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New Trends in Electrical Vehicle Powertrains Luis Romeral Martinez 2019-01-30 The electric vehicle and plug-in hybrid electric vehicle play a fundamental role in the forthcoming new paradigms of mobility and energy models. The electrification of the transport sector would lead to advantages in terms of energy efficiency and reduction of greenhouse gas emissions, but would also be a great opportunity for the introduction of renewable sources in the electricity sector. The chapters in this book show a diversity of current and new developments in the electrification of the transport sector seen from the electric vehicle point of view: first, the related technologies with design, control and supervision, second, the powertrain electric motor efficiency and reliability and, third, the deployment issues regarding renewable sources integration and charging facilities. This is precisely the purpose of this book, that is, to contribute to the literature about current research and development activities related to new trends in electric vehicle power trains.
Grid-to-Vehicle (G2V) and Vehicle-to-Grid (V2G) Technologies Sekyung Han 2021-03-16 This Special Issue “Grid-to-Vehicle (G2V) and Vehicle-to-Grid (V2G) Technologies” was in session from 1 May 2019 to 31 May 2020. For this Special issue, we invited articles on current state-of-the-art technologies and solutions in G2V and V2G, including but not limited to the operation and control of gridable vehicles, energy storage and management systems, charging infrastructure and chargers, EV demand and load forecasting, V2G interfaces and applications, V2G and energy reliability and security, environmental impacts, and economic benefits as well as demonstration projects and case studies in the aforementioned areas. Articles that deal with the latest hot topics in V2G are of particular interest, such as V2G and demand-side response control technique, smart charging infrastructure and grid planning, advanced power electronics for V2G systems, adaptation of V2G systems in the smart grid, adaptation of smart cities for a large number of EVs, integration, and the optimization of V2G systems, utilities and transportation assets for advanced V2G systems, wireless power transfer systems for advanced V2G systems, fault detection, maintenance and diagnostics in V2G processes, communications protocols for V2G systems, energy management system (EMS) in V2G systems, IoT for V2G systems, distributed energy and storage systems for V2G, transportation networks and V2G, energy management for V2G, smart charging/discharging stations for efficient V2G, environmental and socio-economic benefits and challenges of V2G systems, and building integrated V2G systems (BIV2G). Five manuscripts are published in this Special Issue, including “An Ensemble Stochastic Forecasting Framework for Variable Distributed Demand Loads” by Agyeman et al., “Where Will You Park? Predicting Vehicle Locations for Vehicle-to-Grid, An MPC Scheme with Enhanced Active Voltage Vector Region for V2G Inverter” by Shipman et al., “Electric Vehicles Energy Management with V2G/G2V Multifactor Optimization of Smart Grids” by Xia et al., and “A Review on Communication Standards and Charging Topologies of V2G and V2H Operation Strategies” by Savitti et al.
Future Engines Society of Automotive Engineers 2000
Novel Motor Drive Design for a Switched Reluctance Machine Based Electric Vehicle Propulsion System Peng Zhang 2010
Design and Electromagnetic Feature Analysis of AC Rotating Machines Ahmed Masmoudi 2018-05-31 This book provides the basis of the design of rotating AC machines. The first chapter puts the emphasis on the air gap magnetomotive force (MMF) of Rotating AC machines and the second chapter deals with the formulation of the rotating fields that could be generated considering different technique. The third chapter of this book focuses on the arrangement of the armature winding of fractional-slot concentrated winding permanent magnet synchronous machines, which is achieved considering the star of slots approach. Each topic is explained by case studies that show how to implement the theory into real-world design of DC machines.
Vehicular Electric Power Systems Ali Emadi 2003-12-12 Vehicular Electric Power Systems: Land, Sea, Air, and Space Vehicles acquaints professionals with trends and challenges in the development of more electric vehicles (MEVs) using detailed examples and comprehensive discussions of advanced MEV power system architectures, characteristics, and dynamics. The authors focus on real-world applications and highlight issues related to system stability as well as challenges faced during and after implementation. Probes innovations in the development of more electric vehicles for improved maintenance, support, endurance, safety, and cost-efficiency in automotive, aerospace, and marine vehicle engineering Heralding a new wave of advances in power system technology, Vehicular Electric Power Systems discusses: Different automotive power systems including conventional automobiles, more electric cars, heavy-duty vehicles, and electric and hybrid electric vehicles Electric and hybrid electric propulsion systems and control strategies Aerospace power systems including conventional and advanced aircraft, spacecraft, and the international space station Sea and undersea vehicles The modeling, real-time state estimation, and stability assessment of vehicular power systems Applications of fuel cells in various land, sea, air, and space vehicles Modeling techniques for energy storage devices including batteries, fuel cells, photovoltaic cells, and ultracapacitors Advanced power electronic converters and electric motor drives for vehicular applications Guidelines for the proper design of DC and AC distribution architectures
Science Abstracts 1995
Medical Research Centres Informa Healthcare 1995 Focuses on research and development centers in the areas of medical and biomedical sciences including those in anatomy, biochemistry, clinical medicine, dentistry, drugs, genetics, immunology, neoplasms, pharmaceutical technology, and surgery.
