

Fundamentals and Applications of Lithium-ion Batteries in Electric Drive Vehicles

**Jiuchun Jiang
Caiping Zhang**

WILEY

Fundamentals And Application Of Lithium Ion Batteries In Electric Drive Vehicles

Kazunori Ozawa



Fundamentals And Application Of Lithium Ion Batteries In Electric Drive Vehicles:

Fundamentals and Applications of Lithium-ion Batteries in Electric Drive Vehicles Jiuchun Jiang, Caiping Zhang, 2015-05-18 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 *Fundamentals and Applications of Lithium-ion Batteries in Electric Drive Vehicles* Jiuchun Jiang, 2015 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

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New Trends in Electrical Vehicle Powertrains Luis Romeral Martinez,Miguel Delgado Prieto,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

Advances in Heat Transfer ,2024-10-05 Advances in Heat Transfer Volume 58 presents the latest in a serial that highlights new advances in the field with this updated volume presenting interesting chapters written by an international board of authors Sample chapters in this new release include Nanoscale Thin Film Evaporation and Ice thermal energy storage modeling A review Provides the authority and expertise of leading contributors from an international board of authors Presents the latest release in Advances in Heat Transfer serials

Handbook of Energy Transitions Muhammad Asif,2022-10-14 The global energy scenario is undergoing an unprecedented transition In the wake of enormous challenges such as increased population higher energy demands increasing greenhouse gas emissions depleting fossil fuel reserves volatile energy prices geopolitical concerns and energy insecurity issues the energy sector is experiencing a transition in terms of energy resources and their utilization This modern transition is historically more dynamic and multidimensional compared to the past considering the vast technological advancements socioeconomic implications and political responses and ever evolving global policies and regulations Energy insecurity in terms of its critical dimensions access affordability and reliability remains a major problem hindering the socioeconomic progress in developing countries The Handbook of Energy

Transitions presents a holistic account of the 21st century energy transition away from fossil fuels. It provides an overview of the unfolding transition in terms of overall dimensions, drivers, trends, barriers, policies, and geopolitics, and then discusses transition in terms of particular resources or technologies such as renewable energy systems, solar energy, hydropower, hydrogen, and fuel cells, electric vehicles, energy storage systems, batteries, digitalization, smart grids, blockchain, and machine learning. It also discusses the present energy transition in terms of broader policy and developmental perspectives. Further, it examines sustainable development, the economics of energy and green growth, and the role of various technologies and initiatives like renewables, nuclear power, and electrification in promoting energy security and energy transition worldwide. Key Features: Includes technical, economic, social, and policy perspectives of energy transitions; Features practical case studies and comparative assessments; Examines the latest renewable energy and low carbon technologies; Explains the connection between energy transition and global climate change.

Artificial Intelligence and Industrial Applications Tawfik Masrour, Hassan Ramchoun, Tarik Hajji, Mohamed Hosni, 2023-09-14. Amid the dynamic growth of artificial intelligence, this book presents a collection of findings and advancements from the second edition of the A2IA Artificial Intelligence and Industrial Applications conference. The conference, hosted by ENSAM Meknes at Moulay Ismail University, Morocco, fosters knowledge exchange in AI, focusing primarily on its industrial applications. Covering a wide range of topics, the book highlights the adaptable nature of AI and its increasing impact on industrial sectors. It brings together contributions from an international cohort of researchers discussing themes such as intelligent manufacturing and maintenance, intelligent supply chain management, various modes of learning (including supervised, unsupervised, reinforcement, semi-supervised, and graph-based), as well as neural networks, deep learning, planning, and optimization. A defining feature of this edition is its extensive scope and emphasis on the practical applications of AI along with its foundational elements. It facilitates an understanding of AI's current state and potential future direction, showcasing recent developments that bridge the gap between theory and practice. Designed for a diverse readership, this book is of interest to AI practitioners, academics, and enthusiasts, as well as those new to the field. It provides an opportunity to explore AI's critical role in industrial applications and the practical insights it offers, which are likely to be beneficial for decision-making within industrial settings.

New Applications of Electric Drives Miroslav Chomat, 2015-12-09. In the last few decades, electric drives have found their place in a considerable number of diverse applications. They are successfully replacing some other traditional types of drives owing to their better performance and excellent controllability. The introduction of electric drives is, in most cases, also beneficial from the ecological point of view, as they are not directly dependent on fossil fuels, and an increasing part of electric energy they consume is generated in renewable energy sources. This book focuses on applications of electric drives that emerged only recently and on novel aspects that appear in them. Particular attention is given to using electric drives in vehicles, aircraft, non-road mobile machinery, and HVAC systems.

