

# Modern Electric Hybrid Electric And Fuel Cell Vehicles Fundamentals Theory And Design Power Electronics And Applications Series

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**Modern Electric, Hybrid Electric, and Fuel Cell Vehicles** - Mehrdad Ehsani 2004-12-20

Air quality is deteriorating, the globe is warming, and petroleum resources are decreasing. The most promising solutions for the future involve the development of effective and efficient drive train technologies. This comprehensive volume meets this challenge and opportunity by integrating the wealth of disparate information found in scattered paper **Automotive Systems** - G.K. Awari 2021-01-26

This book introduces the principles and practices in automotive systems, including modern automotive systems that incorporate the latest trends in the automobile industry. The fifteen chapters present new and innovative methods to master the complexities of the vehicle of the future. Topics like vehicle classification, structure and layouts, engines, transmissions, braking, suspension and steering are illustrated with modern concepts, such as battery-electric, hybrid electric and fuel cell vehicles and vehicle maintenance practices. Each chapter is supported with examples, illustrative figures, multiple-choice questions and review questions. Aimed at senior undergraduate and graduate students in automotive/automobile engineering, mechanical engineering, electronics engineering, this book covers the following: Construction and working details of all modern as well as fundamental automotive systems Complexities of operation and assembly of various parts of automotive systems in a simplified manner Handling of automotive systems and integration of various components for smooth functioning of the vehicle Modern topics such as battery-electric, hybrid electric and fuel cell vehicles Illustrative examples, figures, multiple-choice questions and review questions at the end of each chapter

**Technologies and Applications for Smart Charging of Electric and Plug-in Hybrid Vehicles** - Ottorino Veneri 2018-07-07

This book outlines issues related to massive integration of electric and plug-in hybrid electric vehicles into power grids. Electricity is becoming the preferred energy vector for the next new generation of road vehicles. It is widely acknowledged that road vehicles based on full electric or hybrid drives can mitigate problems related to fossil fuel dependence. This book explains the emerging and understanding of storage systems for electric and plug-in hybrid vehicles. The recharging stations for these types of vehicles might represent a great advantage for the electric grid by facilitating integration of renewable and distributed energy production. This book presents a broad review from analyzing current literature to ongoing research projects about the new power technologies related to the various charging architectures for electric and plug-in hybrid vehicles. Specifically focusing on DC fast charging operations, as well as, grid-connected power converters and the full range of energy storage systems. These key components are analyzed for distributed generation and charging system integration into micro-grids. The authors demonstrate that these storage systems represent effective interfaces for the control and management of renewable and sustainable distributed energy resources. New standards and applications are emerging from micro-grid pilot projects around the world and case studies demonstrate the convenience and feasibility of distributed energy management. The material in this unique volume discusses potential avenues for further research toward achieving more reliable, more secure and cleaner energy.

**Electric and Hybrid Vehicles** - Amir Khajepour 2014-03-05

An advanced level introductory book covering fundamental aspects, design and dynamics of electric and hybrid electric vehicles There is

significant demand for an understanding of the fundamentals, technologies, and design of electric and hybrid electric vehicles and their components from researchers, engineers, and graduate students. Although there is a good body of work in the literature, there is still a great need for electric and hybrid vehicle teaching materials. **Electric and Hybrid Vehicles: Technologies, Modeling and Control – A Mechatronic Approach** is based on the authors' current research in vehicle systems and will include chapters on vehicle propulsion systems, the fundamentals of vehicle dynamics, EV and HEV technologies, chassis systems, steering control systems, and state, parameter and force estimations. The book is highly illustrated, and examples will be given throughout the book based on real applications and challenges in the automotive industry. Designed to help a new generation of engineers needing to master the principles of and further advances in hybrid vehicle technology Includes examples of real applications and challenges in the automotive industry with problems and solutions Takes a mechatronics approach to the study of electric and hybrid electric vehicles, appealing to mechanical and electrical engineering interests Responds to the increase in demand of universities offering courses in newer electric vehicle technologies **Alternative Fuels and Advanced Vehicle Technologies for Improved Environmental Performance** - Richard Folkson 2014-03-19

