The Hybrid Synchronous Machine Of The New Bmw I3 I8

This volume discusses advances in applied nonlinear optimal control, comprising both theoretical analysis of the developed control methods and case studies about their use in robotics, mechatronics, electric power generation, power electronics, micro-electronics, biological systems, biomedical systems, financial systems and industrial production processes. The advantages of the nonlinear optimal control approaches which are developed here are that, by applying approximate linearization of the controlled systems ' state-space description, one can avoid the elaborated state variables transformations (diffeomorphisms) which are required by global linearization-based control methods. The book also applies the control input directly to the power unit of the controlled systems and not on an equivalent linearized description, thus avoiding the inverse transformations met in global linearization-based control methods and the potential appearance of singularity problems. The method adopted here also retains the known advantages of optimal control, that is, the best trade-off between accurate tracking of reference setpoints and moderate variations of the control inputs. The book ' s findings on nonlinear optimal control are a substantial contribution to the areas of nonlinear control and complex dynamical systems, and will find use in several research and engineering disciplines and in practical applications.

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

Every year, the international transmission and drive community meets up at the International CTI SYMPOSIA - automotive drivetrains, intelligent, electrified - in Germany, China and USA to discuss the best strategies and technologies for tomorrow ' s cars, busses and trucks. From efficiency, comfort or costs to electrification, energy storage and connectivity, these premier industry meetings cover all the key issues in depth.

Electric Vehicle Machines and Drives

Dynamic Frequency Control in Diesel-Hybrid Autonomous Power Systems Using Virtual Synchronous Machines

Mechanical Design and Manufacturing of Electric Motors

Handbook of Automotive Power Electronics and Motor Drives

Permanent Magnet Synchronous Motor Drives for Gearless Traction Elevators

Modern Approaches in Machine Learning and Cognitive Science: A Walkthrough

This book provides a systematic and comprehensive overview of machine learning with cognitive science methods and technologies which have played an important role at the core of practical solutions for a wide scope of tasks between handheld apps, industrial process control, autonomous vehicles, environmental policies, life sciences, playing computer games, computational theory, and engineering development. The chapters in this book focus on readers interested in machine learning, cognitive and neuro-inspired computational systems – theories, mechanisms, and architecture, which underline human and animal behaviour, and their application to conscious and intelligent systems. In the current version, it focuses on the successful implementation and step-by-step explanation of practical applications of the domain. It also offers a wide range of inspiring and interesting cutting-edge contributions to applications of machine learning and cognitive science such as healthcare products, medical electronics, and gaming. Overall, this book provides valuable information on effective, cutting-edge techniques and approaches for students, researchers, practitioners, and academicians working in the field of AI, neural network, machine learning, and cognitive science. Furthermore, the purpose of this book is to address the interests of a broad spectrum of practitioners, students, and researchers, who are interested in applying machine learning and cognitive science methods in their respective domains.

This book collects a selection of papers presented at ELECTRIMACS 2019, the 13th international conference of the IMACS TC1 Committee, held in Salerno, Italy, on 21st-23rd May 2019. The conference papers deal with modelling, simulation, analysis, control, power management, design optimization, identification and diagnostics in electrical power engineering. The main application fields include electric machines and electromagnetic devices, power electronics, transportation systems, smart grids, electric and hybrid vehicles, renewable energy systems, energy storage, batteries, supercapacitors and fuel cells, and wireless power transfer. The contributions included in Volume 1 are particularly focused on electrical engineering simulation aspects and innovative applications.

This ready reference is unique in collating in one scientifically precise and comprehensive handbook the widespread data on what is feasible and realistic in modern fuel cell technology. Edited by one of the leading scientists in this exciting area, the short, uniformly written chapters by around 50 authors (many of them at the International Energy Agency) provide economic data for cost considerations and a full overview of demonstration data, covering such topics as fuel cells for transportation, fuel provision, codes and standards. The result is highly reliable facts and figures for engineers, researchers and decision makers working in the field of fuel cells.