Switched Reluctance Motor Ahmed Tahour 2017-06-21 In the last years, the switched reluctance machines (SRMs) have been the subject of significant developments. SRMs are gaining much interest because of their simplicity in structures, high-output power, high starting torque, wide speed range, rugged and robust construction, reliability, and low manufacturing costs, which make these machines viable for many applications. SRMs include machines of different structures whose common property is the significant variation in the shape of the air gap during rotation. The use of advanced control technologies makes possible the integration of the mechanical and electrical conversion systems in their optimal mode of operation. Different strategies of control can be applied to SRMs, depending on their mode of functioning and the purpose of their applications. The goal of this book is to present recent works on concept, control, and applications in switched reluctance machines.
Axial Flux Permanent Magnet Brushless Machines Jacek F. Gieras 2006-01-16 Axial Flux Permanent Magnet (AFPM) brushless machines are modern electrical machines with a lot of advantageous merits over their conventional counterparts. They are increasingly used in power generation, domestic appliances, industrial drives, electric vehicles, and marine propulsion drives and many other applications. This book deals with the analysis, construction, design, optimisation, control and applications of AFPM machines. The authors present their own research results, as well as significant research contributions made by others. This monograph will be of interest to electrical engineers and other engineers involved in the design and application of AFPM brushless machine drives. It will be an important resource for researchers and graduate students in the field of electrical machine and drives.
Emerging Solutions for e-Mobility and Smart Grids V. Kamaraj 2021-05-07 This book presents select proceedings of the International Conference on Renewable Energy Systems (ICRES 2020). It focuses mainly on the concepts of electric vehicle, selection of batteries, selection of electric motors for specific capacity vehicles, design of controllers, battery chargers and development of testing facility. It presents the importance of energy storage system and modeling aspects of battery, super capacitor, flywheel energy storage and Superconducting magnetic energy storage systems. The book comprehensively presents the integration of renewable energy sources with smart grid, smart grid technologies and equipment, grid interconnection issues and design of intelligent controllers for grid connected system. The state-of-the-art technologies such as charging infrastructure for electric vehicles, robotic applications in energy, energy education and informatics are also covered in this book. This book will benefit the students and researchers in the field of electronics and electrical engineering, energy engineering, automotive engineering, e-mobility specialists and industrial experts.
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.
Crash Safety of High-Voltage Powertrain Based Electric Vehicles Chao Gong 2021-12-02 This book systematically introduces fast winding-based discharge strategies used for permanent magnet synchronous machine-based drives in electric vehicles (EVs) after a crash. The contents are from the author's final thesis securing his Ph.D. degree. The book contains seven chapters. Chapter 1 introduces the motivation of the research. Chapter 2 reviews five types of injury hazards that the occupants might suffer during crashes, addressing the high-voltage problem. In Chapters 3, 4, and 5, different winding-based discharge techniques are developed. Chapter 6 discusses the general principles for selecting an effective and efficient discharge technique for a particular EV. The conclusion is drawn in Chapter 7. Some author's achievements are listed at the end of the book. This book introduces professional knowledge about the subject of electrical engineering. It can be used as a reference book for technicians and scholars in this area.
Integration of Filter Elements in Electric Drives 2007
PM Motor Parametric Design Analyses for Hybrid Electric Vehicle Traction Drive Application R. H. Staunton 2004 The Department of Energy's (DOE) Office of FreedomCAR (Cooperative Automotive Research) and Vehicle Technologies has a strong interest in making rapid progress in permanent magnet (PM) machine development. The program is directing various technology development projects that will advance the technology and lead to request for proposals (RFP) for manufacturer prototypes. This aggressive approach is possible because the technology is clearly within reach and the approach is deemed essential, based on strong market demand, escalating fuel prices, and competitive considerations. In response, this study began parallel development paths that included a literature search/review, development and utilization of multiple parametric models to determine the effects of design parameters, verification of the modeling methodology, development of an interior PM (IPM) machine baseline design, development of alternative machine baseline designs, and cost analyses for several candidate machines. This interim progress report summarizes the results of these activities as of June 2004. This report provides background and summary information for recent machine parametric studies and testing programs that demonstrate both the potential capabilities and technical limitations of brushless PM machines (axial gap and radial gap), the IPM machine, the surface-mount PM machines (interior or exterior rotor), induction machines, and switched reluctance machines. The FreedomCAR program, while acknowledging the progress made by Oak Ridge National Laboratory, Delphi, Delco-Remy International, and others in these programs, has redirected efforts toward a "short path" to a marketable and competitive PM motor for hybrid electric vehicle traction applications. The program has developed a set of performance targets for the type of traction machine desired. The short-path approach entails a comprehensive design effort focusing on the IPM machine and meeting the performance targets. The selection of the IPM machine reflects industry's confidence in this market-proven design that exhibits a power density surpassed by no other machine design.