Most vehicles run on fossil fuels, and this presents a major emissions problem as demand for fuel continues to increase. **Alternative Fuels and Advanced Vehicle Technologies** gives an overview of key developments in advanced fuels and vehicle technologies to improve the energy efficiency and environmental impact of the automotive sector. Part I considers the role of alternative fuels such as electricity, alcohol, and hydrogen fuel cells, as well as advanced additives and oils, in environmentally sustainable transport. Part II explores methods of revising engine and vehicle design to improve environmental performance and fuel economy. It contains chapters on improvements in design, aerodynamics, combustion, and transmission. Finally, Part III outlines developments in electric and hybrid vehicle technologies, and provides an overview of the benefits and limitations of these vehicles in terms of their environmental impact, safety, cost, and design practicalities. **Alternative Fuels and Advanced Vehicle Technologies** is a standard reference for professionals, engineers, and researchers in the automotive sector, as well as vehicle manufacturers, fuel system developers, and academics with an interest in this field. Provides a broad-ranging review of recent research into advanced fuels and vehicle technologies that will be instrumental in improving the energy efficiency and environmental impact of the automotive sector Reviews the development of alternative fuels, more efficient engines, and powertrain technologies, as well as hybrid and electric vehicle technologies

**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.

Automobile Mechanical and Electrical Systems - Tom Denton 2017-08-25

The second edition of Automobile Mechanical and Electrical Systems concentrates on core technologies to provide the essential information required to understand how different vehicle systems work. It gives a complete overview of the components and workings of a vehicle from the engine through to the chassis and electronics. It also explains the necessary tools and equipment needed in effective car maintenance and repair, and relevant safety procedures are included throughout. Designed to make learning easier, this book contains: Photographs, flow charts and quick reference tables Detailed diagrams and clear descriptions that simplify the more complicated topics and aid revision Useful features throughout, including definitions, key facts and 'safety first' considerations. In full colour and with support materials from the author's website ([www.automotive-technology.org](http://www.automotive-technology.org)), this is the guide no student enrolled on an automotive maintenance and repair course should be without.

Modern Electric Vehicle Technology - C. C. Chan 2001

Modern Electric Vehicle Technology covers multidisciplinary aspects of electric vehicles (EVs), and is written for a wide coverage of readers including students, researchers, engineers and administrators. This book is probably the first comprehensive reference book on electric vehicles that includes the following distinct features; It concisely and precisely reviews the state of the art of EV technology and the historical development of EVs, presents the engineering philosophy of electric vehicles. Identifies new configurations, concepts and classifications of modern EV and hybrid EV (HEV) systems. Provides in-depth discussions on electric propulsion systems, emerging EV energy sources and latest EV auxiliaries. Presents the concept of system level simulation and a dedicated EV simulator for system optimisation. and discusses the key issues relating to commercialisation and implementation of EVs.

Modern Electric, Hybrid Electric, and Fuel Cell Vehicles, Third Edition - Mehrdad Ehsani 2018-02-19

The book deals with the fundamentals, theoretical bases, and design methodologies of conventional internal combustion engine (ICE) vehicles, electric vehicles (Evs), hybrid electric vehicles (HEVs), and fuel cell vehicles (FCVs). The design methodology is described in mathematical terms, step-by-step, and the topics are approached from the overall drive train system, not just individual components. Furthermore, in explaining the design methodology of each drive train, design examples are presented with simulation results. All the chapters have been updated, and two new chapters on Mild Hybrids and Optimal Sizing and Dimensioning and Control are included.

Emerging Technologies for Electric and Hybrid Vehicles - Jesús Manuel González Pérez 2018-10-17

This book is a printed edition of the Special Issue "Emerging Technologies for Electric and Hybrid Vehicles" that was published in *energies* New Generation of Electric Vehicles - Zoran Stevic 2012-12-19  
Important factor in political decision-making is a public opinion as well. Therefore, it is very important to raise global ecological awareness and wider public education regarding ecology. Goal of this book is to bring closer to the readers new drive technologies that are intended to environment and nature protection. The book presents modern technique achievements and technologies applied in the implementation of electric vehicles. Special attention was paid to energy efficiency of EV's. Also today's trends, mathematical models and computer design elements of future cars are presented.

Electric and Hybrid Cars - Curtis D. Anderson 2010-03-30

This illustrated history chronicles electric and hybrid cars from the late 19th century to today's fuel cell and plug-in automobiles. It describes the politics, technology, marketing strategies, and environmental issues that have impacted electric and hybrid cars' research and development. The important marketing shift from a "woman's car" to "going green" is discussed. Milestone projects and technologies such as early batteries, hydrogen and bio-mass fuel cells, the upsurge of hybrid vehicles, and the various regulations and market forces that have shaped the industry are also covered.

