

# **Performance Control Of Electronic Machines**

Nabeel A. O. Demerdash, Jiang Biao He, Hao Chen

#### **Performance Control Of Electronic Machines:**

Modeling and High Performance Control of Electric Machines John Chiasson, 2005-05-13 Modeling and High Performance Control of Electric Machines introduces you to both the modeling and control of electric machines The direct current DC machine and the alternating current AC machines induction PM synchronous and BLDC are all covered in detail The author emphasizes control techniques used for high performance applications specifically ones that require both rapid and precise control of position speed or torque You ll discover how to derive mathematical models of the machines and how the resulting models can be used to design control algorithms that achieve high performance Graduate students studying power and control as well as practicing engineers in industry will find this a highly readable text on the operation modeling and control of electric machines An Instructor's Manual presenting detailed solutions to all the problems in the book is available from the Wiley editorial department Instructor Support materials are also available Email IAline wiley com High Performance Control of AC Drives with Matlab / Simulink Models Haitham Abu-Rub, Atif Igbal, Jaroslaw Guzinski, 2012-04-13 A comprehensive guide to understanding AC machines with exhaustive simulation models to practice design and control Nearly seventy percent of the electricity generated worldwide is used by electrical motors Worldwide huge research efforts are being made to develop commercially viable three and multi phase motor drive systems that are economically and technically feasible Focusing on the most popular AC machines used in industry induction machine and permanent magnet synchronous machine this book illustrates advanced control techniques and topologies in practice and recently deployed Examples are drawn from important techniques including Vector Control Direct Torque Control Nonlinear Control Predictive Control multi phase drives and multilevel inverters Key features include systematic coverage of the advanced concepts of AC motor drives with and without output filter discussion on the modelling analysis and control of three and multi phase AC machine drives including the recently developed multi phase phase drive system and double fed induction machine description of model predictive control applied to power converters and AC drives illustrated together with their simulation models end of chapter questions with answers and PowerPoint slides available on the companion website www wiley com go aburub control This book integrates a diverse range of topics into one useful volume including most the latest developments It provides an effective guideline for students and professionals on many vital electric drives aspects It is an advanced textbook for final year undergraduate and graduate students and researchers in power electronics electric drives and motor control It is also a handy tool for specialists and practicing engineers wanting to develop and verify their own algorithms and techniques

**Practical Control of Electric Machines** Rubén Molina Llorente,2020-03-20 This book presents deep analysis of machine control for different applications focusing on its implementation in embedded systems Necessary peripherals for various microcontroller families are analysed for machine control and software architecture patterns for high quality software development processes in motor control units are described Abundant figures help the reader to understand the

theoretical simulation and practical implementation stages of machine control Model based design used as a mathematical and visual approach to construction of complex control algorithms code generation that eliminates hand coding errors and co simulation tools such as Simulink PSIM and finite element analysis are discussed The simulation and verification tools refine and retest the models without having to resort to prototype construction. The book shows how a voltage source inverter can be designed with tricks protection elements and space vector modulation Practical Control of Electric Machines Model Based Design and Simulation is based on the author's experience of a wide variety of systems in domestic automotive and industrial environments and most examples have implemented and verified controls. The text is ideal for readers looking for an insight into how electric machines play an important role in most real life applications of control Practitioners and students preparing for a career in control design applied in electric machines will benefit from the book s easily understood theoretical approach to complex machine control The book contains mathematics appropriate to various levels of experience from the student to the academic and the experienced professional Advances in Industrial Control reports and encourages the transfer of technology in control engineering The rapid development of control technology has an impact on all areas of the control discipline The series offers an opportunity for researchers to present an extended exposition of new work in all aspects of industrial control Analysis of Electric Machinery and Drive Systems Paul C. Krause, Oleg Wasynczuk, Scott D. Sudhoff, Steven D. Pekarek, 2025-05-06 New edition of the popular reference on machine analysis focusing on reference frame theory with techniques for derivation of equations Analysis of Electric Machinery and Drive Systems covers the concepts needed to understand the evolution of electrical and magnetic variables for designing the power electronic circuits that supply or extract electrical energy from a variety of machines comprehensively addressing the varied needs of readers in the electric machinery electric drives and electric power industries This fourth edition has been extensively revised and updated to include nine new or updated chapters on symmetrical three phase stators symmetrical induction machines brushless DC machines synchronous machines neglecting electric transients eigenvalues and voltage behind reactive machine equations direct current machine and drive and torque control of permanent magnet and synchronous reluctance machines Introductory concepts related to the subject have also been expanded upon detailing stationary magnetically coupled circuits energy balance relationships energy in coupling field and steady state and dynamic performance of electromechanical systems The fourth edition also includes illustrations of the free acceleration characteristics of induction and brushless dc machines viewed from various reference frames and many other topics With problems at the end of each chapter to reinforce learning the book explores additional topics including Operational impedances and time constraints of synchronous machines covering Park s equations in operational form and parameters from short circuit and frequency response characteristics Fully controlled three phase bridge converters covering six step sine triangle space vector hysteresis and delta modulations along with open and closed loop voltage and current regulations Motor drives covering volts per hertz constant slip current field oriented and direct torque control as well as slip energy recovery drives Brushless DC motor drives covering average value analysis steady state performance and transient and dynamic performance of voltage source inverter drives Analysis of Electric Machinery and Drive Systems Fourth Edition is a perfect resource for electrical engineering students and an essential up to date reference for electrical and mechanical engineers working with drives

