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MOSHE QUINN

Thermal Management of Electric Vehicle Battery Systems Springer Nature

This timely book provides you with a solid understanding of battery management systems (BMS) in large Li-Ion battery packs, describing the important technical challenges in this field and exploring the most effective solutions. You find in-depth discussions on BMS topologies, functions, and complexities, helping you determine which permutation is right for your application. Packed with numerous graphics, tables, and images, the book explains the OC whysOCO and OC howsOCO of Li-Ion BMS design, installation, configuration and troubleshooting. This hands-on resource includes an unbiased description and comparison of all the off-the-shelf Li-Ion BMSs available today. Moreover, it explains how using the correct one for a given application can help to get a Li-Ion pack up and running in little time at low cost."

Lithium-Ion Batteries John Wiley & Sons

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.

Battery Management Systems for Large Lithium Ion Battery Packs John Wiley & Sons

Silicon Anode Systems for Lithium-Ion Batteries is an introduction to silicon anodes as an alternative to traditional graphite-based anodes. The book provides a comprehensive overview including abundance, system voltage, and capacity. It provides key insights into the basic challenges faced by the materials system such as new configurations and concepts for overcoming the expansion and contraction related problems. This book has been written for the practitioner, researcher or developer of commercial technologies. - Provides a thorough explanation of the advantages, challenge, materials science, and commercial prospects of silicon and related anode materials for lithium-ion batteries - Provides insights into practical issues including processing and performance of advanced Si-based materials in battery-relevant materials systems - Discusses suppressants in electrolytes to minimize adverse effects of solid electrolyte interphase (SEI) formation and safety limitations associated with this technology

Advances in Lithium-Ion Batteries Springer Science & Business Media

This book comprises five peer-reviewed articles covering original research articles on the modeling and simulation of electricity systems for transport

and energy storage. The topics include: 1 - Optimal siting and sizing methodology to design an energy storage system (ESS) for railway lines; 2 - Technical-economic comparison between a 3 kV DC railway and the use of trains with on-board storage systems; 3 - How to improve electrical feeding substations, by changing transformer technology and by installing dedicated high-power-oriented storage systems; 4 - Algorithm applied to a vehicle-to-grid (V2G) technology. 5 - Thermal investigation and optimization of an air-cooled lithium-ion battery pack.

Lithium-Ion Batteries Academic Press

The Handbook of Lithium-Ion Battery Pack Design: Chemistry, Components, Types and Terminology, Second Edition provides a clear and concise explanation of EV and Li-ion batteries for readers that are new to the field. The second edition expands and updates all topics covered in the original book, adding more details to all existing chapters and including major updates to align with all of the rapid changes the industry has experienced over the past few years. This handbook offers a layman's explanation of the history of vehicle electrification and battery technology, describing the various terminology and acronyms and explaining how to do simple calculations that can be used in determining basic battery sizing, capacity, voltage, and energy. By the end of this book the reader will have a solid understanding of the terminology around Li-ion batteries and be able to undertake simple battery calculations. The book is immensely useful to beginning and experienced engineers alike who are moving into the battery field. Li-ion batteries are one of the most unique systems in automobiles today in that they combine multiple engineering disciplines, yet most engineering programs focus on only a single engineering field. This book provides the reader with a reference to the history, terminology and design criteria needed to understand the Li-ion battery and to successfully lay out a new battery concept. Whether you are an electrical engineer, a mechanical engineer or a chemist, this book will help you better appreciate the inter-relationships between the various battery engineering fields that are required to understand the battery as an Energy Storage System. It gives great insights for readers ranging from engineers to sales, marketing, management, leadership, investors, and government officials. - Adds a brief history of battery technology and its evolution to current technologies? - Expands and updates the chemistry to include the latest types - Discusses thermal runaway and cascading failure mitigation technologies? - Expands and updates the descriptions of the battery module and pack components and systems?? - Adds description of the manufacturing processes for cells, modules, and packs? - Introduces and discusses new topics such as battery-as-a-service, cell to pack and cell to chassis designs, and wireless BMS?

Electrochemical Power Sources: Fundamentals, Systems, and Applications Springer Science & Business Media

This comprehensive, two-volume resource provides a thorough introduction to lithium ion (Li-ion) technology. Readers get a hands-on understanding of Li-ion technology, are guided through the design and assembly of a battery, through deployment, configuration and testing. The book covers dozens of applications, with solutions for each application provided. Volume One focuses on the Li-ion cell and its types, formats, and chemistries. Cell arrangements and issues, including series (balance) and parallel (fusing, inrush current) are also discussed. Li-ion Battery Management Systems are explored, focusing on types and topologies, functions, and selection. Battery design, assembly, deployment, troubleshooting and repair are also discussed, along with modular batteries, split batteries and battery arrays. Written by a prominent expert in the field and packed with over 500 illustrations, these volumes contain solutions to practical problems, making it useful for both the novice and experienced practitioners.