Design, Analysis and Application of Brushless Doubly Salient Machines Ying Fan 2017-01-27 This dissertation, "Design, Analysis and Application of Brushless Doubly Salient Machines" by Ying, Fan, ??, was obtained from The University of Hong Kong (Pokfulam, Hong Kong) and is being sold pursuant to Creative Commons: Attribution 3.0 Hong Kong License. The content of this dissertation has not been altered in any way. We have altered the formatting in order to facilitate the ease of printing and reading of the dissertation. All rights not granted by the above license are retained by the author. Abstract: Abstract of thesis entitled "Design, Analysis and Application of Brushless Doubly Salient Machines" submitted by FAN Ying for the degree of Doctor of Philosophy at The University of Hong Kong in April 2006 In response to increasing concern about the environment, research into the development of electric vehicles (EVs) has accelerated in recent years. To enable electric vehicles to compete successfully with gasoline vehicles, the goals of motor drive for electric vehicles are to pursue optimal efficiency over wide operating ranges, high controllability, wide speed range, high reliability and maintenance-free operation. In order to pursue these goals, a new class of motor drives is proposed which consists of two types of stator windings, namely the poly-phase armature winding and dc field winding. This thesis presents the design, analysis and control of this brushless doubly- fed doubly-salient (BDFDS) motor drive. As a result of the search for alternative forms of energy, there has also been much interest in the development of wind power generation. The core element of wind power generation is the electric generator. This thesis first presents a new three-phase 12/8- pole DSPM machine for wind power generation, including its design, analysis and implementation. The corresponding analysis of topological selection is specially elaborated. A three-phase 12/8-pole BDFDS machine is then developed for wind power generation, which uniquely offers constant output voltage and efficiency optimization over a wide range of wind speeds. The finite element method (FEM) has been used for electromagnetic field analysis of the proposed BDFDS machines, in which magnetic saturation, armature field and dc exciting field have been considered. Hence, the static characteristics, being the basis of analysis, design and control of the BDFDS machine, have been deduced. The sizing equation of the BDFDS machine has been deduced and design details have been presented to provide a practical way of making initial calculation of machine dimensions and parameters. A dynamic model of the BDFDS machine has also been derived. Numerical simulation been carried out by using Matlab/Simulink revealed that the proposed three-phase BDFDS machine has the advantage of wide constant power operation range. The control strategies of two BDFDS machines, with skewed and unskewed rotors, have been developed and implemented by a dSPACE-based controller. Sinusoidal current control is used for the BDFDS machine with skewed rotor, whereas square current control is applied to the one with unskewed rotor. Moreover, a half-bridge power converter, which is composed of three IGBT-based power modules, has been employed to provide bi-directional current operation. It has the advantages of reducing the number of power switches and providing independent phase current control. In order to minimize the torque ripple of the four-phase 8/6-pole DSPM motor, a new two-phase operation mode is proposed and analyzed, in which sinusoidal current control is proposed. Theoretical analysis, computer simulation, and experimental results have verified that the operating torque ripple at the rated load can be reduced by about 14% when using the proposed two-phase operation mode. The results of the numerous experiments conducted not only verify the validity of the theoretical analysis but also illustrate the good performance of the newly proposed BDFDS machines for electric
Multidisciplinary Design Optimization Methods for Electrical Machines and Drive Systems Gang Lei 2016-02-05 This book presents various computationally efficient component- and system-level design optimization methods for advanced electrical machines and drive systems. Readers will discover novel design optimization concepts developed by the authors and other researchers in the last decade, including application-oriented, multi-disciplinary, multi-objective, multi-level, deterministic, and robust design optimization methods. A multi-disciplinary analysis includes various aspects of materials, electromagnetics, thermotics, mechanics, power electronics, applied mathematics, manufacturing technology, and quality control and management. This book will benefit both researchers and engineers in the field of motor and drive design and manufacturing, thus enabling the effective development of the high-quality production of innovative, high-performance drive systems for challenging applications, such as green energy systems and electric vehicles.
Standard Handbook for Electrical Engineers, Seventeenth Edition Surya Santoso 2017-11-24 Up-to-date coverage of every facet of electric power in a single volume This fully revised, industry-standard resource offers practical details on every aspect of electric power engineering. The book contains in-depth discussions from more than 100 internationally recognized experts. Generation, transmission, distribution, operation, system protection, and switchgear are thoroughly explained. Standard Handbook for Electrical Engineers, Seventeenth Edition, features brand-new sections on measurement and instrumentation, interconnected power grids, smart grids and microgrids, wind power, solar and photovoltaic power generation, electric machines and transformers, power system analysis, operations, stability and protection, and the electricity market. Coverage includes: •Units, symbols, constants, definitions, and conversion factors •Measurement and instrumentation •Properties of materials •Interconnected power grids •AC and DC power transmission •Power distribution •Smart grids and microgrids •Wind power generation •Solar power generation and energy storage •Substations and switch gear •Power transformers, generators, motors, and drives •Power electronics •Power system analysis, operations, stability, and protection •Electricity markets •Power quality and reliability •Lightning and overvoltage protection •Computer applications in the electric power industry •Standards in electrotechnology, telecommunications, and IT
Design Rules for Induction Machine Self-sensing Ian P. Brown 2009
The Key Technologies for Powertrain System of Intelligent Vehicles Based on Switched Reluctance Motors Yueying Zhu 2021-09-18 This book is intended for engineer’s in automotive industry and in research community of electrical machines. This book systematically focus on all the major aspects of switched reluctance motor for intelligent electric vehicle applications, including optimization design, drive system control, regenerative braking control, and motor-

