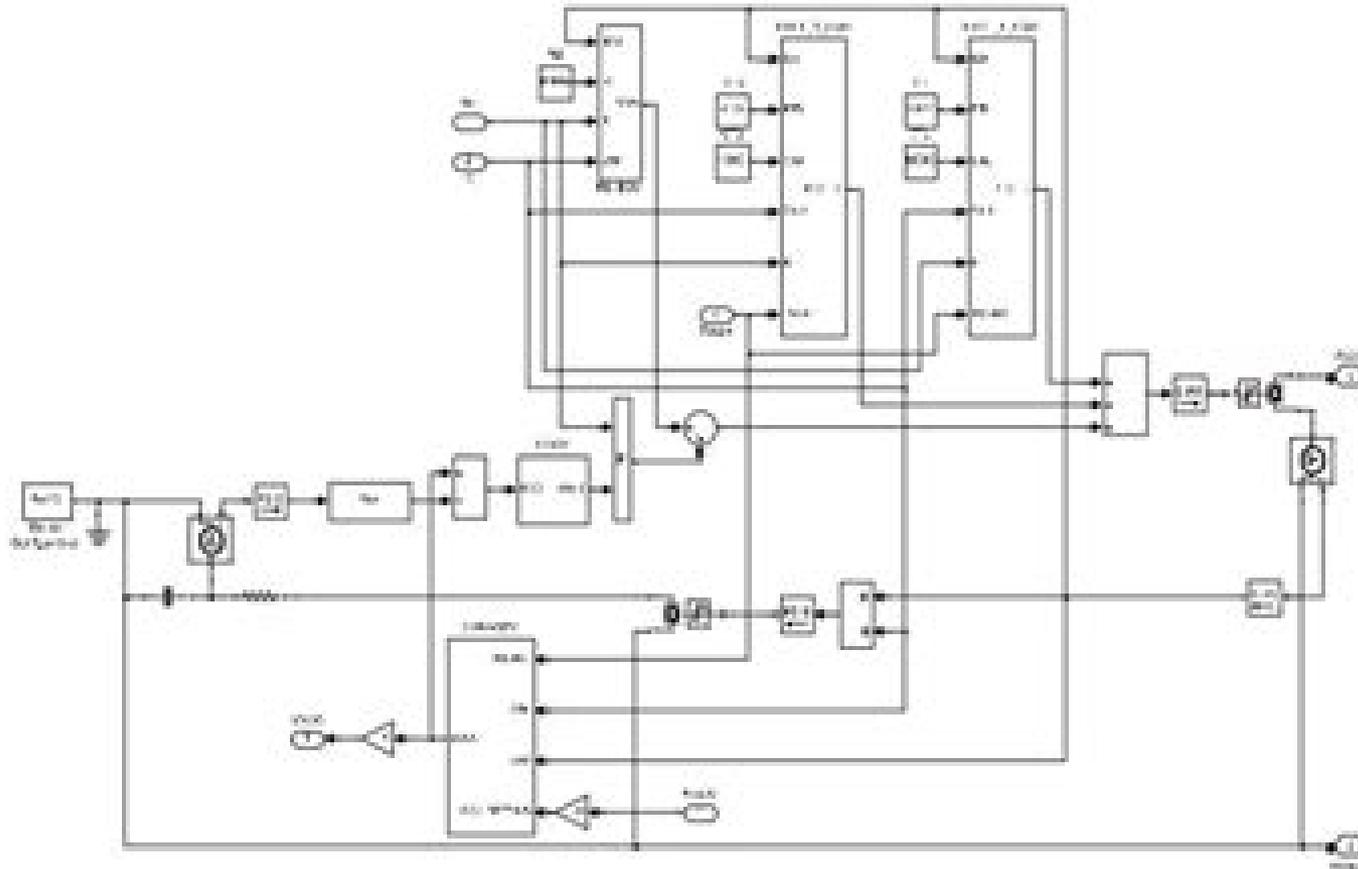


# 3. Simulink Model of Lithium-Ion Battery



Equivalent Circuit of Lithium-Ion Battery Model using Matlab

# Modeling Of Lithium Ion Battery Using Matlab Simulink

**Manaswita Bose, Anish Modi**



## **Modeling Of Lithium Ion Battery Using Matlab Simulink:**

Proceedings of the 7th International Conference on Advances in Energy Research Manaswita Bose, Anish