Design, Analysis, and Operation

DC Bus Capacitor Discharge of Permanent Magnet Synchronous Machine Drive Systems for Hybrid/electric Vehicles

Tutorial Course Notes

Encyclopedia of Electrochemical Power Sources

Linear Synchronous Machines

Power Electronics Handbook

Permanent magnet synchronous machines (PMSMs) are widely used in electric vehicles and hybrid electric vehicles to propel the wheels. Various control strategies have been developed for PMSM drive systems to achieve both high efficiency and safe operation. In a PMSM drive system, generally the high voltage battery and the power converters are connected by a relay. In vehicle key-off events, although the battery is isolated immediately from the relay, the DC bus filter capacitor has to be discharged as quickly as possible to avoid an electrical hazard. This research explores the DC bus capacitor discharge of PMSM drive systems for hybrid/electric vehicles. Based on analyzing the power flow during discharge, a three-stage discharge algorithm has been developed, including a fast discharge stage, a DC bus voltage closed-loop regulation stage, and an inverter shutdown stage. The DC bus capacitor is quickly and safely discharged by dynamically adjusting the command currents for the current vector control of PMSMs. Both simulation and experimental results show the feasibility and performance of the proposed discharge technique.

It provides a comprehensive coverage of electric machines and drives for electric and hybrid vehicles, including both electric propulsion and hybrid propulsion. The corresponding motor drives for electric propulsion range from the existing types, namely the DC, induction, permanent magnet brushless and switched reluctance motor drives, to the advanced types, namely the doubly salient permanent magnet, magnetic-geared, vernier permanent magnet and advanced magnetless motor drives. The corresponding machine systems for hybrid propulsion cover the existing types, namely the integrated starter generator and planetary-geared electric variable transmission systems, and the advanced types, namely the double-rotor electric variable transmission and magnetic-geared electric variable transmission systems. Emphasis is given to the design criteria, performance analyses and application examples or potentials of various motor drives and machine systems.

Analysis of Synchronous Machines, Second Edition is a thoroughly modern treatment of an old subject. Courses generally teach about synchronous machines by introducing the steady-state per phase equivalent circuit without a clear, thorough presentation of the source of this circuit representation, which is a crucial aspect. Taking a different approach, this book provides a deeper understanding of complex electromechanical drives. Focusing on the terminal rather than on the internal characteristics of machines, the book begins with the general concept of winding functions, describing the placement of any practical winding in the slots of the machine. This representation enables readers to clearly understand the calculation of all relevant self- and mutual inductances of the machine. It also helps them to more easily conceptualize the machine in a rotating system of coordinates, at which point they can clearly understand the origin of this important representation of the machine. Provides numerical examples Addresses Park's equations starting from winding functions Describes operation of a synchronous machine as an LCI motor drive Presents synchronous machine transient simulation, as well as voltage regulation Applying his experience from more than 30 years of teaching the subject at the University of Wisconsin, author T.A. Lipo presents the solution of the circuit both in classical form using phasor representation and also by introducing an approach that applies MathCAD®, which greatly simplifies and expands the average student's problem-solving capability. The remainder of the text describes how to deal with various types of transients—such as constant speed transients—as well as unbalanced operation and faults and small signal modeling for transient stability and dynamic stability. Finally, the author addresses large signal modeling using MATLAB®/Simulink®, for complete solution of the non-linear equations of the salient pole synchronous machine. A valuable tool for learning, this updated edition offers thoroughly revised content, adding new detail and better-quality figures.

Proceedings of the Third IFAC Symposium, Lausanne, Switzerland, 12-14 September 1983

Proceedings of the Symposium, Rome, Italy, November 11-14, 1974

Hybrid synchronous motor equipped with annular winding

ELECTRIMACS 2019

Fault Analysis and Protection System Design for DC Grids

Hybrid synchronous machine with transverse magnetic flux

Hybrid synchronous machine with transverse magnetic fluxUSA patentPermanent Magnet Synchronous Machine Based Traction Drive Design for Hybrid Scooter Considering Control Nonlinearities and Compenstions

