek Kabziński, Janusz Kacprzyk, 2020-06-24 This book presents the proceedings of the 20th Polish Control Conference A triennial event that was first held in 1958 the conference successfully combines its long tradition with a modern approach to shed light on problems in control engineering automation robotics and a wide range of applications in these disciplines The book presents new theoretical results concerning the steering of dynamical systems as well as industrial case studies and worked solutions to real world problems in contemporary engineering It particularly focuses on the modelling identification analysis and design of automation systems however it also addresses the evaluation of their performance efficiency and reliability Other topics include fault tolerant control in robotics automated manufacturing mechatronics and industrial systems Moreover it discusses data processing and transfer issues covering a variety of methodologies including model predictive robust and adaptive techniques as well as algebraic and geometric methods and fractional order calculus approaches The book also examines essential application areas such as transportation and autonomous intelligent vehicle systems robotic arms mobile manipulators cyber physical systems electric drives and both surface and underwater marine vessels Lastly it explores biological and medical applications of the control theory inspired methods

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