

Survey Of Electric Traction Drives For Present And Future

This book presents a thorough survey of electric railway development from the earliest days of the London Underground to modern electrified main line trains. Coverage includes chapters on signaling and communications, power supplies, and a detailed survey about traction systems, both AC and DC. The introduction, first of mercury arc rectifiers, and later of power semiconductor controls, is also discussed in detail. The author has a long standing interest in engineering history and has written many papers on aspects of railway technology. This book will be of particular interest to scientists and historians interested in the development of electric railways.

This book reflects the latest research trends, methods and experimental results in the field of electrical and information technologies for rail transportation, which covers abundant state-of-the-art research theories and ideas. As a vital field of research that is highly relevant to current developments in a number of technological domains, the subjects it covered include intelligent computing, information processing, Communication Technology, Automatic Control, etc. The objective of the proceedings is to provide a major interdisciplinary forum for researchers, engineers, academicians as well as industrial professionals to present the most innovative research and development in the field of rail transportation electrical and information technologies. Engineers and researchers in academia, industry, and the government will also explore an insight view of the solutions that combine ideas from multiple disciplines in this field. The volumes serve as an excellent reference work for researchers and graduate students working on rail transportation, electrical and information technologies.

"This book is an introduction to automotive technology, with specific reference to battery electric, hybrid electric, and fuel cell electric vehicles. It could serve electrical engineers who need to know more about automobiles or automotive engineers who need to know about electrical propulsion systems. For example, this reviewer, who is a specialist in electric machinery, could use this book to better understand the automobiles for which the reviewer is designing electric drive motors. An automotive engineer, on the other hand, might use it to better understand the nature of motors and electric storage systems for application in automobiles, trucks or motorcycles. The early chapters of the book are accessible to technically literate people who need to know something about cars. While the first chapter is historical in nature, the second chapter is a good introduction to automobiles, including dynamics of propulsion and braking. The third chapter discusses, in some detail, spark ignition and compression ignition (Diesel) engines. The fourth chapter discusses the nature of transmission systems." —James Kirtley, Massachusetts Institute of Technology, USA "The third edition covers extensive topics in modern electric, hybrid electric, and fuel cell vehicles, in which the profound knowledge, mathematical modeling, simulations, and control are clearly presented. Featured with design of various vehicle drivetrains, as well as a multi-objective optimization software, it is an estimable work to meet the needs of automotive industry." —Haiyan Henry Zhang, Purdue University, USA "The extensive combined experience of the authors have produced an extensive volume covering a broad range but detailed topics on the principles, design and architectures of Modern Electric, Hybrid

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Electric, and Fuel Cell Vehicles in a well-structured, clear and concise manner. The volume offers a complete overview of technologies, their selection, integration & control, as well as an interesting Technical Overview of the Toyota Prius. The technical chapters are complemented with example problems and user guides to assist the reader in practical calculations through the use of common scientific computing packages. It will be of interest mainly to research postgraduates working in this field as well as established academic researchers, industrial R&D engineers and allied professionals.” —Christopher Donaghy-Sparg, Durham University, United Kingdom The book deals with the fundamentals, theoretical bases, and design methodologies of conventional internal combustion engine (ICE) vehicles, electric vehicles (EVs), hybrid electric vehicles (HEVs), and fuel cell vehicles (FCVs). The design methodology is described in mathematical terms, step-by-step, and the topics are approached from the overall drive train system, not just individual components. Furthermore, in explaining the design methodology of each drive train, design examples are presented with simulation results. All the chapters have been updated, and two new chapters on Mild Hybrids and Optimal Sizing and Dimensioning and Control are also included • Chapters updated throughout the text. • New homework problems, solutions, and examples. • Includes two new chapters. • Features accompanying MATLAB™ software.

Power Electronics and Electric Drives for Traction Applications offers a practical approach to understanding power electronics applications in transportation systems ranging from railways to electric vehicles and ships. It is an application-oriented book for the design and development of traction systems accompanied by a description of the core technology. The first four introductory chapters describe the common knowledge and background required to understand the preceding chapters. After that, each application-specific chapter: highlights the significant manufacturers involved; provides a historical account of the technological evolution experienced; distinguishes the physics and mechanics; and where possible, analyses a real life example and provides the necessary models and simulation tools, block diagrams and simulation based validations. Key features: Surveys power electronics state-of-the-art in all aspects of traction applications. Presents vital design and development knowledge that is extremely important for the professional community in an original, simple, clear and complete manner. Offers design guidelines for power electronics traction systems in high-speed rail, ships, electric/hybrid vehicles, elevators and more applications. Application-specific chapters co-authored by traction industry expert. Learning supplemented by tutorial sections, case studies and MATLAB/Simulink-based simulations with data from practical systems. A valuable reference for application engineers in traction industry responsible for design and development of products as well as traction industry researchers, developers and graduate students on power electronics and motor drives needing a reference to the application examples.