This Second Edition of Mechanical Design and Manufacturing of Electric Motors provides in-depth knowledge of design methods and developments of electric motors in the context of rapid increases in energy consumption, and emphasis on environmental protection, alongside new technology in 3D printing, robots, nanotechnology, and digital techniques, and the challenges these pose to the motor industry. From motor classification and design of motor components to model setup and material and bearing selections, this comprehensive text covers the fundamentals of practical design and design-related issues, modeling and simulation, engineering analysis, manufacturing processes, testing procedures, and performance characteristics of electric motors today. This Second Edition adds three brand new chapters on motor breaks, motor sensors, and power transmission and gearing systems. Using a practical approach, with a focus on innovative design and applications, the book contains a thorough discussion of major components and subsystems, such as rotors, shafts, stators, and frames, alongside various cooling techniques, including natural and forced air, direct- and indirect-liquid, phase change, and other newly-emerged innovative cooling methods. It also analyzes the calculation of motor power losses, motor vibration, and acoustic noise issues, and presents engineering analysis methods and case-study results. While suitable for motor engineers, designers, manufacturers, and end users, the book will also be of interest to maintenance personnel, undergraduate and graduate students, and academic researchers.

This book introduces readers to two major sustainable applications of linear synchronous machines: wave energy conversion and magnetic levitation train technology. To do so, it begins with a state-of-the-art review of linear machines, covering induction and synchronous topologies and their applications, with a particular focus on sustainable applications. This is followed by an analysis of the electromagnetic modeling of linear synchronous machines, the goal being to investigate their main features, especially their force production capabilities.

Permanent Magnet Synchronous and Brushless DC Motor Drives

Multiphase Hybrid Electric Machines

Advances in Applied Nonlinear Optimal Control

Design, Analysis and Application

Permanent Magnet Synchronous Machine Based Traction Drive Design for Hybrid Scooter Considering Control Nonlinearities and Compenstions

Hybrid Computation in Dynamic Systems Design

Classical synchronous motors are the most effective device to drive industrial production systems and robots with precision and rapidity. However, numerous applications require efficient controls in non-conventional situations. Firstly, this is the case with synchronous motors supplied by thyristor line-commutated inverters, or with synchronous motors with faults on one or several phases. Secondly, many drive systems use non-conventional motors such as polyphase (more than three phases) synchronous motors, synchronous motors with double excitation, permanent magnet linear synchronous motors, synchronous and switched reluctance motors, stepping motors and piezoelectric motors. This book presents efficient controls to improve the use of these non-conventional motors. Contents 1. Self-controlled Synchronous Motor: Principles of Function and Simplified Control Model, Francis Labrique and Fran ç ois Baudart. 2. Self-controlled Synchronous Motor: Dynamic Model Including the Behavior of Damper Windings and Commutation Overlap, Ernest Matagne. 3. Synchronous Machines in Degraded Mode, Damien Flieller, Ngac Ky Nguyen, Herv é Schwab and Guy Sturtzer. 4. Control of the Double-star Synchronous Machine Supplied by PWM Inverters, Mohamed Fouad Benkhoris. 5. Vectorial Modeling and Control of Multiphase Machines with Non-salient Poles Supplied by an Inverter, Xavier Kestelyn and É ric Semail. 6. Hybrid Excitation Synchronous Machines, Nicolas Patin and Lionel Vido. 7. Advanced Control of the Linear Synchronous Motor, Ghislain Remy and Pierre-Jean Barre. 8. Variable Reluctance Machines: Modeling and Control, Mickael Hilairet, Thierry Lubin and Abdelmouna ï m Tounzi. 9. Control of the Stepping Motor, Bruno Robert and Moez Feki . 10. Control of Piezoelectric Actuators, Fr é d é ric Giraud and Betty Lemaire-Semail.

This book provides technological and socio-economic coverage of renewable energy. It discusses wind power technologies, solar photovoltaic technologies, large-scale energy storage technologies, and ancillary power systems. In this new edition, the book addresses advancements that have been made in renewable energy: grid-connected power plants, power electronics converters, and multi-phase conversion systems. The text has been revised to include up-to-date material, statistics, and current technology trends. Three new chapters have been added to cover turbine generators, AC and DC wind systems, and recent advances solar power conversion. Discusses additional renewable energy sources, such as ocean, special turbines, etc. Covers system integration for solar and wind energy Presents emerging DC wind systems Includes coverage on turbine generators Updated sections on solar power conversion It offers students, practicing engineers, and researchers a comprehensive look at wind and solar power technologies. It is designed as a reference and can serve as a textbook for senior undergraduates in a one-semester course on renewable power or energy systems.

