

# RELUCTANCE SYNCHRONOUS MACHINES AND DRIVES

L. BOLDEA



# Reluctance Synchronous Machines And Drives

**Valeria Hrabovcova, Pavol  
Rafajdus, Pavol Makyš**



## **Reluctance Synchronous Machines And Drives:**

*Reluctance Synchronous Machines and Drives* Ion Boldea, 2023      *Reluctance Synchronous Machines and Drives I.* Boldea, 1996 Reluctance synchronous machines RSMs and drives include a multitude of machine topologies in terms of rotor stator windings and stator current control Line start constant speed and inverter fed variable speed applications are easily achieved in a power range from a few hundred watts to megawatts RSMs offer strong competition to existing variable speed brushless drives for applications from computer peripherals through robotics to electric traction for rail transport This book explores fully the possible topologies their characteristics and applications      **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      **Artificial-Intelligence-based Electrical Machines and Drives** Peter Vas, 1999-01-28 Recently AI techniques have received increased attention world wide and at present 2 industrial drives incorporate some form of AI This is the first comprehensive book which discusses numerous AI applications to electrical machines and drives      **Electric Vehicle Machines and Drives** K. T. Chau, 2015-05-13 A timely comprehensive reference consolidates the research and development of electric vehicle machines and drives for electric and hybrid propulsions Focuses on electric vehicle machines and drives Covers the major technologies in the area including fundamental concepts and applications Emphasis the design criteria performance analyses and application examples or potentials of various motor drives and machine systems Accompanying website includes the simulation models and outcomes as supplementary material      *Electrical Machines and Drives* John Hindmarsh, Alasdair Renfrew, 1996-09-19 Recent years have brought substantial developments in electrical drive technology with the appearance of highly rated very high speed power electronic switches combined with microcomputer control systems This popular textbook has been thoroughly revised and updated in the light of these changes It retains its successful formula of teaching through worked examples which are put in context with concise explanations of theory revision of equations and discussion of the engineering implications Numerous problems are also provided with answers supplied The third edition includes enhanced coverage of power electronic systems and new material on closed loop control in addition to thorough treatment of electrical machines      *Electric Drives* Ion Boldea, Syed A. Nasar, 2005-08-22 Electric drives are everywhere and with the

looming promise of electric vehicles and renewable energy they will become more complex and the demands on their capabilities will continue to increase To keep up with these trends students require hands on knowledge and a keen understanding of the subtleties involved in the operation of modern electr

**Electrical Machine Drives Control** Juha Pyrhonen,Valeria Hrabovcova,R. Scott Semken,2016-10-03 This 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

**Energy Efficiency in Electric Devices, Machines and Drives** Gorazd Štumberger,Boštjan Polajžer,2020-06-18 This Special Issue deals with improvements in the energy efficiency of electric devices machines and drives which are achieved through improvements in the design modelling control and operation of the system Properly sized and placed coils of a welding transformer can reduce the required iron core size and improve the efficiency of the welding system operation New structures of the single phase field excited flux switching machine improve its performance in terms of torque while having higher back EMF and unbalanced electromagnetic forces A properly designed rotor notch reduces the torque ripple and cogging torque of interior permanent magnet motors for the drive platform of electric vehicles resulting in lower vibrations and noise In the field of modelling the torque estimation of a Halbach array surface permanent magnet motor with a non overlapping winding layout was improved by introducing an analytical two dimensional subdomain model A general method for determining the magnetically nonlinear two axis dynamic models of rotary and linear synchronous reluctance machines and synchronous permanent magnet machines is introduced that considers the effects of slotting mutual interaction between the slots and permanent magnets saturation cross saturation and end effects Advanced modern control solutions such as neural network based model reference adaptive control fuzzy control senseless control torque speed tracking control derived from the 3D non holonomic integrator including drift terms maximum torque per ampere and maximum efficiency characteristics are