Lithium-Ion Batteries and Applications: A Practical and Comprehensive Guide to Lithium-Ion Batteries and Arrays, from Toys to Towns, Volume 1, Batteries CRC Press

This book covers both the fundamental and applied aspects of advanced Na-ion batteries (NIB) which have proven to be a potential challenger to Li-ion batteries. Both the chemistry and design of positive and negative electrode materials are examined. In NIB, the electrolyte is also a crucial part of the batteries and the recent research, showing a possible alternative to classical electrolytes – with the development of ionic liquid-based electrolytes – is also explored. Cycling performance in NIB is also strongly associated with the quality of the electrode-electrolyte interface, where electrolyte degradation takes place; thus, Na-ion Batteries details the recent achievements in furthering knowledge of this interface. Finally, as the ultimate goal is commercialization of this new electrical storage technology, the last chapters are dedicated to the industrial point of view, given by two startup companies, who developed two different NIB chemistries for complementary applications and markets.

Reuse and Recycling of Lithium-ion Power Batteries Springer

High-performance secondary batteries, also called rechargeable or storage batteries, are a key component of electric automobiles, power storage for renewable energies, load levellers of electric power lines, base stations for mobile phones, and emergency power supply in hospitals, in addition to having application in energy security and realization of a low-carbon and resilient society. A detailed understanding of the physics and chemistry that occur in secondary batteries is required for developing next-generation secondary batteries with improved performance. Among various types of secondary batteries, lithium-ion batteries are most widely used because of their high energy density, small memory effect, and low self-discharge rate. This book introduces lithium-ion batteries, with an emphasis on their overview, roadmaps, and simulations. It also provides extensive descriptions of ion beam analysis and prospects for in situ diagnostics of lithium-ion batteries. The chapters are written by specialists in cutting-edge research on lithium-ion batteries and related subjects. The book will be a great reference for advanced undergraduate- and graduate-level students, researchers, and engineers in electrochemistry, nanotechnology, and diagnostic methods and instruments.

Lithium-Ion Batteries CRC Press

The aim of this book is to review innovative physical multiscale modeling methods which numerically simulate the structure and properties of electrochemical devices for energy storage and conversion. Written by world-class experts in the field, it revisits concepts, methodologies and approaches connecting ab initio with micro-, meso- and macro-scale modeling of components and cells. It also discusses the major scientific challenges of this field, such as that of lithium-ion batteries. This book demonstrates how fuel cells and batteries can be brought together to take advantage of well-established multi-scale physical modeling methodologies to advance research in this area. This book also highlights promising capabilities of such approaches for inexpensive virtual experimentation. In recent years, electrochemical systems such as polymer electrolyte membrane fuel cells, solid oxide fuel cells, water electrolyzers, lithium-ion batteries and supercapacitors have attracted much attention due to their potential for clean energy conversion and as storage devices. This has resulted in tremendous technological progress, such as the development of new electrolytes and new engineering designs of electrode structures. However, these technologies do not yet possess all the necessary

characteristics, especially in terms of cost and durability, to compete within the most attractive markets. Physical multiscale modeling approaches bridge the gap between materials' atomistic and structural properties and the macroscopic behavior of a device. They play a crucial role in optimizing the materials and operation in real-life conditions, thereby enabling enhanced cell performance and durability at a reduced cost. This book provides a valuable resource for researchers, engineers and students interested in physical modelling, numerical simulation, electrochemistry and theoretical chemistry.

Modeling, Dynamics, and Control of Electrified Vehicles Springer Nature

Batteries are vital for storing renewable energy for stationary and mobile applications. Managing batteries requires knowledge of parameters such as charge and power output. State estimation estimates such parameters using measurement and modelling; a process conveyed in this book through experimental results and verification.

Silicon Anode Systems for Lithium-Ion Batteries Springer

This book surveys state-of-the-art research on and developments in lithium-ion batteries for hybrid and electric vehicles. It summarizes their features in terms of performance, cost, service life, management, charging facilities, and safety. Vehicle electrification is now commonly accepted as a means of reducing fossil-fuels consumption and air pollution. At present, every electric vehicle on the road is powered by a lithium-ion battery. Currently, batteries based on lithium-ion technology are ranked first in terms of performance, reliability and safety. Though other systems, e.g., metal-air, lithium-sulphur, solid state, and aluminium-ion, are now being investigated, the lithium-ion system is likely to dominate for at least the next decade – which is why several manufacturers, e.g., Toyota, Nissan and Tesla, are chiefly focusing on this technology. Providing comprehensive information on lithium-ion batteries, the book includes contributions by the world's leading experts on Li-ion batteries and vehicles.