**Plug-in Hybrids** - Sherry Boschert 2006

A politically polarized America is coming together over a new kind of car--the plug-in hybrid that will save drivers money, reduce pollution, and increase US security by reducing dependence on imported oil. Plug-in Hybrids points out that, where hydrogen fuel-cell cars won't be ready for decades, the technology for plug-in hybrids exists today. Unlike conventional hybrid cars that can't run without gasoline, plug-in hybrids use gasoline or cheaper, cleaner, domestic electricity--or both. Although plug-in hybrids are not yet for sale, demand for them is widespread, coming from characters across the political spectrum, such as: \* Chelsea Sexton, the automotive insider: working for General Motors, Sexton fought attempts to destroy the all-electric EV1 car and describes how car companies are resisting plug-in hybrids--and why they'll make them - anyway. \* Felix Kramer and the tech squad: Kramer started a nonprofit organization using the Internet to tap into a small army of engineers who built the first plug-in Prius hybrids. \* R. James Woolsey, former CIA director and national security hawk: seeing the end of oil supplies looming, Woolsey is demanding plug-in hybrids to wean us from petroleum. Cautioning that the oil and auto companies know how to undermine the success of plug-in car programs to protect their interests, the book gives readers tools to ensure that plug-in hybrids get to market--and stay here.

Electric Vehicle Machines and Drives - K. T. Chau 2015-05-13

A timely comprehensive reference consolidates the research and development of electric vehicle machines and drives for electric and hybrid propulsions • Focuses on electric vehicle machines and drives • Covers the major technologies in the area including fundamental concepts and applications • Emphasis the design criteria, performance analyses and application examples or potentials of various motor drives and machine systems • Accompanying website includes the simulation models and outcomes as supplementary material

**Build Your Own Electric Vehicle, Third Edition** - Seth Leitman 2013-02-08

**BUILD, CONVERT, OR BUY A STATE-OF-THE-ART ELECTRIC VEHICLE**  
Thoroughly revised and expanded, Build Your Own Electric Vehicle, Third Edition, is your go-to guide for converting an internal combustion engine vehicle to electric or building an EV from the ground up. You'll also find out about the wide variety of EVs available for purchase and how they're being built. This new edition details all the latest breakthroughs, including AC propulsion and regenerative braking systems, intelligent controllers, batteries, and charging technologies. Filled with updated photos, this cutting-edge resource fully describes each component--motor, battery, controller, charger, and chassis--and provides illustrated, step-by-step instructions on how to assemble all the parts. Exclusive web content features current supplier and dealer lists. Custom-built for environmentalists, engineers, students, hobbyists, and mechanics, this hands-on guide puts you in the fast lane toward a cost-effective, reliable green machine. Build Your Own Electric Vehicle, Third Edition, covers: Environmental impact and energy savings The best EV for you--purchase trade-offs, conversion trade-offs, and conversion costs Chassis and design Different types of electric motors and controllers Lithium EV batteries Chargers and electrical systems EV builds and conversions Licensing and insuring your EV Driving and maintenance List of manufacturers and dealers regularly updated on website

**Modern Electric, Hybrid Electric, and Fuel Cell Vehicles** - Mehrdad Ehsani 2018-02-19

The book deals with the fundamentals, theoretical bases, and design methodologies of conventional internal combustion engine (ICE) vehicles, electric vehicles (Evs), hybrid electric vehicles (HEVs), and fuel cell vehicles (FCVs). The design methodology is described in mathematical terms, step-by-step, and the topics are approached from the overall drive train system, not just individual components. Furthermore, in explaining the design methodology of each drive train, design examples are presented with simulation results. All the chapters have been updated, and two new chapters on Mild Hybrids and Optimal Sizing and Dimensioning and Control are included.

**Modern Electric, Hybrid Electric, and Fuel Cell Vehicles** - Mehrdad Ehsani 2019

*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.

*Hybrid Electric Vehicles* - Chris Mi 2011-05-23

*Modern Hybrid Electric Vehicles* provides vital guidance to help a new generation of engineers master the principles of and further advance hybrid vehicle technology. The authors address purely electric, hybrid electric, plug-in hybrid electric, hybrid hydraulic, fuel cell, and off-road hybrid vehicle systems. They focus on the power and propulsion systems for these vehicles, including issues related to power and energy management. They concentrate on material that is not readily available in other hybrid electric vehicle (HEV) books such as design examples for hybrid vehicles, and cover new developments in the field including electronic CVT, plug-in hybrid, and new power converters and controls. Covers hybrid vs. pure electric, HEV system architecture (including plug-in and hydraulic), off-road and other industrial utility vehicles, non-ground-vehicle applications like ships, locomotives, aircrafts, system reliability, EMC, storage technologies, vehicular power and energy management, diagnostics and prognostics, and electromechanical vibration issues. Contains core fundamentals and principles of modern hybrid vehicles at component level and system level. Provides graduate students and field engineers with a text suitable for classroom teaching or self-study.