Interest in permanent magnet synchronous machines (PMSMs) is continuously increasing worldwide, especially with the increased use of renewable energy and the electrification of transports. This book contains the successful submissions of fifteen papers to a Special Issue of Energies on the subject area of " Permanent Magnet Synchronous Machines ". The focus is on permanent magnet synchronous machines and the electrical systems they are connected to. The presented work represents a wide range of areas. Studies of control systems, both for permanent magnet synchronous machines and for brushless DC motors, are presented and experimentally verified. Design studies of generators for wind power, wave power and hydro power are presented. Finite element method simulations and analytical design methods are used. The presented studies represent several of the different research fields on permanent magnet machines and electric drives.

Control in Power Electronics and Electrical Drives

Design of a Permanent Magnet Synchronous Machine for a Flywheel Energy Storage System Within a Hybrid Electric Vehicle

Design of Wound Field Synchronous Machines and Hybrid Excitation Synchronous Machines for Electric Vehicle Traction with Brushless Capacitive Field Excitation

Rome, Italy, November 11-14, 1974

Slot-pole Study of Hybrid Excitation Flux Switching Synchronous Machine (HEFSSM) with DC Polarity in Radial Direction

Future Powertrain Technologies

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.

Includes contributions on electromagnetic fields in electrical engineering which intends at joining theory and practice. This book helps the world-wide electromagnetic community, both academic and engineering, in understanding electromagnetism itself and its application to technical problems.

This book offers a comprehensive reference guide to the important topics of fault analysis and protection system design for DC grids, at various voltage levels and for a range of applications. It bridges a much-needed research gap to enable wide-scale implementation of energy-efficient DC grids. Following an introduction, DC grid architecture is presented, covering the devices, operation and control methods. In turn, analytical methods for DC fault analysis are presented for different types of faults, followed by separate chapters on various DC fault identification methods, using time, frequency and time-frequency domain analyses of the DC current and voltage signals. The unit and non-unit protection strategies are discussed in detail, while a dedicated chapter addresses DC fault isolation devices. Step-by-step guidelines are provided for building hardware-based experimental test setups, as well as methods for validating the various algorithms. The book also features several application-driven case studies.

Permanent Magnet Synchronous Machines

Applications for Electrified Powertrains

Latest Trends in AI, Volume 2

Advanced Computer Techniques in Applied Electromagnetics

18th International Congress and Expo 9 - 12 December 2019, Berlin, Germany

CTI SYMPOSIUM 2019

Among the various factors greatly influencing the development process of future powertrain technologies, the trends in climate change and digitalization are of huge public interest. To handle these trends, new disruptive technologies are integrated into the development process. They open up space for diverse research which is distributed over the entire vehicle design process. This book contains recent research articles which incorporate results for selecting and designing powertrain topology in consideration of the vehicle operating strategy as well as results for handling the reliability of new powertrain components. The field of investigation spans from the identification of ecologically optimal transformation of the existent vehicle fleet to the development of machine learning-based operating strategies and the comparison of complex hybrid electric vehicle topologies to reduce CO2 emissions.

Despite two decades of massive strides in research and development on control strategies and their subsequent implementation, most books on permanent magnet motor drives still focus primarily on motor design, providing only elementary coverage of control and converters. Addressing that gap with information that has largely been disseminated only in journals and at conferences, Permanent Magnet Synchronous and Brushless DC Motor Drives is a long-awaited comprehensive overview of power electronic converters for permanent magnet synchronous machines and control strategies for variable-speed operation. It introduces machines, power devices, inverters, and control, and addresses modeling, implementation, control strategies, and flux weakening operations, as well as parameter sensitivity, and rotor position sensorless control. Suitable for both industrial and academic audiences, this book also covers the simulation, low cost inverter topologies, and commutation torque ripple of PM brushless DC motor drives. Simulation of the motor drives system is illustrated with MATLAB® codes in the text. This book is divided into three parts—fundamentals of PM synchronous and brushless dc machines, power devices, inverters; PM synchronous motor drives, and brushless dc motor drives. With regard to the power electronics associated with these drive systems, the author: Explores use of the standard three-phase bridge inverter for driving the machine, power factor correction, and inverter control Introduces space vector modulation step by step and contrasts with PWM Details dead time effects in the inverter, and its compensation Discusses new power converter topologies being considered for low-cost drive systems in PM brushless DC motor drives This reference is dedicated exclusively to PM ac machines, with a timely emphasis on control and standard, and low-cost converter topologies. Widely used for teaching at the doctoral level and for industrial audiences both in the U.S. and abroad, it will be a welcome addition to any engineer ' s library.