High Performance Control of AC Drives with Matlab/Simulink Haitham Abu-Rub, Atif Igbal, Jaroslaw Guzinski, 2021-04-06 High Performance Control of AC Drives with Matlab Simulink Explore this indispensable update to a popular graduate text on electric drive techniques and the latest converters used in industry The Second Edition of High Performance Control of AC Drives with Matlab Simulink delivers an updated and thorough overview of topics central to the understanding of AC motor drive systems. The book includes new material on medium voltage drives covering state of the art technologies and challenges in the industrial drive system as well as their components and control current source inverter based drives PWM techniques for multilevel inverters and low switching frequency modulation for voltage source inverters This book covers three phase and multiphase more than three phase motor drives including their control and practical problems faced in the field e g adding LC filters in the output of a feeding converter are considered The new edition contains links to Matlab Simulink models and PowerPoint slides ideal for teaching and understanding the material contained within the book Readers will also benefit from the inclusion of A thorough introduction to high performance drives including the challenges and requirements for electric drives and medium voltage industrial applications An exploration of mathematical and simulation models of AC machines including DC motors and squirrel cage induction motors A treatment of pulse width modulation of power electronic DC AC converter including the classification of PWM schemes for voltage source and current source inverters Examinations of harmonic injection PWM and field oriented control of AC machines Voltage source and current source inverter fed drives and their control Modelling and control of multiphase motor drive system Supported with a companion website hosting online resources Perfect for senior undergraduate MSc and PhD students in power electronics and electric drives High Performance Control of AC Drives with Matlab Simulink will also earn a place in the libraries of researchers working in the field of AC motor drives and power electronics engineers in industry Nonlinear Control of Electric Machinery Dawson, 2019-01-22 This work presents nonlinear control algorithms for a benchmark mechanical system actuated by different types of electric machinery emphasizing system stability and robustness pivotal in the development of optimal position trajectory controllers for common motors College or university bookstores may order five or more copies at a special student price available on request from Marcel Dekker **Introduction to Modern Analysis of Electric** Machines and Drives Paul C. Krause, Thomas C. Krause, 2022-12-28 Introduction to Modern Analysis of Electric Machines and Drives Comprehensive resource introducing magnetic circuits and rotating electric machinery including models and discussions of control techniques Introduction to Modern Analysis of Electric Machines and Drives is written for the junior or

senior student in Electrical Engineering and covers the essential topic of machine analysis for those interested in power systems or drives engineering The analysis contained in the text is based on Tesla's rotating magnetic field and reference frame theory which comes from Tesla s work and is presented for the first time in an easy to understand format for the typical student Since the stators of synchronous and induction machines are the same for analysis purposes they are analyzed just once Only the rotors are different and therefore analyzed separately This approach makes it possible to cover the analysis efficiently and concisely without repeating derivations In fact the synchronous generator equations are obtained from the equivalent circuit which is obtained from work in other chapters without any derivation of equations which differentiates Introduction to Modern Analysis of Electric Machines and Drives from all other textbooks in this area Topics explored by the two highly qualified authors in Introduction to Modern Analysis of Electric Machines and Drives include Common analysis tools covering steady state phasor calculations stationary magnetically linear systems winding configurations and two and three phase stators Analysis of the symmetrical stator covering the change of variables in two and three phase transformations and more Symmetrical induction machines covering symmetrical two pole two phase rotor windings electromagnetic force and torque and p pole machines Direct current machines and drives covering commutation voltage and torque equations permanent magnet DC machines and DC drives Introduction to Modern Analysis of Electric Machines and Drives is appropriate as either a first or second course in the power and drives area Once the reader has covered the material in this book they will have a sufficient background to start advanced study in the power systems or Electrical Machine Drives Control Juha Pyrhonen, Valeria Hrabovcova, R. Scott Semken, 2016-10-03 This drives areas comprehensive text examines existing and emerging electrical drive technologies The authors clearly define the most basic electrical drive concepts and go on to explain the most important details while maintaining a solid connection to the theory and design of the associated electrical machines Also including links to a number of industrial applications the authors take their investigation of electrical drives beyond theory to examine a number of practical aspects of electrical drive control and application Key features Provides a comprehensive summary of all aspects of controlled speed electrical drive technology including control and operation Handling of electrical drives is solidly linked to the theory and design of the associated electrical machines Added insight into problems and functions are illustrated with clearly understandable figures Offers an understanding of the main phenomena associated with electrical machine drives Considers the problem of bearing currents and voltage stresses of an electrical drive Includes up to date theory and design guidelines taking into account the most recent advances This book s rigorous coverage of theoretical principles and techniques makes for an excellent introduction to controlled speed electrical drive technologies for Electrical Engineering MSc or PhD students studying electrical drives It also serves as an excellent reference for practicing electrical engineers looking to carry out design analyses and development of controlled speed electrical drives Electronic Control of Switched Reluctance Machines TJE Miller, 2001-05-18 Switched