*Handbook of Automotive Power Electronics and Motor Drives* - Ali Emadi 2017-12-19

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.

*Uninterruptible Power Supplies and Active Filters* - Ali Emadi 2017-12-19

As industry power demands become increasingly sensitive, power quality distortion becomes a critical issue. The recent increase in nonlinear loads drawing non-sinusoidal currents has seen the introduction of various tools to manage the clean delivery of power. Power demands of medical

facilities, data storage and information systems, emergency equipment, etc. require uninterrupted, high quality power. Uninterruptible power supplies (UPS) and active filters provide this delivery. The first to treat these power management tools together in a comprehensive discussion, *Uninterruptible Power Supplies and Active Filters* compares the similarities of UPS, active filters, and unified power quality conditioners. The book features a description of low-cost and reduced-parts configurations presented for the first time in any publication, along with a presentation of advanced digital controllers. These configurations are vital as industries seek to reduce the cost of power management in their operations. As this field of power management technology continues to grow, industry and academia will come to rely upon the comprehensive treatment found within this book. Industrial engineers in power quality, circuits and devices, and aerospace engineers as well as graduate students will find this a complete and insightful resource for studying and applying the tools of this rapidly developing field.

**Electric and Hybrid Vehicles** - Gianfranco Pistoia 2010-07-27

*Electric and Hybrid Vehicles: Power Sources, Models, Sustainability, Infrastructure and the Market* reviews the performance, cost, safety, and sustainability of battery systems for hybrid electric vehicles (HEVs) and electric vehicles (EVs), including nickel-metal hydride batteries and Li-ion batteries. Throughout this book, especially in the first chapters, alternative vehicles with different power trains are compared in terms of lifetime cost, fuel consumption, and environmental impact. The emissions of greenhouse gases are particularly dealt with. The improvement of the battery, or fuel cell, performance and governmental incentives will play a fundamental role in determining how far and how substantial alternative vehicles will penetrate into the market. An adequate recharging infrastructure is of paramount importance for the diffusion of vehicles powered by batteries and fuel cells, as it may contribute to overcome the so-called range anxiety. Thus, proposed battery charging techniques are summarized and hydrogen refueling stations are described. The final chapter reviews the state of the art of the current models of hybrid and electric vehicles along with the powertrain solutions adopted by the major automakers. Contributions from the world's leading industry and research experts. Executive summaries of specific case studies. Information on basic research and application approaches.

**Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles** - Sheldon S. Williamson 2013-10-24

This book addresses the practical issues for commercialization of current and future electric and plug-in hybrid electric vehicles (EVs/PHEVs). The volume focuses on power electronics and motor drives based solutions for both current as well as future EV/PHEV technologies. Propulsion system requirements and motor sizing for EVs is also discussed, along with practical system sizing examples. PHEV power system architectures are discussed in detail. Key EV battery technologies are explained as well as corresponding battery management issues are summarized. Advanced power electronic converter topologies for current and future charging infrastructures will also be discussed in detail. EV/PHEV interface with renewable energy is discussed in detail, with practical examples.

**Fundamentals and Applications of Lithium-ion Batteries in Electric Drive Vehicles** - Jiuchun Jiang 2015-02-25

A theoretical and technical guide to the electric vehicle lithium-ion battery management system. Covers the timely topic of battery management systems for lithium batteries. After introducing the problem and basic background theory, it discusses battery modeling and state estimation. In addition to theoretical modeling it also contains practical information on charging and discharging control technology, cell equalisation and application to electric vehicles, and a discussion of the key technologies and research methods of the lithium-ion power battery management system. The author systematically expounds the theory knowledge included in the lithium-ion battery management systems and its practical application in electric vehicles, describing the theoretical connotation and practical application of the battery management systems. Selected graphics in the book are directly derived from the real vehicle tests. Through comparative analysis of the different system structures and different graphic symbols, related concepts are clear and the understanding of the battery management systems is enhanced. Contents include: key technologies and the difficulty point of vehicle power battery management system; lithium-ion battery performance modeling and simulation; the estimation theory and methods of the lithium-ion battery state of charge, state of energy, state of health and peak power; lithium-ion battery charge and discharge control technology; consistent evaluation and equalization techniques of the battery pack; battery management system design and application in electric vehicles. A

theoretical and technical guide to the electric vehicle lithium-ion battery management system Using simulation technology, schematic diagrams and case studies, the basic concepts are described clearly and offer detailed analysis of battery charge and discharge control principles Equips the reader with the understanding and concept of the power battery, providing a clear cognition of the application and management of lithium ion batteries in electric vehicles Arms audiences with lots of case studies Essential reading for Researchers and professionals working in energy technologies, utility planners and system engineers.