This book provides an insight into the design, modeling, control, and application of multiphase hybrid permanent magnet machines for electrified powertrains in electric and hybrid electric vehicles. The authors present an overview of electric and hybrid electric vehicles, hybrid electric machine topologies, hybrid permanent magnet (HPM) machine design, multiphase hybrid machines, operation of multiphase generators in series hybrid electric vehicles (SHEV), and machine hardware build-up and testing. Readers will gain an understanding of multiphase machine configuration, their design, control, and recent applications, along with the benefits they provide, and learn general design steps, prototyping, and hardware build-up processes of multiphase electric machines. Multiphase Hybrid Electric Machines: Applications for Electrified Powertrains will be a valuable reference for undergraduate and graduate students, researchers, and practicing engineers, working on electric/hybrid electric vehicles, as well as electric machine applications in renewable energy systems specifically wind turbines, HVAC systems, robotics, and aerospace industry.

Wind and Solar Power Systems

Electric Vehicle Machines and Drives: Design, Analysis and Application

Analysis of Synchronous Machines

Fuel Cells

Proceedings of the Symposium Hybrid Computation in Dynamic Systems Design

Selected Papers - Volume 1

Permanent magnet synchronous (PMS) motors stand at the forefront of electric motor development due to their energy saving capabilities and performance potential. The motors have been developed in response to mounting environmental crises and growing electricity prices, and they have enabled the emergence of motor drive applications like those found in electric and hybrid vehicles, fly by wire, and drones. Control of Permanent Magnet Synchronous Motors is a timely advancement along that path as the first comprehensive, self-contained, and thoroughly up-to-date book devoted solely to the control of PMS motors. It offers a deep and extended analysis, design, implementation, and performance evaluation of major motor control methods, including Vector, Direct Torque, Predictive, Deadbeat, and Combined Control, in a systematic and coherent manner. All major Sensorless Control and Parameter Estimation methods are also studied. The book places great emphasis on energy saving control schemes.

Entrepreneurship in Power Semiconductor Devices, Power Electronics, and Electric Machines and Drive Systems introduces the basics of entrepreneurship and a methodology for the study of entrepreneurship in electrical engineering and other engineering fields. Entrepreneurship is considered here in three fields of electrical engineering, viz. power semiconductor devices, power electronics and electric machines and drive systems, and their current practice. It prepares the reader by providing a review of the subject matter in the three fields, their current status in research and development with analysis aspect as needed, thus allowing readers to gain self-sufficiency while reading the book. Each field's emerging applications, current market and future market forecasts are introduced to understand the basis and need for emerging startups. Practical learning is introduced in: (i) power semiconductor devices entrepreneurship through the prism of 20 startups in detail, (ii) power electronics entrepreneurship through 28 startup companies arranged under various application fields and (iii) electric machines and drive systems entrepreneurship through 15 startups in electromagnetic and 1 in electrostatic machines and drive systems. The book: (i) demystifies entrepreneurship in a practical way to equip engineers and students with entrepreneurship as an option for their professional growth, pursuit and success; (ii) provides engineering managers and corporate-level executives a detailed view of entrepreneurship activities in the considered three fields that may potentially impact their businesses, (iii) provides entrepreneurship education in an electrical engineering environment and with direct connection and correlation to their fields of study and (iv) endows a methodology that can be effectively employed not only in the three illustrated fields of electrical engineering but in other fields as well. This book is for electrical engineering students and professionals. For use in undergraduate and graduate courses in electrical engineering, the book contains discussion questions, exercise problems, team and class projects, all from a practical point of view, to train students and assist professionals for future entrepreneurship endeavors.

Contains 97 papers which provide a valuable overview of the latest technical innovations in this rapidly expanding field. Areas of development which receive particular attention include the emergence of power switching transistors, the application of microprocessors to regulation and control of static converters and electrical drives, the use of more sophisticated control strategies and the utilization of power electronics in new application fields.