reluctance motors have steadily increased in commercial importance since their introduction in the early 1980 s while their technology especially of their electronic control has made great progress Their unique characteristics introduce a delicate balance in which the copper and iron are diminished in quantity complexity and cost in favour of a greater reliance on sophistication in the controller Thus mastery of the control is the key challenge in the application of these machines This book is intended for engineer s in industry and in the large research community in electrical machines and drives It introduces the techniques for controlling switched reluctance machines starting from first principles and building up to the most advanced forms of sensorless control It covers the recent advances in electronic control and includes aspects of motion control automation acoustic noise reduction and energy efficiency Covers the recent changes in control technology Includes up to date equipment and methods Contains applications and case studies **Electric Machinery and Drives** Nabeel A. O. Demerdash, Jiang Biao He, Hao Chen, 2025-02-14 Comprehensive resource on the fundamentals of electric machinery and variable speed drives and their many conventional and emerging applications Electric Machinery and Drives An Electromagnetics Perspective provides advanced concepts of electrical machinery with control drives and emphasizes the necessity of integration of power electronics and control strategy when studying modern electrical machinery The text incorporates the fundamentals of electric machinery variable speed drives and motor controls with the scope of including both the introduction of detailed operating principles as well as the electromagnetic design and control details from scratch The authors start with the introduction of electric circuit notations and elementary concepts of electrical circuits power electronics magnetostatics magnetic circuits and fundamentals of electromechanical energy conversion Later the book elaborates on the operating principles of polyphase induction machines and synchronous machines as well as the associated scale and vector controls of these machines To aid in reader comprehension the text includes a solutions manual and accompanying video animations Electric Machinery and Drives also contains information on Real and reactive power in single phase and balanced three phase circuits and devices using consumer system concepts and notations Forces and torques in simple magnetically linear and nonlinear multi excited electromechanical devices and systems Simplified T equivalent circuit model and its use in performance calculations of induction machines and associated torque slip speed characteristics Brush commutator and brushless DC machines and natural ABC frame and Park s two reaction DQO frame state space modeling of synchronous and induction machines Special machines including single phase induction machines switched reluctance machines and others Electric Machinery and Drives is an ideal learning resource in undergraduate or graduate level courses for all universities with electrical engineering programs across the world Additionally the text may be used as a fundamental reference by researchers and engineers in electrical mechanical automotive aerospace and automation engineering

**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 **Electromechanical Motion Devices** Paul C. Krause, Oleg Wasynczuk, Steven D. Pekarek, 2012-08-10 This text provides a basic treatment of modern electric machine analysis that gives readers the necessary background for comprehending the traditional applications and operating characteristics of electric machines as well as their emerging applications in modern power systems and electric drives such as those used in hybrid and electric vehicles Through the appropriate use of reference frame theory Electromagnetic Motion Devices Second Edition introduces readers to field oriented control of induction machines constant torque and constant power control of dc permanent magnet ac machines and brushless dc machines It also discusses steady state and transient performance in addition to their applications Electromagnetic Motion Devices Second Edition presents The derivations of all machine models starting with a common first principle approach based upon Ohm's Faraday's Ampere's and Newton's Euler s laws A generalized two phase approach to reference frame theory that can be applied to the ac machines featured in the book The influences of the current and voltage constraints in the torque versus speed profile of electric machines operated with an electric drive Complete with slides videos animations problems solutions Thoroughly classroom tested and complete with a supplementary solutions manual and video library Electromagnetic Motion Devices Second Edition is an invaluable book for anyone interested in modern machine theory and applications If you would like access to the solutions manual and video library please send an email to ieeeproposals wiley com **AC Electric Motors Control** Fouad Giri,2013-03-25 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 designmethods 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 Machines Charles A. Gross, 2006-10-20 The two major broad applications of electrical energy are information processing and energy processing Hence it is no wonder that electric machines have occupied a large and revered space in the field of electrical engineering Such an important topic requires a careful approach and Charles A Gross Electric Machines offers the most balanced application oriented and modern perspective on electromagnetic machines available Written in a style that is both accessible and authoritative this book explores all aspects of electromagnetic mechanical EM machines Rather than viewing the EM machine in isolation the author treats the machine as part of an integrated system of source controller motor and load The discussion progresses systematically through basic machine physics and principles of operation to real world applications and relevant control issues for each type of machine presented Coverage ranges from DC induction and synchronous machines to specialized machines such as transformers translational machines and microelectromechanical systems MEMS Stimulating example applications include electric vehicles wind energy and vertical transportation Numerous example problems illustrate and reinforce the concepts discussed Along with appendices filled with unit conversions and background material Electric Machines is a succinct in depth and complete guide to understanding electric machines for novel applications Advanced Electric Drives Mr. Rohit Manglik, 2024-07-30 EduGorilla Publication is a trusted name in the education sector committed to empowering learners with high quality study materials and resources Specializing in competitive exams and academic support EduGorilla provides comprehensive and well structured content tailored to meet