suspension system control, which is particularly suited for readers who are interested to learn the theory of the motor used for intelligent electric vehicles.The comprehensive and systematic treatment of practical issues around switched reluctance motor considering vehicle requirments is one of the major features of the book. The book can benefit researchers, engineers, and graduate students in fields of switched reluctance motor, electric vehicle drive system, regenerative braking system, motor-suspension system, etc.

Energy Efficiency in Electric Devices, Machines and Drives Gorazd Štumberger 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.

International Advanced Researches & Engineering Congress 2017 Proceeding Book Recep HALICIOGLU 2017-12-29 INTERNATIONAL WORKSHOPS (at IAREC'17) (This book inclueds English (main) and Turkish languages) International Workshop on Mechanical Engineering International Workshop on Mechatronics Engineering International Workshop on Energy Systems Engineering International Workshop on Automotive Engineering and Aerospace Engineering International Workshop on Material Engineering International Workshop on Manufacturing Engineering International Workshop on Physics Engineering International Workshop on Electrical and Electronics Engineering International Workshop on Computer Engineering and Software Engineering International Workshop on Chemical Engineering International Workshop on Textile Engineering International Workshop on Architecture International Workshop on Civil Engineering International Workshop on Geomatics Engineering International Workshop on Industrial Engineering International Workshop on Food Engineering International Workshop on Aquaculture Engineering International Workshop on Agriculture Engineering International Workshop on Mathematics Engineering International Workshop on Bioengineering Engineering International Workshop on Biomedical Engineering International Workshop on Genetic Engineering International Workshop on Environmental Engineering International Workshop on Other Engineering Science

Advances in Smart Grid Technology Ning Zhou 2020-09-18 This book comprises the select proceedings of the International Conference on Power Engineering Computing and Control (PECCON) 2019. This volume covers several important topics such as optimal data selection and error-free data acquiring via artificial intelligence and machine learning techniques, information and communication technologies for monitoring and control of smart grid components, and data security in smart grid network. In addition, it also focuses on economics of renewable electricity generation, policies for distributed generation, smart eco-structures and systems. This book can be useful for beginners, researchers as well as professionals interested in the area of smart grid technology.

Electrical & Electronics Abstracts 1997

High-level Modeling, Supervisory Control Strategy Development, and Validation for a Proposed Power-split Hybrid-electric Vehicle Design Joseph M. Morbitzer 2005 Abstract: Over the last decade, hybrid-electric vehicles have progressed from a futuristic icon to a firm production reality for a growing number of automobile manufacturers. While the motivation for this trend may vary, hybrid-electric vehicles today symbolize a recognition of the necessity to evolve advanced automotive technologies in order to sustain a culture of freedom of mobility. The Challenge X program communicates this message towards academia and future automotive engineers with strong support from both government and industry. The work of this thesis was aimed toward The Ohio State University's objectives as a participant in the Challenge X competition. As an initial task, the Ohio State team defined a set of vehicle technical specifications to steer and motivate the vehicle design and control strategy development. After an extensive decision-making process, a specific architecture emerged with the potential to meet the vehicle technical specifications. The chosen configuration is a charge-sustaining, power-split, hybrid-electric vehicle design. A downsized Diesel engine and integrated starter/alternator drive the front wheels through an automatic transaxle. A larger, tractive electric machine and single-speed gearbox exist on the rear drivetrain. Both electric machines and their respective inverters connect electrically to a single high-voltage battery pack. The validation procedure for both the vehicle architecture and a control strategy involves use of a computer vehicle simulator. A quasi-static vehicle model acts as a basis for a simulator to validate the design and control strategy with respect to energy management. A dynamic vehicle model establishes a foundation for eventual creation of a second simulator for drivability validation. Both simulators operate in a forward-moving fashion and contain three primary sections: (i) the driver, (ii) the hybrid-electric powertrain, and (iii) the vehicle. Both models are also highly nonlinear, but the main differentiating property is the relatively large system order of the dynamic model as compared to the quasi-static model. The high-level supervisory control strategy strives to accomplish certain objectives. The initial task involves appropriately selecting the vehicle mode from those predefined as being advantageous to the particular architecture. The control strategy then calculates the driver power request and commands the powertrain actuators so as to meet that request. In certain and applicable vehicle modes, the torque split also aims to minimize fuel consumption. High-voltage battery pack state-of-charge management is both indirectly and inherently incorporated into the fuel consumption minimization approach. As a future task, drivability assurance may involve a final adjustment of control strategy commands so as to respect certain levels of several identified drivability metrics during the vehicle response. Rapid prototyping with a rolling chassis apparatus provided a method of investigation into the pragmaticality of solely utilizing the tractive electric machine and high-voltage battery pack for vehicle propulsion. Initial experimentation validates functionality of the electric machine and inverter and also indicates potential for the power electronics system to act alone in acceptably accelerating the vehicle inertia from a rest. More revealing analysis of the vehicle architecture and control strategy occurred via software-in-the-loop techniques using a simulator based upon the quasi-static vehicle model. Simulation results verify expected fuel economy gains from conversion to a downsized Diesel engine, engine disablement at a vehicle rest, and regenerative braking. However, the simulator also demonstrates a reduced fuel economy from extended operation of the vehicle in a pure electric mode. Moreover, the simulator indicates a concern with the ability of the tractive electric machine and proposed high-voltage battery pack to sufficiently and solely power the vehicle in a pure electric mode. Further findings of the simulated vehicle in full hybrid-electric vehicle operation clearly reveal the control strategy's preference in exclusively relying upon the Diesel engine for most normal operation. Reasons for this behavior primarily result from the relatively high efficiency of the Diesel engine and ensuing lack of opportunity to improve overall system efficiency through engine load shifting. Still, the downsized engine necessitates some presence of power electronics for supplementation during large power requests. Therefore, for this particular vehicle architecture, the control strategy may be better suited to simply maintain sufficient charge of the high-voltage battery pack for supplemental power delivery as opposed to aggressive and frequent use of the electric machines. Reflection of these simulation results along with some certain intangible issues motivates several suggestions concerning a few particular potential vehicle architecture modifications for consideration and contemplation by the Ohio State Challenge X team.