**Modern Electric, Hybrid Electric, and Fuel Cell Vehicles** - Mehrdad Ehsani 2018-02-02

"This book is an introduction to automotive technology, with specific reference to battery electric, hybrid electric, and fuel cell electric vehicles. It could serve electrical engineers who need to know more about automobiles or automotive engineers who need to know about electrical propulsion systems. For example, this reviewer, who is a specialist in electric machinery, could use this book to better understand the automobiles for which the reviewer is designing electric drive motors. An automotive engineer, on the other hand, might use it to better understand the nature of motors and electric storage systems for application in automobiles, trucks or motorcycles. The early chapters of the book are accessible to technically literate people who need to know something about cars. While the first chapter is historical in nature, the second chapter is a good introduction to automobiles, including dynamics of propulsion and braking. The third chapter discusses, in some detail, spark ignition and compression ignition (Diesel) engines. The fourth chapter discusses the nature of transmission systems." —James Kirtley, Massachusetts Institute of Technology, USA "The third edition covers extensive topics in modern electric, hybrid electric, and fuel cell vehicles, in which the profound knowledge, mathematical modeling, simulations, and control are clearly presented. Featured with design of various vehicle drivetrains, as well as a multi-objective optimization software, it is an estimable work to meet the needs of automotive industry." —Haiyan Henry Zhang, Purdue University, USA "The extensive combined experience of the authors have produced an extensive volume covering a broad range but detailed topics on the principles, design and architectures of Modern Electric, Hybrid Electric, and Fuel Cell Vehicles in a well-structured, clear and concise manner. The volume offers a complete overview of technologies, their selection, integration & control, as well as an interesting Technical Overview of the Toyota Prius. The technical chapters are complemented with example problems and user guides to assist the reader in practical calculations through the use of common scientific computing packages. It will be of interest mainly to research postgraduates working in this field as well as established academic researchers, industrial R&D engineers and allied professionals." —Christopher Donaghy-Sparg, Durham University, United Kingdom The book deals with the fundamentals, theoretical bases, and design methodologies of conventional internal combustion engine (ICE) vehicles, electric vehicles (EVs), hybrid electric vehicles (HEVs), and fuel cell vehicles (FCVs). The design methodology is described in mathematical terms, step-by-step, and the topics are approached from the overall drive train system, not just individual components. Furthermore, in explaining the design methodology of each drive train, design examples are presented with simulation results. All the chapters have been updated, and two new chapters on Mild Hybrids and Optimal Sizing and Dimensioning and Control are also included

- Chapters updated throughout the text.
- New homework problems, solutions, and examples.
- Includes two new chapters.
- Features accompanying MATLAB software.

*Hybrid Electric Vehicles* - Chris Mi 2017-11-29

The latest developments in the field of hybrid electric vehicles Hybrid Electric Vehicles provides an introduction to hybrid vehicles, which include purely electric, hybrid electric, hybrid hydraulic, fuel cell vehicles, plug-in hybrid electric, and off-road hybrid vehicular systems. It focuses on the power and propulsion systems for these vehicles, including issues related to power and energy management. Other topics covered include hybrid vs. pure electric, HEV system architecture (including plug-in & charging control and hydraulic), off-road and other industrial utility vehicles, safety and EMC, storage technologies, vehicular power and energy management, diagnostics and prognostics, and electromechanical vibration issues. Hybrid Electric Vehicles, Second Edition is a comprehensively updated new edition with four new chapters covering recent advances in hybrid vehicle technology. New areas covered include battery modelling, charger design, and wireless charging. Substantial details have also been included on the architecture of hybrid excavators in the chapter related to special

hybrid vehicles. Also included is a chapter providing an overview of hybrid vehicle technology, which offers a perspective on the current debate on sustainability and the environmental impact of hybrid and electric vehicle technology. Completely updated with new chapters Covers recent developments, breakthroughs, and technologies, including new drive topologies Explains HEV fundamentals and applications Offers a holistic perspective on vehicle electrification Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives, Second Edition is a great resource for researchers and practitioners in the automotive industry, as well as for graduate students in automotive engineering.