the needs of students across various streams and levels Advanced Electric Drive Vehicles Ali Emadi, 2014-10-24 Electrification is an evolving paradigm shift in the transportation industry toward more efficient higher performance safer smarter and more reliable vehicles There is in fact a clear trend to move from internal combustion engines ICEs to more integrated electrified powertrains Providing a detailed overview of this growing area Advanced Electric Drive Vehicles begins with an introduction to the automotive industry an explanation of the need for electrification and a presentation of the fundamentals of conventional vehicles and ICEs It then proceeds to address the major components of electrified vehicles i e power electronic converters electric machines electric motor controllers and energy storage systems This comprehensive work Covers more electric vehicles MEVs hybrid electric vehicles HEVs plug in hybrid electric vehicles PHEVs range extended electric vehicles REEVs and all electric vehicles EVs including battery electric vehicles BEVs and fuel cell vehicles FCVs Describes the electrification technologies applied to nonpropulsion loads such as power steering and air conditioning systems Discusses hybrid battery ultra capacitor energy storage systems as well as 48 V electrification and belt driven starter generator systems Considers vehicle to grid V2G interface and electrical infrastructure issues energy management and optimization in advanced electric drive vehicles Contains numerous illustrations practical examples case studies and challenging questions and problems throughout to ensure a solid understanding of key concepts and applications Advanced Electric Drive Vehicles makes an ideal textbook for senior level undergraduate or graduate engineering courses and a user friendly reference for researchers engineers managers and other professionals interested in transportation electrification

The Industrial Electronics Handbook - Five Volume Set Bogdan M. Wilamowski, J. David Irwin, 2011-03-04 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

Electromechanical Systems and Devices Sergey Edward Lyshevski,2008-03-26 Students entering today s engineering fields will find an increased emphasis on practical analysis design and control They must be able to translate their advanced programming abilities and sound theoretical backgrounds into superior problem solving skills Electromechanical Systems and Devices facilitates the creation of critical problem solvin *Electric Machines and Drives* Miroslav Chomat,2011-02-28 The subject of this book is an important and diverse field of electric machines and drives The twelve chapters of the book written by renowned authors both academics and practitioners cover a large part of the field of electric machines and drives Various types of electric machines including three phase and single phase induction machines or doubly fed machines are addressed Most of the chapters focus on modern control methods of induction machine drives such as vector and direct torque control Among others the book addresses sensorless control techniques modulation strategies parameter identification artificial intelligence operation under harsh or failure conditions and modelling of electric or magnetic

quantities in electric machines Several chapters give an insight into the problem of minimizing losses in electric machines and increasing the overall energy efficiency of electric drives *Power Electronics and Motor Drive Systems* Stefanos Manias, 2016-11-08 Power Electronics and Motor Drive Systems is designed to aid electrical engineers researchers and students to analyze and address common problems in state of the art power electronics technologies Author Stefanos Manias supplies a detailed discussion of the theory of power electronics circuits and electronic power conversion technology systems with common problems and methods of analysis to critically evaluate results These theories are reinforced by simulation examples using well known and widely available software programs including SPICE PSIM and MATLAB SIMULINK Manias expertly analyzes power electronic circuits with basic power semiconductor devices as well as the new power electronic converters He also clearly and comprehensively provides an analysis of modulation and output voltage current control techniques passive and active filtering and the characteristics and gating circuits of different power semiconductor switches such as BJTs IGBTs MOSFETs IGCTs MCTs and GTOs Includes step by step analysis of power electronic systems Reinforced by simulation examples using SPICE PSIM and MATLAB SIMULINK Provides 110 common problems and solutions in power electronics technologies

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