Modi, 2020-10-17 This book presents selected papers from the 7th International Conference on Advances in Energy Research ICAER 2019 providing a comprehensive coverage encompassing all fields and aspects of energy in terms of generation storage and distribution Themes such as optimization of energy systems energy efficiency economics management and policy and the interlinkages between energy and environment are included The contents of this book will be of use to researchers and policy makers alike *Management and Applications of Energy Storage Devices* Kenneth Eloghene Okedu, 2022-03-30

This book reviews recent trends developments and technologies of energy storage devices and their applications It describes the electrical equivalent circuit model of batteries the technology of battery energy storage systems in rooftop solar photovoltaic PV systems and the implementation of second life batteries in hybrid electric vehicles It also considers a novel energy management control strategy for PV batteries operating in DC microgrids along with the present state and opportunities of solid state batteries In addition the book examines the technology of thin film energy storage devices based on physical vapor deposition as well as the challenges of ionic polymer metal composite membranes Furthermore due to the novel battery technology in energy storage devices this book covers the structural optical and related electrical studies of polyacrylonitrile PAN bearing in mind the applications of gel polymer electrolytes in solid state batteries Since energy storage plays a vital role in renewable energy systems another salient part of this book is the research on phase change materials for maximum solar energy utilization and improvement This volume is a useful reference for readers who wish to familiarize themselves with the newest advancements in energy storage systems *Electric Vehicles and the Future of Energy Efficient Transportation* Subramaniam, Umashankar, Williamson, Sheldon S., Krishna S., Mohan, J. L., Febin

Daya, 2021-04-16 The electric vehicle market has been gradually gaining prominence in the world due to the rise in pollution levels caused by traditional IC engine based vehicles The advantages of electric vehicles are multi pronged in terms of cost energy efficiency and environmental impact The running and maintenance cost are considerably less than traditional models The harmful exhaust emissions are reduced besides the greenhouse gas emissions when the electric vehicle is supplied from a renewable energy source However apart from some Western nations many developing and underdeveloped countries have yet to take up this initiative This lack of enthusiasm has been primarily attributed to the capital investment required for charging infrastructure and the slow transition of energy generation from the fossil fuel to the renewable energy format Currently there are very few charging stations and the construction of the same needs to be ramped up to supplement the growth of electric vehicles Grid integration issues also crop up when the electric vehicle is used to either do supply addition to or draw power from the grid These problems need to be fixed at all the levels to enhance the future of energy efficient transportation *Electric Vehicles and the Future of Energy Efficient Transportation* explores the growth and adoption of

electric vehicles for the purpose of sustainable transportation and presents a critical analysis in terms of the economics technology and environmental perspectives of electric vehicles The chapters cover the benefits and limitations of electric vehicles techno economic feasibility of the technologies being developed and the impact this has on society Specific points of discussion include electric vehicle architecture wireless power transfer battery management and renewable resources This book is of interest for individuals in the automotive sector and allied industries policymakers practitioners engineers technicians researchers academicians and students looking for updated information on the technology economics policy and environmental aspects of electric vehicles

Modern Automotive Electrical Systems Pedram Asef, Sanjeevikumar Padmanaban, Andrew Laphorn, 2022-12-28 MODERN AUTOMOTIVE ELECTRICAL SYSTEMS Presenting the concepts and advances of modern automotive electrical systems this volume written and edited by a global team of experts also goes into the practical applications for the engineer student and other industry professionals In recent decades the rapid and mature development of electronics and electrical components and systems have inevitably been recognized in the automotive industry This book serves engineers scientists students and other industry professionals as a guide to learn fundamental and advanced concepts and technologies with modelling simulations and case studies After reading this book users will have understood the main electrical and electronic components used in electric vehicles EVs In this new volume are many fundamentals and advances of modern automotive electrical systems such as advanced technologies in modern automotive electrical systems electrical machines characterization and their drives technology for EVs modeling and analysis of energy storage systems applied artificial intelligence techniques for energy management systems fault detection and isolation in electric powertrains and thermal management for automotive electrical systems Also covered are new innovations such as the use of power electronics in low and high voltage circuits electrified propulsion systems energy storage systems and intelligent energy management methods in EVs Valuable as a learning tool for beginners in this area as well as a daily reference for engineers and scientists working in these areas this is a must have for any library *E-Mobility* M.