Advanced Battery Technologies Manuela González, David Anseán, 2021-08-31

In recent years lithium ion batteries LIBs have been increasingly contributing to the development of novel engineering systems with energy storage requirements LIBs are playing an essential role in our society as they are being used in a wide variety of applications ranging from consumer electronics electric mobility renewable energy storage biomedical applications or aerospace systems Despite the remarkable achievements and applicability of LIBs there are several features within this technology that require further research and improvements In this book a collection of 10 original research papers addresses some of those key features including battery testing methodologies state of charge and state of health monitoring and system level power electronics applications One key aspect to emphasize when it comes to this book is the multidisciplinary nature of the selected papers The presented research was developed at university departments institutes and organizations of different disciplines including Electrical Engineering Control Engineering Computer Science or Material Science to name a few examples The overall result is a book that represents a coherent collection of multidisciplinary works within the prominent field of LIBs

Transition to Sustainable Energy Technologies Carlo Villante, Sonia Dell'Aversano, Stefano Ranieri, 2025-06-27 This book explains the challenges related to global energy transition focusing on decarbonization renewable technologies and sustainable mobility It offers a comprehensive exploration of integrated socio economic environmental and technological perspectives and provides actionable solutions and practical pathways for transitioning to sustainable energy systems Designed to be used in short academic courses this textbook is an excellent foundational text for upper level undergraduate and graduate students in engineering and environmental sciences taking specialized courses in energy systems renewable technologies climate change mitigation and environmental impacts It is also a great resource for professionals and policy makers involved in energy projects Features Offers an interdisciplinary approach to energy transitions combining theoretical frameworks with practical applications Explores the full spectrum of energy systems comparing conventional to renewable sources energy vectors and energy storage technologies Incorporates real world data from leading institutions and integrates key historical milestones like the Paris Agreement with forward looking trends Highlights cutting edge innovations including solar and wind energy hydrogen energy storage systems synthetic fuels and smart grids and emphasizes their integration into energy systems and sustainable mobility solutions Bridges the gap between socio economic environmental and technological perspectives The Open Access version of this book available at <http://www.taylorfrancis.com> has been made available under a Creative Commons Attribution Non Commercial No Derivatives CC BY NC ND 4.0 license

Smart Cities, Green Technologies, and Intelligent Transport Systems Brian Donnellan, Cornel Klein, Markus Helfert, Oleg Gusikhin, António Pascoal, 2018-11-23 This book constitutes the thoroughly refereed post conference proceedings of the 5th International Conference on Smart Cities and Green ICT Systems SMARTGREENS 2017 and the Third International Conference on Vehicle Technology and Intelligent Transport Systems VEHITS 2017 held in Porto Portugal in April 2017 The 8 full papers of SMARTGREENS 2017 presented were carefully reviewed and selected from 70

submissions VEHITS 2017 received 77 paper submissions from which 9 papers were selected and published in this book The papers reflect topics such as smart cities energy aware systems and technologies sustainable computing and communications sustainable transportation and smart mobility **Lithium Ion Batteries** Masataka Wakihara, Osamu Yamamoto, 2008-11-21 Rechargeable Batteries with high energy density are in great demand as energy sources for various purposes e g handies zero emission electric vehicles or load leveling in electric power Lithium batteries are the most promising to fulfill such needs because of their intrinsic discharge voltage with relatively light weight This volume has been conceived keeping in mind selected fundamental topics together with the characteristics of the lithium ion battery on the market It is thus a comprehensive overview of the new challenges facing the further development of lithium ion batteries from the standpoint of both materials science and technology It will be useful for any scientist involved in the research and development of batteries in academia and industry and also for graduate students entering the field since it covers important topics from both fundamental and application points of view Lithium Ion Batteries in Electric Drive Vehicles Ahmad A Pesaran, 2016-05-16 This research focuses on the technical issues that are critical to the adoption of high energy producing lithium Ion batteries In addition to high energy density high power density this publication considers performance requirements that are necessary to assure lithium ion technology as the battery format of choice for electrified vehicles Presentation of prime topics includes Long calendar life greater than 10 years Sufficient cycle life Reliable operation under hot and cold temperatures Safe performance under extreme conditions End of life recycling To achieve aggressive fuel economy standards carmakers are developing technologies to reduce fuel consumption including hybridization and electrification Cost and affordability factors will be determined by these relevant technical issues which will provide for the successful implementation of lithium ion batteries for application in future generations of electrified vehicles *Linden's Handbook of Batteries, Fifth Edition* Kirby W. Beard, 2019-05-10 Publisher's Note Products purchased from Third Party sellers are not guaranteed by the publisher for quality authenticity or access to any online entitlements included with the product Thoroughly revised comprehensive coverage of battery technology characteristics and applications This fully updated guide offers complete coverage of batteries and battery usage from classic designs to emerging technologies Compiled by a pioneer in secondary lithium batteries the book contains all the information needed to solve engineering problems and make proper battery selections You will get in depth descriptions of the principles properties and performance specifications of every major battery type Linden's Handbook of Batteries Fifth Edition contains cutting edge data and equations design specifications and troubleshooting techniques from international experts New chapters discuss renewable energy systems battery failure analysis lithium ion battery technology materials and component design Recent advances in smartphones and hybrid car batteries are clearly explained including maximizing re chargeability reducing cost improving safety and lessening environmental impact Coverage includes Electricity electrochemistry and batteries Raw materials Battery components