With the growing interest in electrical machines in recent times, the multiphase machine field has developed into a fascinating research area. Their intrinsic features (power splitting, better fault tolerance, or lower torque ripple) make them an appealing competitor to conventional three-phase machines. Multiphase electric drives have been recently used in applications where fault tolerance and continuous operation of the drive are required. However, the difficulties in extending the three-phase conventional current regulation and control structure to multiphase systems still limit their broad applicability in industry solutions. The main

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objective of this book is to illustrate new advances, developments, and applications in the field of multiphase machines and drives, while exposing these advances, developments, and applications to the scientific community and industry.

Today, there is a great deal of attention focused on sustainable growth worldwide. The increase in efficiency in the use of energy may even, in this historical moment, bring greater benefit than the use of renewable energies. Electricity appears to be the most sustainable of energies and the most promising hope for a planet capable of growing without compromising its own health and that of its inhabitants. Power electronics and electrical drives are the key technologies that will allow energy savings through the reduction of energy losses in many applications. This Special Issue has collected several scientific contributions related to energy efficiency in electrical equipment. Some articles are dedicated to the use and optimization of permanent magnet motors, which allow obtaining the highest level of efficiency. Most of the contributions describe the energy improvements that can be achieved with power electronics and the use of suitable control techniques. Last but not least, some articles describe interesting solutions for hybrid vehicles, which were created mainly to save energy in the smartest way possible.

The complexity of AC motor control lies in the multivariable and nonlinear nature of AC machine dynamics. Recent advancements in control theory now make it possible to deal with long-standing problems in AC motors control. This text expertly draws on these developments to apply a wide range of model-based control design methods to a variety of AC motors. Contributions from over thirty top researchers explain how modern control design methods can be used to achieve tight speed regulation, optimal energetic efficiency, and operation reliability and safety, by considering online state variable estimation in the absence of mechanical sensors, power factor correction, machine flux optimization, fault detection and isolation, and fault tolerant control. Describing the complete control approach, both controller and observer designs are demonstrated using advanced nonlinear methods, stability and performance are analysed using powerful techniques, including implementation considerations using digital computing means. Other key features:

- Covers the main types of AC motors including triphase, multiphase, and doubly fed induction motors, wound rotor, permanent magnet, and interior PM synchronous motors
- Illustrates the usefulness of the advanced control methods via industrial applications including electric vehicles, high speed trains, steel mills, and more
- Includes special focus on sensorless nonlinear observers, adaptive and robust nonlinear controllers, output-feedback controllers, fault detection and isolation algorithms, and fault tolerant controllers

This comprehensive volume provides researchers and designers and R&D engineers with a single-source reference on AC motor system drives in the automotive and transportation industry. It will also appeal to advanced students in automatic control, electrical, power systems, mechanical engineering and robotics, as well as mechatronic, process, and applied control system engineers.

A railway is a complex distributed engineering system: the construction of a new railway or the modernisation of an existing one requires a deep understanding of the constitutive components and their interaction, inside the system itself and towards the outside world. The former covers the various subsystems (featuring a complex mix of high power sources, sensitive safety critical systems, intentional transmitters, etc.) and their interaction, including the specific functions and their relevance to safety. The latter

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represents all the additional possible external victims and sources of electromagnetic interaction. EMC thus starts from a comprehension of the emissions and immunity characteristics and the interactions between sources and victims, with a strong relationship to electromagnetics and to system modeling. On the other hand, the said functions are achieved and preserved and their relevance for safety is adequately handled, if the related requirements are well posed and managed throughout the process from the beginning. The link is represented by standards and their correct application, as a support to analysis, testing and demonstration.

A NATO Advanced Study Institute on "Demand-Side Management and Electricity End-Use Efficiency" was held in order to present and to discuss some of the most recent developments in demand-side electric power management and planning methodologies as well as research progress in relevant end-use technologies. Electricity is assuming an increasingly important role in buildings and industry, due to its flexibility, efficiency of conversion and cleanliness at the point of use. However the production and transmission of electricity requires huge investments and may have undesirable environmental impacts. The recent nuclear accident in Chernobyl and the damage caused by acid precipitation are creating increasing concerns about the impacts of power plants. Some environmental problems are local or regional, others such as global warming can affect the whole world. Although environmental impacts may be minimized with additional investments, electricity generation will become even more capital intensive. Energy, and electricity in particular, is not directly consumed by people. To achieve improved standards of living, what is important is the level of production of goods and services. If it is possible to produce the same quantity of goods and services with less electricity and in a cost-effective way, substantial benefits can be gained. By reducing costs, electricity efficiency can raise the standards of living and increase the competitiveness of an economy. Electricity efficiency also leads to reduced requirements in power plant operation, thus leading to reduced consumption of primary energy supplies and a higher quality environment.