*Introduction to Hybrid Vehicle System Modeling and Control* - Wei Liu 2013-02-08

This is an engineering reference book on hybrid vehicle system analysis and design, an outgrowth of the author's substantial work in research, development and production at the National Research Council Canada, Azure Dynamics and now General Motors. It is an irreplaceable tool for helping engineers develop algorithms and gain a thorough understanding of hybrid vehicle systems. This book covers all the major aspects of hybrid vehicle modeling, control, simulation, performance analysis and preliminary design. It not only systemically provides the basic knowledge of hybrid vehicle system configuration and main components, but also details their characteristics and mathematic models. Provides valuable technical expertise necessary for building hybrid vehicle system and analyzing performance via drivability, fuel economy and emissions Built from the author's industry experience at major vehicle companies including General Motors and Azure Dynamics Inc. Offers algorithm implementations and figures/examples extracted from actual practice systems Suitable for a training course on hybrid vehicle system development with supplemental materials An essential resource enabling hybrid development and design engineers to understand the hybrid vehicle systems necessary for control algorithm design and developments.

**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.

**Advanced Electric Drive Vehicles** - Ali Emadi 2014-10-24

Electrification is an evolving paradigm shift in the transportation industry toward more efficient, higher performance, safer, smarter, and more reliable vehicles. There is in fact a clear trend to move from internal combustion engines (ICEs) to more integrated electrified powertrains. Providing a detailed overview of this growing area, **Advanced Electric Drive Vehicles** begins with an introduction to the automotive industry, an explanation of the need for electrification, and a presentation of the fundamentals of conventional vehicles and ICEs. It then proceeds to address the major components of electrified vehicles—i.e., power electronic converters, electric machines, electric motor controllers, and

energy storage systems. This comprehensive work: Covers more electric vehicles (MEVs), hybrid electric vehicles (HEVs), plug-in hybrid electric vehicles (PHEVs), range-extended electric vehicles (REEVs), and all-electric vehicles (EVs) including battery electric vehicles (BEVs) and fuel cell vehicles (FCVs) Describes the electrification technologies applied to nonpropulsion loads, such as power steering and air-conditioning systems Discusses hybrid battery/ultra-capacitor energy storage systems, as well as 48-V electrification and belt-driven starter generator systems Considers vehicle-to-grid (V2G) interface and electrical infrastructure issues, energy management, and optimization in advanced electric drive vehicles Contains numerous illustrations, practical examples, case studies, and challenging questions and problems throughout to ensure a solid understanding of key concepts and applications **Advanced Electric Drive Vehicles** makes an ideal textbook for senior-level undergraduate or graduate engineering courses and a user-friendly reference for researchers, engineers, managers, and other professionals interested in transportation electrification.

**Electric Vehicle Technology Explained** - James Larminie 2012-09-17

Fully updated throughout, **Electric Vehicle Technology, Second Edition**, is a complete guide to the principles, design and applications of electric vehicle technology. Including all the latest advances, it presents clear and comprehensive coverage of the major aspects of electric vehicle development and offers an engineering-based evaluation of electric motor scooters, cars, buses and trains. This new edition includes: important new chapters on types of electric vehicles, including pickup and linear motors, overall efficiencies and energy consumption, and power generation, particularly for zero carbon emissions expanded chapters updating the latest types of EV, types of batteries, battery technology and other rechargeable devices, fuel cells, hydrogen supply, controllers, EV modeling, ancillary system design, and EV and the environment brand new practical examples and case studies illustrating how electric vehicles can be used to substantially reduce carbon emissions and cut down reliance on fossil fuels futuristic concept models, electric and high-speed trains and developments in magnetic levitation and linear motors an examination of EV efficiencies, energy consumption and sustainable power generation. MATLAB® examples can be found on the companion website [www.wiley.com/go/electricvehicle2e](http://www.wiley.com/go/electricvehicle2e) Explaining the underpinning science and technology, this book is essential for practicing electrical, automotive, power, control and instrumentation engineers working in EV research and development. It is also a valuable reference for academics and students in automotive, mechanical, power and electrical engineering.

**Electric Vehicles** - Nil Patel 2020-11-25

This book focuses on the latest emerging technologies in electric vehicles (EV), and their economic and environmental impact. The topics covered include different types of EV such as hybrid electrical vehicle (HEV), battery electrical vehicle (BEV), fuel cell electrical vehicle (FCEV), plug-in hybrid electrical vehicle (PHEV). Theoretical background and practical examples of conventional electrical machines, advanced electrical machines, battery energy sources, on-board charging and off-board charging techniques, and optimization methods are presented here. This book can be useful for students, researchers and practitioners interested in different problems and challenges associated with electric vehicles.