Principles of electrochemical cell operations Battery product overview Electrochemical cell designs platform technologies Primary batteries Secondary batteries Miscellaneous and specialty batteries Battery applications Battery industry infrastructure

Electrochemical Power Sources: Fundamentals, Systems, and Applications Jürgen Garche, Klaus Brandt, 2018-09-20 Safety of Lithium Batteries describes how best to assure safety during all phases of the life of Lithium ion batteries production transport use and disposal About 5 billion Li ion cells are produced each year predominantly for use in consumer electronics This book describes how the high energy density and outstanding performance of Li ion batteries will result in a large increase in the production of Li ion cells for electric drive train vehicle xEV and battery energy storage BES or EES purposes The high energy density of Li battery systems comes with special hazards related to the materials employed in these systems The manufacturers of cells and batteries have strongly reduced the hazard probability by a number of measures However absolute safety of the Li system is not given as multiple incidents in consumer electronics have shown Presents the relationship between chemical and structure material properties and cell safety Relates cell and battery design to safety as well as system operation parameters to safety Outlines the influences of abuses on safety and the relationship to battery testing Explores the limitations for transport and storage of cells and batteries Includes recycling disposal and second use of lithium ion batteries

Rechargeable Lithium-Ion Batteries Thandavarayan Maiyalagan, Perumal Elumalai, 2020-12-17 Lithium ion batteries are the most promising among the secondary battery technologies for providing high energy and high power required for hybrid electric vehicles HEV and electric vehicles EV Lithium ion batteries consist of conventional graphite or lithium titanate as anode and lithium transition metal oxides as cathode A lithium salt dissolved in an aprotic solvent such as ethylene carbonate and diethylene carbonate is used as electrolyte This rechargeable battery operates based on the principle of electrochemical lithium insertion re insertion or intercalation de intercalation during charging discharging of the battery It is essential that both electrodes have layered structure which should accept and release the lithium ion In advanced lithium ion battery technologies other than layered anodes are also considered High cell voltage high capacity as well as energy density high Columbic efficiency long cycle life and convenient to fabricate any size or shape of the battery are the vital features of this battery technology Lithium ion batteries are already being used widely in most of the consumer electronics such as mobile phones laptops PDAs etc and are in early stages of application in HEV and EV which will have far and wide implications and benefits to society The book contains ten chapters each focusing on a specific topic pertaining to the application of lithium ion batteries in Electric Vehicles Basic principles electrode materials electrolytes high voltage cathodes recycling spent Li ion batteries and battery charge controller are addressed This book is unique among the countable books focusing on the lithium ion battery technologies for vehicular applications It provides fundamentals and practical knowledge on the lithium ion battery for vehicular application Students scholars academicians and battery and automobile industries will find this volume useful