Electric Aircraft Dynamics Elsevier

Electric Aircraft Dynamics: A Systems Engineering Approach surveys engineering sciences that underpin the dynamics, control, monitoring, and design of electric propulsion systems for aircraft. It is structured to appeal to readers with a science and engineering background and is modular in format. The closely linked chapters present descriptive material and relevant mathematical modeling techniques. Taken as a whole, this ground-breaking text equips professional and student readers with a solid foundation for advanced work in this emerging field. Key Features: Provides the first systems-based overview of this emerging aerospace technology Surveys low-weight battery technologies and their use in electric aircraft propulsion Explores the design and use of plasma actuation for boundary layer and flow control Considers the integrated design of electric motor-driven propellers Includes PowerPoint slides for instructors using the text for classes Dr. Ranjan Vepa earned his PhD in applied mechanics from Stanford University, California. He currently serves as a lecturer in the School of Engineering and Material Science, Queen Mary University of London, where he has also been the programme director of the Avionics Programme since 2001. Dr. Vepa is a member of the Royal Aeronautical Society, London; the Institution of Electrical and Electronic Engineers (IIEE), New York; a Fellow of the Higher Education Academy; a member of the Royal Institute of Navigation, London; and a chartered engineer.

Battery State Estimation MDPI

Battery Management Systems - Design by Modelling describes the design of Battery Management Systems (BMS) with the aid of simulation methods. The basic tasks of BMS are to ensure optimum use of the energy stored in the battery (pack) that powers a portable device and to prevent damage inflicted on the battery (pack). This becomes increasingly important due to the larger power consumption associated with added features to portable devices on the one hand and the demand for longer run times on the other hand. In addition to explaining the general principles of BMS tasks such as charging algorithms and State-of-Charge (SoC) indication methods, the book also covers real-life examples of BMS functionality of practical portable devices such as shavers and cellular phones. Simulations offer the advantage over measurements that less time is needed to gain knowledge of a battery's behaviour in interaction with other parts in a portable device under a wide variety of conditions. This knowledge can be used to improve the design of a BMS, even before a prototype of the portable device has been built. The battery is the central part of a BMS and good simulation models that can be used to improve the BMS design were previously unavailable. Therefore, a large part of the book is devoted to the construction of simulation models for rechargeable batteries. With the aid of several illustrations it is shown that design improvements can indeed be realized with the presented battery models. Examples include an improved charging algorithm that was elaborated in simulations and verified in practice and a new SoC indication system that was developed showing promising results. The contents of Battery Management Systems - Design by Modelling is based on years of research performed at the Philips Research Laboratories. The combination of basic and detailed descriptions of battery behaviour both in chemical and electrical terms makes this book truly multidisciplinary. It can therefore be read both by people with an (electro)chemical and an electrical engineering background.

Review of the Research Program of the U.S. DRIVE Partnership BoD – Books on Demand

This edited volume, with contributions from the Computer Aided Engineering for Batteries (CAEBAT) program, provides firsthand insights into nuances of implementing battery models in actual geometries. It discusses practical examples and gaps in our understanding, while reviewing in depth the theoretical background and algorithms. Over the last ten years, several world-class academics, automotive original equipment manufacturers (OEMs), battery cell manufacturers and software developers worked together under an effort initiated by the U.S. Department of Energy to develop mature, validated modeling tools to simulate design, performance, safety and life of automotive batteries. Until recently, battery modeling was a niche focus area with a relatively small number of experts. This book opens up the research topic for a broader audience from industry and academia alike. It is a valuable resource for anyone who works on battery engineering but has limited hands-on experience with coding.

Numerical Methods and Applications Artech House

Thermal Management of Electric Vehicle Battery Systems provides a thorough examination of various conventional and cutting edge electric vehicle (EV) battery thermal management systems (including phase change material) that are currently used in the industry as well as being proposed for future EV batteries. It covers how to select the right thermal management design, configuration and parameters for the users' battery chemistry, applications and operating conditions, and provides guidance on the setup, instrumentation and operation of their thermal management systems

(TMS) in the most efficient and effective manner. This book provides the reader with the necessary information to develop a capable battery TMS that can keep the cells operating within the ideal operating temperature ranges and uniformities, while minimizing the associated energy consumption, cost and environmental impact. The procedures used are explained step-by-step, and generic and widely used parameters are utilized as much as possible to enable the reader to incorporate the conducted analyses to the systems they are working on. Also included are comprehensive thermodynamic modelling and analyses of TMSs as well as databanks of component costs and environmental impacts, which can be useful for providing new ideas on improving vehicle designs. Key features: Discusses traditional and cutting edge technologies as well as research directions Covers thermal management systems and their selection for different vehicles and applications Includes case studies and practical examples from the industry Covers thermodynamic analyses and assessment methods, including those based on energy and exergy, as well as exergoeconomic, exergoenvironmental and enviroeconomic techniques Accompanied by a website hosting codes, models, and economic and environmental databases as well as various related information Thermal Management of Electric Vehicle Battery Systems is a unique book on electric vehicle thermal management systems for researchers and practitioners in industry, and is also a suitable textbook for senior-level undergraduate and graduate courses.