**Electric and Hybrid Vehicles** - Tom Denton 2020-06-17

Electric and hybrid vehicles are now the present, not the future. This straightforward and highly illustrated full colour textbook is endorsed by the Institute of the Motor Industry, and introduces the subject for further education and undergraduate students as well as technicians. This new edition includes a new section on diagnostics and completely updated case studies. It covers the different types of electric vehicle, costs and emissions, and the charging infrastructure, before moving on to explain how hybrid and electric vehicles work. A chapter on electrical technology introduces learners to subjects such as batteries, control systems and charging which are then covered in more detail within their own chapters. The book also covers the maintenance and repair procedures of these vehicles, including fault finding, servicing, repair and first-responder information. Clear diagrams, photos and flow charts outline the charging infrastructure, how EV technology works, and how to repair and maintain hybrid and electric vehicles. Optional IMI online eLearning materials enable students to study the subject further and test their knowledge. It is particularly suitable for students studying towards IMI Level 2 Award in Hybrid Electric Vehicle Operation and Maintenance, IMI Level 3 Award in Hybrid Electric Vehicle Repair and Replacement, IMI Accreditation, C&G and other EV/Hybrid courses.

**Hybrid Electric Vehicles** - Simona Onori 2015-12-16

This SpringerBrief deals with the control and optimization problem in hybrid electric vehicles. Given that there are two (or more) energy sources (i.e., battery and fuel) in hybrid vehicles, it shows the reader how to implement an energy-management strategy that decides how much of the vehicle's power is provided by each source instant by instant. Hybrid Electric Vehicles: •introduces methods for modeling energy flow in hybrid electric vehicles; •presents a standard mathematical formulation of the optimal control problem; •discusses different optimization and control strategies for energy management, integrating the most recent research results; and •carries out an overall comparison of the different control strategies presented. Chapter by chapter, a case study is thoroughly developed, providing illustrative numerical examples that show the basic principles applied to real-world situations. The brief is intended as a straightforward tool for learning quickly about state-of-the-art energy-management strategies. It is particularly well-suited to the needs of graduate students and engineers already familiar with the basics of hybrid vehicles but who wish to learn more about their control strategies.

**Electric Vehicles** - Seref Soylu 2011-09-12

In this book, modeling and simulation of electric vehicles and their components have been emphasized chapter by chapter with valuable contribution of many researchers who work on both technical and regulatory sides of the field. Mathematical models for electrical vehicles and their components were introduced and merged together to make this book a guide for industry, academia and policy makers.

**Hybrid, Electric, and Fuel-Cell Vehicles** - Jack Erjavec 2012-06-06

HYBRID, ELECTRIC AND FUEL-CELL VEHICLES, Second Edition, covers the cutting-edge technology and technology that are revolutionizing today's automotive industry. Author Jack Erjavec combines in-depth industry expertise with an engaging, reader-friendly style, providing extensive detail on new and upcoming electric vehicles, including hybrids in production today and the fuel cell vehicles of tomorrow. Expansive coverage ranges from basic theory related to vehicle construction, electricity, batteries, and motors, to the political and social impact of these high-profile vehicles. In addition to up-to-date, highly accurate technical information on vehicles available today—including service procedures and safe shop practices—the text provides an informed look into the future with material on vehicles currently under development. Important Notice: Media content referenced within the product description or the product text may not be available in the ebook version.

**Optimal and Robust Scheduling for Networked Control Systems** -

Stefano Longo 2018-09-03

Optimal and Robust Scheduling for Networked Control Systems tackles the problem of integrating system components—controllers, sensors, and actuators—in a networked control system. It is common practice in industry to solve such problems heuristically, because the few theoretical results available are not comprehensive and cannot be readily applied by practitioners. This book offers a solution to the deterministic scheduling problem that is based on rigorous control theoretical tools but also addresses practical implementation issues. Helping to bridge the gap between control theory and computer science, it suggests that the consideration of communication constraints at the design stage will significantly improve the performance of the control system. Technical Results, Design Techniques, and Practical Applications The book brings together well-known measures for robust performance as well as fast stochastic algorithms to assist designers in selecting the best network configuration and guaranteeing the speed of offline optimization. The authors propose a unifying framework for modelling NCSs with time-triggered communication and present technical results. They also introduce design techniques, including for the codesign of a controller and communication sequence and for the robust design of a communication sequence for a given controller. Case studies explore the use of the FlexRay TDMA and time-triggered control area network (CAN) protocols in an automotive control system. Practical Solutions to Your Time-Triggered Communication Problems This unique book develops ready-to-use engineering tools for large-scale control system integration with a focus on robustness and performance. It emphasizes techniques that are directly applicable to time-triggered communication problems in the automotive industry and in avionics, robotics, and automated manufacturing.