Advanced Electrical Drives Rik De Doncker 2010-11-30 Electrical drives convert in a controlled manner, electrical energy into mechanical energy. Electrical drives comprise an electrical machine, i.e. an electro-mechanical energy converter, a power electronic converter, i.e. an electrical-to-electrical converter, and a controller/communication unit. Today, electrical drives are used as propulsion systems in high-speed trains, elevators, escalators, electric ships, electric forklift trucks and electric vehicles. Advanced control algorithms (mostly digitally implemented) allow torque control over a high-bandwidth. Hence, precise motion control can be achieved. Examples are drives in robots, pick-and-place machines, factory automation hardware, etc. Most drives can operate in motoring and generating mode. Wind turbines use electrical drives to convert wind energy into electrical energy. More and more, variable speed drives are used to save energy for example, in air-conditioning units, compressors, blowers, pumps and home appliances. Key to ensure stable operation of a drive in the aforementioned applications are torque control algorithms. In Advanced Electrical Drives, a unique approach is followed to derive model based torque controllers for all types of Lorentz force machines, i.e. DC, synchronous and induction machines. The rotating transformer model forms the basis for this generalized modeling approach that ultimately leads to the development of universal field-oriented control algorithms. In case of switched reluctance machines, torque observers are proposed to implement direct torque algorithms. From a didactic viewpoint, tutorials are included at the end of each chapter. The reader is encouraged to execute these tutorials to familiarize him or herself with all aspects of drive technology. Hence, Advanced Electrical Drives encourages “learning by doing”. Furthermore, the experienced drive specialist may find the simulation tools useful to design high-performance controllers for all sorts of electrical drives.

Advanced Electric Drives Ned Mohan 2014-07-22 With nearly two-thirds of global electricity consumed by electric motors, it should come as no surprise that their proper control represents appreciable energy savings. The efficient use of electric drives also has far-reaching applications in such areas as factory automation (robotics), clean transportation (hybrid-electric vehicles), and renewable (wind and solar) energy resource management. Advanced Electric Drives utilizes a physics-based approach to explain the fundamental concepts of modern electric drive control and its operation under dynamic conditions. Author Ned Mohan, a decades-long leader in Electrical Energy Systems (EES) education and research, reveals how the investment of proper controls, advanced MATLAB and Simulink simulations, and careful forethought in the design of energy systems translates to significant savings in energy and dollars. Offering students a fresh alternative to standard mathematical treatments of dq-axis transformation of a-b-c phase quantities, Mohan’s unique physics-based approach “visualizes” a set of representative dq windings along an orthogonal set of axes and then relates their currents and voltages to the a-b-c phase quantities. Advanced Electric Drives is an invaluable resource to facilitate an understanding of the analysis, control, and modelling of electric machines. • Gives readers a “physical” picture of electric machines and drives without resorting to mathematical transformations for easy visualization • Confirms the physics-based analysis of electric drives mathematically • Provides readers with an analysis of electric machines in a way that can be easily interfaced to common power electronic converters and controlled using any control scheme • Makes the MATLAB/Simulink files used in examples available to anyone in an accompanying website • Reinforces fundamentals with a variety of discussion questions, concept quizzes, and homework problems

Modeling and Simulation for Electric Vehicle Applications Mohamed Amine Fakhfakh 2016-10-05 The book presents interesting topics from the area of modeling and simulation of electric vehicles application. The results presented by the authors of the book chapters are very interesting and inspiring. The book will familiarize the readers with the solutions and enable the readers to enlarge them by their own research. It will be useful for students of Electrical Engineering; it helps them solve practical problems.