Lithium-Ion Batteries Gianfranco Pistoia, 2013-12-16

Lithium Ion Batteries features an in depth description of different lithium ion applications including important features such as safety and reliability This title acquaints readers with the numerous and often consumer oriented applications of this widespread battery type Lithium Ion Batteries also explores the concepts of nanostructured materials as well as the importance of battery management systems This handbook is an invaluable resource for electrochemical engineers and battery and fuel cell experts everywhere from research institutions and universities to a worldwide array of professional industries Contains all applications of consumer and industrial lithium ion batteries including reviews in a single volume Features contributions from the world s leading industry and research experts Presents executive summaries of specific case studies Covers information on basic research and application approaches *Lithium Ion Batteries in Electric Drive Vehicles* Ahmad A. Pesaran, 2016 This special SAE publication is focused on lithium ion technologies in electric drive vehicles HEVs PHEVs EVs EREVs mild HEVs with 48 V and even conventional vehicles with start stop technology Ten SAE technical papers are included in this publication which examines several relevant issues for the implementation of lithium ion technology and reviews solutions offered in addressing those issues *Lithium-Ion Batteries: Basics and Applications* Reiner Korthauer, 2018-08-07 The handbook focuses on a complete outline of lithium ion batteries Just before starting with an exposition of the fundamentals of this system the book gives a short explanation of the newest cell generation The most important elements are described as negative positive electrode materials electrolytes seals and separators The battery disconnect unit and the battery management system are important parts of modern lithium ion batteries An economical faultless and efficient battery production is a must today and is represented with one chapter in the handbook Cross cutting issues like electrical chemical functional safety are further topics Last but not least standards and transportation themes are the final chapters of the handbook The different topics of the handbook provide a good knowledge base not only for those working daily on electrochemical energy storage but also to scientists engineers and students concerned in modern battery systems **Advanced Battery Management Technologies for Electric Vehicles** Rui Xiong, Weixiang Shen, 2019-02-26 A comprehensive examination of advanced battery management technologies and practices in modern electric vehicles Policies surrounding energy sustainability and environmental impact have become of increasing interest to governments industries and the general public worldwide Policies embracing strategies that reduce fossil fuel dependency and greenhouse gas emissions have driven the widespread adoption of electric vehicles EVs including hybrid electric vehicles HEVs pure electric vehicles PEVs and plug in electric vehicles PHEVs Battery management systems BMSs are crucial components of such vehicles protecting a battery system from operating outside its Safe Operating Area SOA monitoring its working conditions calculating and reporting its states and charging and balancing the battery system Advanced Battery Management Technologies for Electric Vehicles is a compilation of contemporary model based state estimation methods and battery charging and balancing techniques providing readers with practical knowledge of both fundamental concepts and practical

applications This timely and highly relevant text covers essential areas such as battery modeling and battery state of charge energy health and power estimation methods Clear and accurate background information relevant case studies chapter summaries and reference citations help readers to fully comprehend each topic in a practical context Offers up to date coverage of modern battery management technology and practice Provides case studies of real world engineering applications Guides readers from electric vehicle fundamentals to advanced battery management topics Includes chapter introductions and summaries case studies and color charts graphs and illustrations Suitable for advanced undergraduate and graduate coursework Advanced Battery Management Technologies for Electric Vehicles is equally valuable as a reference for professional researchers and engineers

Lithium Ion Rechargeable Batteries Kazunori Ozawa, 2009-12-01 Starting out with an introduction to the fundamentals of lithium ion batteries this book begins by describing in detail the new materials for all four major uses as cathodes anodes separators and electrolytes It then goes on to address such critical issues as self discharge and passivation effects highlighting lithium ion diffusion and its profound effect on a battery's power density life cycle and safety issues The monograph concludes with a detailed chapter on lithium ion battery use in hybrid electric vehicles Invaluable reading for materials scientists electrochemists physicists and those working in the automobile and electrotechnical industries as well as those working in computer hardware and the semiconductor industry

Enjoying the Song of Appearance: An Emotional Symphony within **Fundamentals And Application Of Lithium Ion Batteries In Electric Drive Vehicles**

In a global used by screens and the ceaseless chatter of quick interaction, the melodic beauty and mental symphony created by the published term frequently fade into the background, eclipsed by the relentless sound and disruptions that permeate our lives. Nevertheless, situated within the pages of **Fundamentals And Application Of Lithium Ion Batteries In Electric Drive Vehicles** a charming fictional value overflowing with organic thoughts, lies an immersive symphony waiting to be embraced. Crafted by a wonderful musician of language, that charming masterpiece conducts readers on a psychological trip, well unraveling the concealed melodies and profound affect resonating within each carefully constructed phrase. Within the depths of the emotional assessment, we shall discover the book is main harmonies, analyze its enthralling publishing style, and submit ourselves to the profound resonance that echoes in the depths of readers souls.

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