applied to improve drive performance and overall system operation

### **Linear Electric Machines, Drives, and MAGLEVs**

**Handbook** Ion Boldea, 2023-07-31 Linear motion is richly present in various industries from direct electric propulsion in urban and interurban people movers on wheels or on magnetic cushions MAGLEVs to indoor transport of goods conveyors etc through plunger solenoids to open hotel doors and as electromagnetic power switches to compressor drives by linear oscillatory permanent magnet PM motors smart phones integrated microphone and loudspeakers and controlled vehicles suspension etc Besides the traditional rotary motor drives with mechanical transmissions which mean friction limitations weather dependent in traction heavy vehicles more losses positioning errors backlash in the process and higher maintenance costs to handle them linear motion in industry by direct electromagnetic forces is free of friction limitations for traction free of mechanical transmission and thus more efficient with less maintenance cost and fewer positioning errors backlash This explains why they are used in so many applications already since the dramatic advancement of power electronics and digital control in the last four decades Modeling performance design control and testing of linear electric machines LEMs show notable differences with respect to rotary electric motor drives which warrant a dedicated treatment of these aspects The Second Edition First Edition 2013 concentrates on the above technical aspects of various types of LEMs in close relationship with specific applications via numerical examples of modeling design control and testing with ample representative results from literature industry and some of the author's contributions such as Technical field and circuit modeling of linear induction motors in flat configurations for low and high speeds with and without dynamic end effects and in tubular configurations short travel design control and testing Linear synchronous motor LSM drives in dc excited homopolar reluctance and superconducting excitation configurations for urban and interurban high speed vehicles propulsion and integrated propulsion and levitation in MAGLEVs modeling design and control with full scale numerical examples with emphasis on lower KWh passenger Km at high speeds Flat and tubular linear permanent magnet PM synchronous motors L PMSMs mainly destined to industrial indoor transport for automation at high efficiency in clean rooms Linear flux modulation motors new breed suitable for very low speed applications due to higher thrust density Plunger solenoids in various applications including new valve PM actuators with millisecond response time Linear resonant PM oscillatory motors design control and testing mainly destined to compressors for higher efficiency in compact drives Attraction and repulsive force suspension levitation systems for MAGLEVs Active and passive guideway MAGLEVs in urban and superhigh speed interurban transport at lower Kwh per passenger km in lighter vehicles without wheels The numerous numerical design and control examples with practical specifications throughout the 23 chapters of the book allow the reader deep and fast access to a practical but thorough unitary good for comparisons methodology in designing and controlling LEMs for various applications

**Control in Power Electronics** Marian P. Kazmierkowski, Ramu Krishnan, Frede Blaabjerg, 2002-08-30 The authors were originally brought together to share research and applications through the international Danfoss Professor Programme at

Aalborg University in Denmark Personal computers would be unwieldy and inefficient without power electronic dc supplies Portable communication devices and computers would also be impractical High performance lighting systems motor controls and a wide range of industrial controls depend on power electronics In the near future we can expect strong growth in automotive applications dc power supplies for communication systems portable applications and high end converters We are approaching a time when all electrical energy will be processed and controlled through power electronics somewhere in the path from generation to end use The most up to date information available is presented in the text Written by a world renowned leader in the field      **Analysis of Electrical Machines** Valeria Hrabovcova,Pavol Rafajdus,Pavol

Makyš,2020-05-20 This book is devoted to students PhD students postgraduates of electrical engineering researchers and scientists dealing with the analysis design and optimization of electrical machine properties The purpose is to present methods used for the analysis of transients and steady state conditions In three chapters the following methods are presented 1 a method in which the parameters resistances and inductances are calculated on the basis of geometrical dimensions and material properties made in the design process 2 a method of general theory of electrical machines in which the transients are investigated in two perpendicular axes and 3 FEM which is a mathematical method applied to electrical machines to investigate many of their properties      *International Conference on Electrical Machines and Drives* ,1993

The Electric Generators Handbook - 2 Volume Set Ion Boldea,2005-11-16 The modern world hungers for electricity Traditionally this hunger was sated with predominantly constant speed regulated synchronous generators However new demands require the stable quick and efficient delivery and control offered by variable speed generators Surveying all of the technologies used to satisfy the world s demand for o      Power Electronics and Motor Drives Bimal K. Bose,2020-11-13 Power Electronics and Motor Drives Advances and Trends Second Edition is the perfect resource to keep the electrical engineer up to speed on the latest advancements in technologies equipment and applications Carefully structured to include both traditional topics for entry level and more advanced applications for the experienced engineer this reference sheds light on the rapidly growing field of power electronic operations New content covers converters machine models and new control methods such as fuzzy logic and neural network control This reference will help engineers further understand recent technologies and gain practical understanding with its inclusion of many industrial applications Further supported by a glossary per chapter this book gives engineers and researchers a critical reference to learn from real world examples and make future decisions on power electronic technology and applications Provides many practical examples of industrial applications Updates on the newest electronic topics with content added on fuzzy logic and neural networks Presents information from an expert with decades of research and industrial experience      **Axial Flux Permanent Magnet Brushless Machines** Jacek F. Gieras,Rong-Jie Wang,Maarten J. Kamper,2008-03-26 Axial Flux Permanent Magnet AFPM brushless machines are modern electrical machines with a lot of advantages over their conventional counterparts This

timeless and revised second edition deals with the analysis construction design control and applications of AFPM machines The authors present their own research results as well as significant research contributions made by others