Electric Powertrain John G. Hayes 2018-02-05 The why, what and how of the electric vehicle powertrain Empowers engineering professionals and students with the knowledge and skills required to engineer electric vehicle powertrain architectures, energy storage systems, power electronics converters and electric drives. The modern electric powertrain is relatively new for the automotive industry, and engineers are challenged with designing affordable, efficient and high-performance electric powertrains as the industry undergoes a technological evolution. Co-authored by two electric vehicle (EV) engineers with decades of experience designing and putting into production all of the powertrain technologies presented, this book provides readers with the hands-on knowledge, skills and expertise they need to rise to that challenge. This four-part practical guide provides a comprehensive review of battery, hybrid and fuel cell EV systems and the associated energy sources, power electronics, machines, and drives. The first part of the book begins with a historical overview of electromobility and the related environmental impacts motivating the development of the electric powertrain. Vehicular requirements for electromechanical propulsion are then presented. Battery electric vehicles (BEV), fuel cell electric vehicles (FCEV), and conventional and hybrid electric vehicles (HEV) are then described, contrasted and compared for vehicle propulsion. The second part of the book features in-depth analysis of the electric powertrain traction machines, with a particular focus on the induction machine and the surface- and interior-permanent magnet ac machines. The brushed dc machine is also considered due to its ease of operation and understanding, and its historical place, especially as the traction machine on NASA’s Mars rovers. The third part of the book features the theory and applications for the propulsion, charging, accessory, and auxiliary power electronics converters. Chapters are presented on isolated and non-isolated dc-dc converters, traction inverters, and battery charging. The fourth part presents the introductory and applied electromagnetism required as a foundation throughout the book. • Introduces and holistically integrates the key EV powertrain technologies. • Provides a comprehensive overview of existing and emerging automotive solutions. • Provides experience-based expertise for vehicular and powertrain system and sub-system level study, design, and optimization. • Presents many examples of powertrain technologies from leading manufacturers. • Discusses the dc traction machines of the Mars rovers, the ultimate EVs from NASA. • Investigates the environmental motivating factors and impacts of electromobility. • Presents a structured university teaching stream from introductory undergraduate to postgraduate. • Includes real-world problems and assignments of use to design engineers, researchers, and students alike. • Features a companion website with numerous references, problems, solutions, and practical assignments. • Includes introductory material throughout the book for the general scientific reader. • Contains essential reading for government regulators and policy makers. Electric Powertrain: Energy Systems, Power Electronics and Drives for Hybrid, Electric and Fuel Cell Vehicles is an important professional resource for practitioners and researchers in the battery, hybrid, and fuel cell EV transportation industry. The book is a structured holistic textbook for the teaching of the fundamental theories and applications of energy sources, power electronics, and electric machines and drives to engineering undergraduate and postgraduate students. Textbook Structure and Suggested Teaching Curriculum This is primarily an engineering textbook covering the automotive powertrain, energy storage and energy conversion, power electronics, and electrical machines. A significant additional focus is placed on the engineering design, the energy for transportation, and the related environmental impacts. This textbook is an educational tool for practicing engineers and others, such as transportation policy planners and regulators. The modern automobile is used as the vehicle upon which to base the theory and applications, which makes the book a useful educational reference for our industry colleagues, from chemists to engineers. This material is also written to be of interest to the general reader, who may have little or no interest in the power electronics and machines. Introductory science, mathematics, and an inquiring mind suffice for some chapters. The general reader can read the introduction to each of the chapters and move to the next as soon as the material gets too advanced for him or her. Part I Vehicles and Energy Sources Chapter 1 Electromobility and the Environment Chapter 2 Vehicle Dynamics Chapter 3 Batteries Chapter 4 Fuel Cells Chapter 5 Conventional and Hybrid Powertrains Part II Electrical Machines Chapter 6 Introduction to Traction Machines Chapter 7 The Brushed DC Machine Chapter 8 Induction Machines Chapter 9 Surface-permanent-magnet AC Machines Chapter 10: Interior-permanent-magnet AC Machines Part III Power Electronics Chapter 11 DC-DC Converters Chapter 12 Isolated DC-DC Converters Chapter 13 Traction Drives and Three-phase Inverters Chapter 14 Battery Charging Chapter 15 Control of the Electric Drive Part IV Basics Chapter 16 Introduction to Electromagnetism, Ferromagnetism, and Electromechanical Energy Conversion The first third of the book (Chapters 1 to 6), plus parts of Chapters 14 and 16, can be taught to the general science or engineering student in the second or third year. It covers the introductory automotive material using basic concepts from mechanical, electrical, environmental, and electrochemical engineering. Chapter 14 on electrical charging and Chapter 16 on electromagnetism can also be used as a general introduction to electrical engineering. The basics of electromagnetism, ferromagnetism and electromechanical energy conversion (Chapter 16) and dc machines (Chapter 7) can be taught to second year (sophomore) engineering students who have completed introductory electrical circuits and physics. The third year (junior) students typically have covered ac circuit analysis, and so they can cover ac machines, such as the induction machine (Chapter 8) and the surface permanent-magnet ac machine (Chapter 9). As the students typically have studied control theory, they can investigate the control of the speed and torque loops of the motor drive (Chapter 15). Power electronics, featuring non-isolated buck and boost converters (Chapter 11), can also be introduced in the third year. The final-year (senior) students can then go on to cover the more advanced technologies of the interior-permanent-magnet ac machine (Chapter 10). Isolated power converters (Chapter 12), such as the full-bridge and resonant converters, inverters (Chapter 13), and power-factor-corrected battery chargers (Chapter 14), are covered in the power electronics section. This material can also be covered at the introductory postgraduate level. Various homework, simulation, and research exercises are presented throughout the textbook. The reader is encouraged to attempt these exercises as part of the learning experience. Instructors are encouraged to contact the author, John Hayes, direct to discuss course content or structure.

PM Motor Parametric Design Analyses for a Hybrid Electric Vehicle Traction Drive Application R. H. Staunton 2004 The Department of Energy's (DOE) Office of FreedomCAR (Cooperative Automotive Research) and Vehicle Technologies office has a strong interest in making rapid progress in permanent magnet (PM) machine development. The DOE FreedomCAR program is directing various technology development projects that will advance the technology and hopefully lead to a near-term request for proposals (RFP) for a to-be-determined level of initial production. This aggressive approach is possible because the technology is clearly within reach and the approach is deemed essential, based on strong market demand, escalating fuel prices, and competitive considerations. In response, this study began parallel development paths that included a literature search/review, development and utilization of multiple parametric models, verification of the modeling methodology, development of an interior PM (IPM) machine baseline design, development of alternative machine baseline designs, and cost analyses for several candidate machines. This report summarizes the results of these activities as of September 2004. This report provides background and summary information for recent machine parametric studies and testing programs that demonstrate both the potential capabilities and technical limitations of brushless PM machines (axial gap and radial gap), the IPM machine, the surface-mount PM machines (interior or exterior rotor), induction machines, and switched-reluctance machines. The FreedomCAR program, while acknowledging the progress made by Oak Ridge National Laboratory (ORNL), Delphi, Delco-Remy International, and others in these programs, has redirected efforts toward a "short path" to a marketable and competitive PM motor for hybrid electric vehicle (HEV) traction applications. The program has developed a set of performance targets for the type of traction machine desired. The short-path approach entails a comprehensive design effort focusing on the IPM machine and meeting the performance targets. The selection of the IPM machine reflects industry's confidence in this market-proven design that exhibits a high power density.