"This book gives readers crucial information to understand magnetic design, dynamic modeling, and high-grade control of switched reluctance motor drives (SRM) in the context of various motoring and generation applications. That includes those required in automotive, consumer products, and energy-harvesting industries. Content covers experimental and application-related design strategies and provides insightful explanations of multi-physics problems within SRM. It opens the door for new opportunities to use SRM drives in other relevant industries, especially those aimed at operation under harsh environmental conditions and very high speeds."--Provided by publisher.

Fault Diagnosis, Prognosis, and Reliability for Electrical Machines and Drives An insightful treatment of present and emerging technologies in fault diagnosis and failure prognosis In Fault Diagnosis, Prognosis, and Reliability for Electrical Machines and Drives, a team of distinguished researchers delivers a comprehensive exploration of current and emerging approaches to fault diagnosis and failure prognosis of electrical machines and drives. The authors begin with foundational background, describing the physics of failure, the motor and drive designs and components that affect failure and signals, signal processing, and analysis. The book then moves on to describe the features of these signals and the methods commonly used to extract these features to diagnose the health of a motor or drive, as well as the methods used to identify

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the state of health and differentiate between possible faults or their severity. Fault Diagnosis, Prognosis, and Reliability for Electrical Machines and Drives discusses the tools used to recognize trends towards failure and the estimation of remaining useful life. It addresses the relationships between fault diagnosis, failure prognosis, and fault mitigation. The book also provides: A thorough introduction to the modes of failure, how early failure precursors manifest themselves in signals, and how features extracted from these signals are processed A comprehensive exploration of the fault diagnosis, the results of characterization, and how they used to predict the time of failure and the confidence interval associated with it A focus on medium-sized drives, including induction, permanent magnet AC, reluctance, and new machine and drive types Perfect for researchers and students who wish to study or practice in the rea of electrical machines and drives, Fault Diagnosis, Prognosis, and Reliability for Electrical Machines and Drives is also an indispensable resource for researchers with a background in signal processing or statistics.

The first comprehensive case study of railroad electrification in the United States, this pioneering book highlights a subject of current government and industry studies and a target of billions of dollars of Amtrak rehabilitation funds. Both energy conservation and environmental quality remain at stake together with transportation efficiency. Electric traction on the Pennsylvania Railroad was a technological success handicapped by an economic factor: the onetime relatively low cost of petroleum, which gave diesel locomotives and highway vehicles a temporary advantage. Today the growing cost advantage of electricity--generated with coal; atomic energy; water, wind, and solar power--prefigures a revival of electric railroad traction. Drawing upon previously untapped records of the PRR and its suppliers, notably General Electric, the author traces stages in cooperative risk management. First came challenges of limited scope which steam locomotives were unable to meet: the New York City tunnel extension of 1910 and the Philadelphia suburban modernization begun in 1913. Next came a decade of mainline electrification, 1928-38: first New York to Washington and then passenger and freight extensions to Harrisburg. These projects were preceded by large-scale research and experimentation, followed by constant improvement in equipment and operations. Electric traction is depicted as a program involving not only the railroad but also its consultants, equipment and energy suppliers, and (to a lesser degree) governmental bodies. Locomotive and power transmission design is described in detail--with copious illustrations--as are the creative achievements of managers, engineers, and workers. And the presentation will be clear to readers without specialized technical or business backgrounds.

Electrical drives play an important role as electromechanical energy convert ers in transportation, material handling and most production processes. The ease of controlling electrical drives is an important aspect for meeting the in creasing demands by the user with respect to flexibility and precision, caused by technological progress in industry as well as the need for energy conser vation. At the same time, the control of electrical drives has provided strong incentives to control engineering in general, leading to the development of new control structures and their introduction to other areas of control. This is due to the stringent operating conditions and widely varying specifications - a drive may alternately require control of torque, acceleration, speed or position - and the fact that most electric drives have - in contrast to chem ical or thermal processes - well defined structures and consistent dynamic characteristics. During the last years the field of controlled electrical drives has undergone rapid expansion due mainly to the advances of semiconductors in the form of power electronics as well as analogue and digital signal electronics, eventu ally culminating in microelectronics and microprocessors. The introduction of electronically switched solid-state power converters has renewed the search for adjustable speed AC motor drives, not subject to the limitations of the mechanical commutator of DC drives which dominated the field for a century.