**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

*The Rediscovery of Synchronous Reluctance and Ferrite Permanent Magnet Motors* Gianmario Pellegrino, Thomas M. Jahns, Nicola Bianchi, Wen L. Soong, Francesco Cupertino, 2016-04-28 This book offers an essential compendium on the analysis and design of synchronous motors for variable speed applications Focusing on synchronous reluctance and ferrite permanent magnet PM synchronous reluctance machines it provides a broad perspective on three phase machines for variable speed applications a field currently dominated by asynchronous machines and rare earth PM synchronous machines It also describes synchronous reluctance machines and PM machines without rare earth materials comparing them to state of the art solutions The book provides readers with extensive information on and finite element models of PM synchronous machines including all relevant equations and with an emphasis on synchronous reluctance and PM assisted synchronous reluctance machines It covers ferrite assisted machines modeled as a subcase of PM assistance fractional slot combinations solutions and a quantitative normalized comparison of torque capability with benchmark PM machines The book discusses a wealth of techniques for identifying machine parameters with an emphasis on self commissioning algorithms and presents methods for automated machine design and optimization including a software tool developed for this purpose Addressing an important gap in the field of PM less and less PM electrical machines it is intended as a self contained reference guide for both graduate students and professional machine designers and as a useful text for university courses on automated and or optimized design of electrical machines and drives

**Chaos in Electric Drive Systems** K. T. Chau, Zheng Wang, 2011-03-31 In Chaos in Electric Drive Systems

Analysis Control and Application authors Chau and Wang systematically introduce an emerging technology of electrical engineering that bridges abstract chaos theory and practical electric drives. The authors consolidate all important information in this interdisciplinary technology including the fundamental concepts, mathematical modeling, theoretical analysis, computer simulation, and hardware implementation. The book provides comprehensive coverage of chaos in electric drive systems with three main parts: analysis, control, and application. Corresponding drive systems range from the simplest to the latest types: DC, induction, synchronous, reluctance, switched reluctance, and permanent magnet brushless drives. The first book to comprehensively treat chaos in electric drive systems. Reviews chaos in various electrical engineering technologies and drive systems. Presents innovative approaches to stabilize and stimulate chaos in typical drives. Discusses practical application of chaos stabilization, chaotic modulation, and chaotic motion. Authored by well-known scientists in the field. Lecture materials available from the book's companion website. This book is ideal for researchers and graduate students who specialize in electric drives, mechatronics, and electric machinery, as well as those enrolled in classes covering advanced topics in electric drives and control. Engineers and product designers in industrial electronics, consumer electronics, electric appliances, and electric vehicles will also find this book helpful in applying these emerging techniques. Lecture materials for instructors available at [www.wiley.com/go/chaos](http://www.wiley.com/go/chaos).

*Control of Electric Machine Drive Systems* Seung-Ki Sul, 2011-04-20. A unique approach to sensorless control and regulator design of electric drives. Based on the author's vast industry experience and collaborative works with other industries, *Control of Electric Machine Drive Systems* is packed with tested, implemented, and verified ideas that engineers can apply to everyday problems in the field. Originally published in Korean as a textbook, this highly practical, updated version features the latest information on the control of electric machines and apparatus, as well as a new chapter on sensorless control of AC machines, a topic not covered in any other publication. The book begins by explaining the features of the electric drive system and trends of development in related technologies, as well as the basic structure and operation principles of the electric machine. It also addresses steady-state characteristics and control of the machines and the transformation of physical variables of AC machines using reference frame theory in order to provide a proper foundation for the material. The heart of the book reviews several control algorithms of electric machines and power converters, explaining active damping and how to regulate current, speed, and position in a feedback manner. Seung-Ki Sul introduces tricks to enhance the control performance of the electric machines and the algorithm to detect the phase angle of an AC source and to control DC link voltages of power converters. Topics also covered are Vector control, Control algorithms for position speed sensorless drive of AC machines, Methods for identifying the parameters of electric machines and power converters, The matrix algebra to model a three-phase AC machine in  $d-q-n$  axes. Every chapter features exercise problems drawn from actual industry experience. The book also includes more than 300 figures and offers access to an FTP site which provides MATLAB programs for selected problems. The book's practicality and real-world relatability make it an

invaluable resource for professionals and engineers involved in the research and development of electric machine drive business industrial drive designers and senior undergraduate and graduate students To obtain instructor materials please send an email to [pressbooks@ieee.org](mailto:pressbooks@ieee.org) To visit this book's FTP site to download MATLAB codes please click on this link [ftp://ftp.wiley.com/public/sci\\_tech\\_med/electric\\_machine](ftp://ftp.wiley.com/public/sci_tech_med/electric_machine) MATLAB codes are also downloadable from Wiley Booksupport Site at <http://booksupport.wiley.com>

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### Reluctance Synchronous Machines And Drives Introduction

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