Operation, Construction, and Functionality of Direct Current Machines Amin, Muhammad 2015-04-30 Direct current machines are a quickly evolving domain whose applications affect many aspects of modern life from computers and printers to toys, electric vehicles, and traction applications. As their many uses continue to grow, it has become apparent that understanding these machines is the key to understanding our future. Operation, Construction, and Functionality of Direct Current Machines brings together many concepts, from the most basic working principles and construction of DC machines to more advanced topics such as electro-magnetism, armature reaction, parallel operations, and many more. Highlighting theoretical concepts and numerical problems, this book is an essential reference source for students, educators, and anyone interested in the field of electric machines.

Automotive Innovation Patrick Hossay 2019-06-25 Automotive Innovation: The Science and Engineering behind Cutting-Edge Automotive Technology provides a survey of innovative automotive technologies in the auto industry. Automobiles are rapidly changing, and this text explores these trends. IC engines, transmissions, and chassis are being improved, and there are advances in digital control, manufacturing, and materials. New vehicles demonstrate improved performance, safety and efficiency factors; electric vehicles represent a green energy alternative, while sensor technologies and computer processors redefine the nature of driving. The text explores these changes, the engineering and science behind them, and directions for the future.

Design, Analysis and Application of Magnetless Doubly Salient Machines Christopher H. T. Lee 2018-01-22 This thesis investigates the key characteristics of magnetless doubly salient machines, evaluates their design philosophies, and proposes new topologies for various applications. It discusses the background of and previous research on magnetless machines, while also outlining upcoming trends and potential future developments. The thesis begins by presenting various torque-improving structures – namely the multi-tooth structure, the double-rotor (DR) structure, the axial-field (AF) structure, and the flux-reversal (FR) structure – for magnetless machines. It subsequently

addresses the idea of merging the design philosophies of two different machines to form new dual-mode machines. Thanks to a reconfigured winding arrangement and controllable DC-field excitation, the proposed machines can further extend their operating range to meet the extreme demands of applications in electric vehicles and wind power generation. Lastly, the thesis employs the finite element method (FEM) to thoroughly analyze the proposed machines' key performance parameters and develops experimental setups to verify the proposed concepts.

Modeling for Hybrid and Electric Vehicles Using Simscape Shuvra Das 2022-06-01 Automobiles have played an important role in the shaping of the human civilization for over a century and continue to play a crucial role today. The design, construction, and performance of automobiles have evolved over the years. For many years, there has been a strong shift toward electrification of automobiles. It started with the by-wire systems where more efficient electro-mechanical subsystems started replacing purely mechanical devices, e.g., anti-lock brakes, drive-by-wire, and cruise control. Over the last decade, driven by a strong push for fuel efficiency, pollution reduction, and environmental stewardship, electric and hybrid electric vehicles have become quite popular. In fact, almost all the automobile manufacturers have adopted strategies and launched vehicle models that are electric and/or hybrid. With this shift in technology, employers have growing needs for new talent in areas such as energy storage and battery technology, power electronics, electric motor drives, embedded control systems, and integration of multi-disciplinary systems. To support these needs, universities are adjusting their programs to train students in these new areas of expertise. For electric and hybrid technology to deliver superior performance and efficiency, all sub-systems have to work seamlessly and in unison every time and all the time. To ensure this level of precision and reliability, modeling and simulation play crucial roles during the design and development cycle of electric and hybrid vehicles. Simscape, a Matlab/Simulink toolbox for modeling physical systems, is an ideally suited platform for developing and deploying models for systems and sub-systems that are critical for hybrid and electric vehicles. This text will focus on guiding the reader in the development of models for all critical areas of hybrid and electric vehicles. There are numerous texts on electric and hybrid vehicles in the market right now. A majority of these texts focus on the relevant technology and the physics and engineering of their operation. In contrast, this text focuses on the application of some of the theories in developing models of physical systems that are at the core of hybrid and electric vehicles. Simscape is the tool of choice for the development of these models. Relevant background and appropriate theory are referenced and summarized in the context of model development with significantly more emphasis on the model development procedure and obtaining usable and accurate results.

Design Optimization of the Electrically Peaking Hybrid (ELPH) Vehicle M. Ehsani 1998 Electrically Peaking Hybrid (ELPH) is a parallel hybrid electric vehicle propulsion concept that was invented at Texas A&M University, by the advanced vehicle systems research group. Over the past six years, design methodologies, component development, and system optimization work has been going on for this invention. This project was a first attempt in integrating the above developments into an optimized design of an ELPH passenger car. Design specifications were chosen for a full size passenger car, performing as well as any conventional car, over the EPA-FTP-75 combined city/highway drive cycles. The results of this design project were two propulsion systems. Both were appropriate for commercial production, from the point of view of cost, availability of the technologies, and components. One utilized regenerative braking and the other did not. Substantial fuel savings and emissions reductions resulted from simulating these designs on the FTP-75 drive cycle. For example, our ELPH full size car, with regenerative braking, was capable of delivering over 50 miles per gallon in city driving, with corresponding reductions in its emissions. This project established the viability of the ELPH concept and the design methodologies, in computer simulations. More work remains to be done on investigating more advanced power plants, such as fuel cells, and more advanced components, such as switched reluctance motor drives, for the designs. Furthermore, the design optimization can be carried out to more detailed levels, for prototyping and production.