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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

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. This book addresses the needs of researchers and practitioners in the field of high-speed trains, especially those whose work involves safety and reliability issues in traction systems. It will appeal to researchers and graduate students at institutions of higher learning, research labs, and in the industrial R&D sector, catering to a readership from a broad range of disciplines including intelligent transportation, electrical engineering, mechanical engineering, chemical engineering, the biological sciences and engineering, economics, ecology, and the mathematical sciences.

Allows the reader to deepen their understanding of various technologies for both fixed power supply installations of railway systems and for railway rolling stock This book explores the electric railway systems that play a crucial role in the mitigation of congestion and pollution caused by road traffic. It is divided into two parts: the first covering fixed power supply systems, and the second concerning the systems for railway rolling stock. In particular, after a historical introduction to the framework of technological solutions in current use, the authors investigate electrification systems for the power supply of rail vehicles, trams, and subways. Electrical Railway Transportation Systems explores the direct current systems used throughout the world for urban and suburban transport, which are also used in various countries for regional transport. It provides a study of alternating current systems, whether for power supply frequency or for special railway frequency, that are used around the world for the electrification of railway lines, long-distance lines, and high-speed lines. In addition, this resource: Analyzes multiple railway systems from a theoretical and realizable vantage point, with particular regard to functionality, electromagnetic compatibility, and interferences with other electrical systems Studies electric traction railway vehicles, presenting various types of drives and auxiliary devices currently in circulation Discusses solutions employed to ensure interoperability of vehicles that run along lines powered by different systems (e.g., DC and AC, at different frequencies) Electrical Railway Transportation Systems is an ideal text for graduate students studying the subject as well as for industry professionals working in the field.

The book on Sustainable Automotive Technologies aims to draw special attention to the research and practice focused on new technologies

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and approaches capable of meeting the challenges to sustainable mobility. In particular, the book features incremental and radical technical advancements that are able to meet social, economic and environmental targets in both local and global contexts. These include original solutions to the problems of pollution and congestion, vehicle and public safety, sustainable vehicle design and manufacture, new structures and materials, new power-train technologies and vehicle concepts. In addition to vehicle technologies, the book is also concerned with the broader systemic issues such as sustainable supply chain systems, integrated logistics and telematics, and end-of-life vehicle management. It captures selected peer reviewed papers accepted for presentation at the 4th International Conference on Sustainable Automotive Technologies, ICSAT2012, held at the RMIT, Melbourne, Australia.

This book includes the original, peer-reviewed research papers from the 9th Frontier Academic Forum of Electrical Engineering (FAFEE 2020), held in Xi'an, China, in August 2020. It gathers the latest research, innovations, and applications in the fields of Electrical Engineering. The topics it covers including electrical materials and equipment, electrical energy storage and device, power electronics and drives, new energy electric power system equipment, IntelliSense and intelligent equipment, biological electromagnetism and its applications, and insulation and discharge computation for power equipment. Given its scope, the book benefits all researchers, engineers, and graduate students who want to learn about cutting-edge advances in Electrical Engineering.

Includes about 55,000 individual mining and mineral industry term entries with about 150,000 definitions under these terms.

Control in Power Electronics and Electrical Drives contains the proceedings of the Second International Federation of Automatic Control Symposium held in Düsseldorf, Germany, on October 3-5, 1977. The symposium provided a forum for discussing the effects of converter control on the design of electrical machines. Comprised of 102 chapters, this book begins by focusing on control systems employing electronic power converters, along with converter circuits and converter control procedures. The next section deals with the behavior of inverter-fed electrical machines and requirements imposed by converter operation. Topics covered include the status of power thyristors and rectifiers; the dynamic performance of converter-fed synchronous motors; and open loop control of a linear vernier reluctance motor in a stepping mode. Subsequent sections explore converter-fed alternating current and direct current drives; applications of controlled industrial drives; and solid-state energy conversion. A number of methods for analyzing power electronic circuits are discussed and illustrated. This monograph will be of interest to electronics and electrical engineers.

This book has evolved from the lecture series Elektrische Bahnen (Electric Railways) which has been held at Ruhr-Universität Bochum since 1996. Its primary audience is students of electrical energy technologies, control engineering and mechanical engineering as well as young engineers of electrical engineering, especially in the fields of power electronics, in railway industry and in railway-operating companies. The book intends to convey mechanical fundamentals of electric railway propulsion, which includes rail-bound guidance, transmission of traction effort from wheel to rail under the influence of non-constant levels of adhesion and the transmission of motor torque to a spring-mounted and thus swaying drive wheel set."

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