**Fuel Cells, Engines and Hydrogen** - Frederick J. Barclay 2006-07-11

Fuel cell technology is the most exciting and legitimate alternative source of power currently available to us as world resources of non-renewable fuel continue to be depleted. No other power generating technology holds the same benefits that fuel cells offer, including high reliability and efficiency, negligible environmental impact, and security of supply. Fuel

cells run on hydrogen – the simplest and most plentiful gas in the universe - although they can also run on carbon monoxide, methane, or even coal. Their applications are diverse, from powering automobiles, buildings and portable electronics, to converting methane gas from wastewater plants and landfills into electricity. Fuel Cells, Engines and Hydrogen is a controversial text that challenges the accepted industry parameters for measuring fuel cell performance and efficiency. Based on his interdisciplinary experience in the fields of power, nuclear power, and desalination, the author contends that the development potential of the fuel cell is related to the quantity fuel chemical exergy, which, like electrical potential, is a quantitative measure of work done. The fuel cell community currently characterises these devices in terms of the enthalpy of combustion (calorific value) – however the author argues a correct, qualitatively different and fourfold larger characterisation is via the fuel chemical exergy, in units of work, and not energy. He asserts that the distortion introduced by this accepted perspective needs to be corrected before relatively efficient fuel cells, integrated with comparatively low performing gas turbines, reach the market. Fuel Cells, Engines and Hydrogen features a foreword by Dr Gerry Agnew, Executive VP Engineering of Rolls Royce Fuel Cells Systems Ltd. It is essential reading for all engineers involved with fuel cells and/ or the manufacture of hydrogen from natural gas, as well as academics in related disciplines such as thermodynamics, physical chemistry, materials, physics, mechanical and chemical engineering.

**Hybrid Systems, Optimal Control and Hybrid Vehicles** - Thomas J. Böhme 2017-02-01

This book assembles new methods showing the automotive engineer for the first time how hybrid vehicle configurations can be modeled as systems with discrete and continuous controls. These hybrid systems describe naturally and compactly the networks of embedded systems which use elements such as integrators, hysteresis, state-machines and logical rules to describe the evolution of continuous and discrete dynamics and arise inevitably when modeling hybrid electric vehicles. They can throw light on systems which may otherwise be too complex or recondite. Hybrid Systems, Optimal Control and Hybrid Vehicles shows the reader how to formulate and solve control problems which satisfy multiple objectives which may be arbitrary and complex with contradictory influences on fuel consumption, emissions and drivability. The text introduces industrial engineers, postgraduates and researchers to the theory of hybrid optimal control problems. A series of novel algorithmic developments provides tools for solving engineering problems of growing complexity in the field of hybrid vehicles. Important topics of real relevance rarely found in text books and research publications—switching costs, sensitivity of discrete decisions and their impact on fuel savings, etc.—are discussed and supported with practical applications. These demonstrate the contribution of optimal hybrid control in predictive energy management, advanced powertrain calibration, and the optimization of vehicle configuration with respect to fuel economy, lowest emissions and smoothest drivability. Numerical issues such as computing resources, simplifications and stability are treated to enable readers to assess such complex systems. To help industrial engineers and managers with project decision-making, solutions for many important problems in hybrid vehicle control are provided in terms of requirements, benefits and risks.

**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.

Solid Oxide Fuel Cell Lifetime and Reliability - Nigel Brandon 2017-05-23

Solid Oxide Fuel Cell Lifetime and Reliability: Critical Challenges in Fuel  
Cells presents in one volume the most recent research that aims at  
solving key issues for the deployment of SOFC at a commercial scale and  
for a wider range of applications. To achieve that, authors from different  
regions and backgrounds address topics such as electrolytes,  
contaminants, redox cycling, gas-tight seals, and electrode  
microstructure. Lifetime issues for particular elements of the fuel cells,

like cathodes, interconnects, and fuel processors, are covered as well as  
new materials. They also examine the balance of SOFC plants,  
correlations between structure and electrochemical performance,  
methods for analysis of performance and degradation assessment, and  
computational and statistical approaches to quantify degradation. For its  
holistic approach, this book can be used both as an introduction to these  
issues and a reference resource for all involved in research and  
application of solid oxide fuel cells, especially those developing  
understanding in industrial applications of the lifetime issues. This  
includes researchers in academia and industrial R&D, graduate students  
and professionals in energy engineering, electrochemistry, and materials  
sciences for energy applications. It might also be of particular interest  
to analysts who are looking into integrating SOFCs into energy systems.  
Brings together in a single volume leading research and expert thinking  
around the broad topic of SOFC lifetime and durability Explores issues  
that affect solid oxide fuel cells elements, materials, and systems with a  
holistic approach Provides a practical reference for overcoming some of  
the common failure mechanisms of SOFCs Features coverage of  
integrating SOFCs into energy systems