Modern Electric, Hybrid Electric, and Fuel Cell Vehicles Mehrdad Ehsani 2017-12-19 Air pollution, global warming, and the steady decrease in petroleum resources continue to stimulate interest in the development of safe, clean, and highly efficient transportation. Building on the foundation of the bestselling first edition, Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design, Second Edition updates and expands its detailed coverage of the vehicle technologies that offer the most promising solutions to these issues affecting the automotive industry. Proven as a useful in-depth resource and comprehensive reference for modern automotive systems engineers, students, and researchers, this book speaks from the perspective of the overall drive train system and not just its individual components. New to the second edition: A case study appendix that breaks down the Toyota Prius hybrid system Corrections and updates of the material in the first edition Three new chapters on drive train design methodology and control principles A completely rewritten chapter on Fundamentals of Regenerative Braking Employing sufficient mathematical rigor, the authors comprehensively cover vehicle performance characteristics, EV and HEV configurations, control strategies, modeling, and simulations for modern vehicles. They also cover topics including: Drive train architecture analysis and design methodologies Internal Combustion Engine (ICE)-based drive trains Electric propulsion systems Energy storage systems Regenerative braking Fuel cell applications in vehicles Hybrid-electric drive train design The first edition of this book gave practicing engineers and students a systematic reference to fully understand the essentials of this new technology. This edition introduces newer topics and offers deeper treatments than those included in the first. Revised many times over many years, it will greatly aid engineers, students, researchers, and other professionals who are working in automotive-related industries, as well as those in government and academia.

Graph-Based Modelling in Science, Technology and Art Stanis?aw Zawi?lak 2021-09-02 This book presents interdisciplinary, cutting-edge and creative applications of graph theory and modeling in science, technology, architecture and art. Topics are divided into three parts: the first one examines mechanical problems related to gears, planetary gears and engineering installations; the second one explores graph-based methods applied to medical analyses as well as biological and chemical modeling; and the third part includes various topics e.g. drama analysis, aiding of design activities and network visualisation. The authors represent several countries in Europe and America, and their contributions show how different, useful and fruitful the utilization of graphs in modelling of engineering systems can be. The book has been designed to serve readers interested in the subject of graph modelling and those with expertise in related areas, as well as members of the worldwide community of graph modelers.

Control Oriented Modelling of AC Electric Machines Ahmed Masmoudi 2018-04-11 The book discusses the modeling of induction and synchronous machines aimed at the synthesis of dedicated control strategies. The first part focuses on induction machines (IMs), and starts with the analysis of the principle of operation, which is based on the induction phenomenon. It then establishes the a-b-c model, assuming a sinusoidal spatial repartition of the air gap flux density, a linear magnetic circuit, and constant phase resistors. The a-b-c model enables the establishment of a state representation of the induction machine. Then, the Park transformation is introduced and applied to the IM a-b-c model, leading to its Park one, which is then used to analyze the IM steady-state operation. The chapter also includes a case study dealing with the doubly fed induction machine, which is widely integrated in wind power generating systems. Following the introduction of the continuous development of synchronous machines (SMs), the second part establishes the a-b-c model for salient pole machines. Then, the Park transformation is applied to the established a-b-c model, leading to the Park one. The section highlights the formulation and analysis of the electromagnetic torque, with its synchronizing and reluctant components investigated in terms of the torque angle. Subsequently, it characterizes the operation at (i) maximum torque and (ii) unity power factor before focusing on the flux weakening approaches that could be implemented in SMs considering both smooth and salient pole topologies. Lastly, it presents a case study dealing with an investigation of the main features of the electric drive unit of a hybrid propulsion system and the possibility of their improvement, with an emphasis on the extension of the flux weakening range.

Electric and Hybrid Vehicles Iqbal Husain 2021-02-22 A thoroughly revised third edition of this widely praised, bestselling textbook presents a comprehensive systems-level perspective of electric and hybrid vehicles with emphasis on technical aspects, mathematical relationships and basic design guidelines. The emerging technologies of electric vehicles require the dedication of current and future engineers, so the target audience for the book is the young professionals and students in engineering eager to learn about the area. The book is concise and clear, its mathematics are kept to a necessary minimum and it contains a well-balanced set of contents of the complex technology. Engineers of multiple disciplines can either get a broader overview or explore in depth a particular aspect of electric or hybrid vehicles. Additions in the third edition include simulation-based design analysis of electric and hybrid vehicles and their powertrain components, particularly that of traction inverters, electric machines and motor drives. The technology trends to incorporate wide bandgap power electronics and reduced rare-earth permanent magnet electric machines in the powertrain components have been highlighted. Charging stations are a critical component for the electric vehicle infrastructure, and hence, a chapter on vehicle interactions with the power grid has been added. Autonomous driving is another emerging technology, and a chapter is included describing the autonomous driving system architecture and the hardware and software needs for such systems. The platform has been set in this book for system-level simulations to develop models using various softwares used in academia and industry, such as MATLAB®/Simulink, PLECS, PSIM, Motor-CAD and Altair Flux. Examples and simulation results are provided in this edition using these software tools. The third edition is a timely revision and contribution to the field of electric vehicles that has reached recently notable markets in a more and more environmentally sensitive world.

Electric Vehicle Machines and Drives K. T. Chau 2015-05-26 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