The Rediscovery of Synchronous Reluctance and Ferrite Permanent Magnet Motors

Asymmetric Stator Teeth for Torque Ripple Reduction of Permanent Magnet Synchronous Machines for Hybrid Electric Vehicles

Control of Non-conventional Synchronous Motors

Entrepreneurship in Power Semiconductor Devices, Power Electronics, and Electric Machines and Drive Systems

Control of Permanent Magnet Synchronous Motors

Abstract: For the past several decades, the development of modern power electronics devices and motor control technologies makes Variable Speed Drive (VSD) popular in various application areas, such as on-road vehicles, home appliances as well as renewable energy field. Permanent Magnet Synchronous Machines (PMSM), one of the most promising motor technologies for its high power density, wide speed operation range and fast torque-speed response, has attracted great interest among various VSD applications. In this work, a PMSM based Integrated Start Generator (ISG) system is developed for a 50cc gasoline scooter to achieve higher efficiency and better road performance while still reasonably priced. The classical control theory based on root locus analysis and frequency response analysis is used to study a linear Single Input and Single Output (SISO) system. However, the PM machine as well as its drive inverter is a highly nonlinear, tightly coupled, multi-variable dependent system, which the classical control theory cannot be applied to directly. This work focuses on the analysis and compensation of these nonideal terms with an emphasis mainly on two perspectives: 1) Current control loop modeling with transfer function and the effect of various coupling terms and their compensations; 2) Inverter dead time investigation, its effect on the voltage output and new dead-time compensation method. The application of PM machine on an ISG scooter has a number of requirements and specifications of both the PM machine design and control algorithm implementation. One is the contradiction between mounting space limitation and high starting torque requirement. Another is the control challenge of speeding the motor to more than 10K rpm with only low resolution hall position sensors. A cost effective 1.5 KW Interior Permanent Magnet (IPM) machine and its drive inverter are designed based on these requirements. This IPM machine, its matching inverter and a 2 Ah 48V lithium-ion battery are well packaged on a prototype 50cc four stroke ISG scooter. Experiments are carrier out to test multi-modes of this ISG system including starting, acceleration, and regeneration.

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.

The Encyclopedia of Electrochemical Power Sources is a truly interdisciplinary reference for those working with batteries, fuel cells, electrolyzers, supercapacitors, and photo-electrochemical cells. With a focus on the environmental and economic impact of electrochemical power sources, this five-volume work consolidates coverage of the field and serves as an entry point to the literature for professionals and students alike. Covers the main types of power sources, including their operating principles, systems, materials, and applications Serves as a primary source of information for electrochemists, materials scientists, energy technologists, and engineers Incorporates nearly 350 articles, with timely coverage of such topics as environmental and sustainability considerations

USA patent

patent no. WO0152388

Application to Sustainable Energy and Mobility

Data, Facts, and Figures

Preliminary Development of Hybrid Excitation Flux Switching Synchronous Machine

Design Optimization of 12 Slots-10 Poles Hybrid Excitation Flux Switching Synchronous Machine with DC Polarity in Radial Direction

Power Electronics Handbook, Fourth Edition, brings together over 100 years of combined experience in the specialist areas of power engineering to offer a fully revised and updated expert guide to total power solutions. Designed to provide the best technical and most commercially viable solutions available, this handbook undertakes any or all aspects of a project requiring specialist design, installation, commissioning and maintenance services. Comprising a complete revision throughout and enhanced chapters on semiconductor diodes and transistors and thyristors, this volume includes renewable resource content useful for the new generation of engineering professionals. This market leading reference has new chapters covering electric traction theory and motors and wide band gap (WBG) materials and devices. With this book in hand, engineers will be able to execute design, analysis and evaluation of assigned projects using sound engineering principles and adhering to the business policies and product/program requirements. Includes a list of leading international academic and professional contributors Offers practical concepts and developments for laboratory test plans Includes new technical chapters on electric vehicle charging and traction theory and motors Includes renewable resource content useful for the new generation of engineering professionals

Design and Development of a Permanent Magnet Synchronous motor for a Hybrid Electric vehicle drive