Behaviour of Lithium-Ion Batteries in Electric Vehicles Springer Science & Business Media

In the decade since the introduction of the first commercial lithium-ion battery research and development on virtually every aspect of the chemistry and engineering of these systems has proceeded at unprecedented levels. This book is a snapshot of the state-of-the-art and where the work is going in the near future. The book is intended not only for researchers, but also for engineers and users of lithium-ion batteries which are found in virtually every type of portable electronic product.

Battery Management Systems Newnes

"This book covers an overview and applications of the thermal storage systems used in batteries for the electric automotive industry such as in electric vehicles, thermal storage system in smart grid systems, thermal harvesting for battery-less use for wireless sensor networks, thermo-electric generators and biomedical sensing. The thermal storage system can be used to harvest energy for implementation of battery-less, zero-maintenance and place-and-forget electronic systems. This book has been prepared for the needs of those who seek an application on developing the thermal system. The choice of material is guided by the basic objective of making an engineer or student capable of dealing with thermal system design. The book can be used as reference book for undergraduate and postgraduate students in the area of thermal system overview, design and applications. Lithium iron phosphate (LiFePO₄) batteries have gained significant traction in the electric automotive industry in the recent years mainly due to their high safety performance, flat voltage profile and low cost. Although LiFePO₄ batteries have excellent thermal stability, they still suffer from thermal runaway like other lithium-ion type cells. Thermal volatility is a major drawback in the lithium-ion and sufficient knowledge of the thermal distribution and heat generation of the LiFePO₄ battery is necessary to avoid catastrophic thermal failure. The first chapter details the thermal analysis of a LiFePO₄ battery cell with a latent heat thermal cooling wrap. The model has been developed as a tool to study the cooling effects of the wrap on the battery cell during discharging. The proposed latent heat storage based battery cooling wrap is used to passively manage the heat produced by the cell and absorbing and maintaining the battery temperature within operational temperatures and below thermal runaway temperature. Thermal energy storage (TES) is another important concept of the smart grid systems. For non-renewable, the benefit of TES systems is the improvement of the generation performance by supporting the energy demand during peak hours. Also, TES is often able to improve the system efficiency in a way that is more energy and cost effective. The best-known method for thermal energy storage is by utilizing the latent heat of fusion of energy storage material known as phase change materials (PCM). TES systems are classified into two main categories such as sensible and latent heat storage. An overview of the research on performance improvement are also delineated. Hence, the thermal energy harvesting has indeed gained attention in the last decade due to its promising possibilities in area such as wireless sensor networks (WSN) for wide range of IoT (Internet of Things) applications. Thermal energy scavenging from waste heat can enable implementation of battery-less, zero-maintenance and place-and-forget electronic systems. Scavenging energy from the temperature difference between human body heat and ambiance is an attractive solution for powering wearables for

continuous health monitoring, biomedical sensing and body area sensor networks (BASN). The low energy efficiency and low voltage output of the thermo-electric generators (TEG) pose challenges to the deployment of industry ready powering systems"--

Scientific and Technical Aerospace Reports CRC Press

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.

Lithium-Ion Batteries: Basics and Applications Elsevier

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

Lithium-Ion Batteries Artech House

Battery System Modeling provides advances on the modeling of lithium-ion batteries. Offering step-by-step explanations, the book systematically guides the reader through the modeling of state of charge estimation, energy prediction, power evaluation, health estimation, and active control strategies. Using applications alongside practical case studies, each chapter shows the reader how to use the modeling tools provided. Moreover, the chemistry and characteristics are described in detail, with algorithms provided in every chapter. Providing a technical reference on the design and application of Li-ion battery management systems, this book is an ideal reference for researchers involved in batteries and energy storage. Moreover, the step-by-step guidance and comprehensive introduction to the topic makes it accessible to audiences of all levels, from experienced engineers to graduates. - Explains how to model battery systems, including equivalent, electrical circuit and electrochemical nernst modeling - Includes comprehensive coverage of battery state estimation methods, including state of charge estimation, energy prediction, power evaluation and health estimation - Provides a dedicated chapter on active control strategies