Kathires, G. R. Kanagachidambaresan, Sheldon S. Williamson, 2021-12-01 The book provides easy interpretable explanations for the key technologies involved in Electric Vehicles and Hybrid Electric Vehicles The authors discuss the various electrical machines drives and controls used in EV and HEV The book provides a detailed coverage of Regenerative Braking Systems used in EV and HEV The book also illustrates the battery technology and battery management systems in EV and HEV This book is intended for academicians researchers and industrialists In addition this book has the following features Discusses the various Economic and Environmental Impact of Electric and Hybrid Electric Vehicles Discusses the role of Artificial Intelligence in Electric Hybrid Electric Vehicles Illustrates the concept of Vehicle to Grid Technology and the smart charging station infrastructure and issues involved in the same Elucidates the concept of Internet of Vehicles Presents the latest research and applications in alternate energy vehicles *Recent Advances in Mechanical Engineering* Balaguru

Sethuraman,Pushpdant Jain,Manoj Gupta,2023-07-24 This book consists of select proceedings of the 1st International Conference on Sustainable Technologies and Advances in Automation Aerospace and Robotics STAAAR 2022 This book focuses on advancements in the fields of robotics and automation applications of AI aerodynamics computational fluid dynamics material characterization renewable energy computer aided engineering design rapid prototyping aerospace engineering and dynamics and vibrations The major topics in the book include Industry 4 0 applications of additive manufacturing in biomedical automotive and aviation industries implants and prosthesis applications in human body applications of latest technologies such as machine learning IoT static and dynamic balancing force transmissibility advanced mechanisms etc This book provides vital information to researchers academicians and industrialists to enhance their knowledge in the field of recent advancements in the field of mechanical engineering

*Dynamic Systems Modeling of Lithium Ion Battery Systems in MATLAB Inclusive of Temperature Dependency* Joshua Savitz,2017 In order to design a battery system to be used in an electric vehicle dynamic battery system models must be created to understand the complex performance of the system when loaded with varying discharge profiles and in various temperature environments In this way prototyping of the battery systems is partially replaced by simulations that predict the performance instead of battery testing In this thesis performance models were created based on system geometry ambient temperature and current profile to track the runtime voltage output and cell temperature accurately of individual cells and of the system as a whole A single cell 6 cells in series and a parallel set of 6 cell in series in each branch geometries are analyzed at 0C 23C and 35C with a constant pulsed and constant with pulsed current profiles An equivalent circuit model with 1 RC pair inclusive of temperature dependency is hence utilized for the single cell model and then will be implemented into battery system configurations The focus is put on ambient temperature rather than discharge rate so the model parameters are set as functions of state of charge and ambient temperature and found through a parameter estimation conducted within MATLAB Simulink This simple equivalent circuit model captures the dynamic processes happening within the cell s but not to the extent it could with a 2 RC pair model Experimental tests were conducted to derive the model parameters and validate the models The accuracy achieved in the prediction of voltage output within the single cell model is around 50mV which was the initially determined tolerance for max error The multi cell battery system models and thermal models had large amounts of error

**To Advance Modeling Tools and Validate Database from Micro-climate Monitoring Systems and Other Sources to Develop One-hour-ahead PV Forecasts** Byron Washom,University of California, San Diego,2015 **Annual Index/abstracts of Sae Technical Papers, 2000** Society Of Automotive Engineers,2001 [The Affect of Choice of Battery Pack Technology and Size on Hybrid Electric Vehicle Performance and Fuel Economy](#) Robert C. Balch,2000 *Meeting Abstracts* Electrochemical Society,2002 *Manufacturing Science and Technology, ICMST2011* Wu Fan,2011-11-22 Selected peer reviewed papers from the 2011 International Conference on Manufacturing Science and Technology ICMST

2011 September 16 18 2011 Singapore *Electric Vehicle Progress*, 2002 **Annual Report** California Energy Commission. Public Interest Energy Research, 2015 **Technical Literature Abstracts** Society of Automotive Engineers, 2000 Battery System Modeling Shunli Wang, Carlos Fernandez, Yu Chunmei, Yongcun Fan, Cao Wen, Daniel-Ioan Stroe, Zonghai Chen, 2021-06-23 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 The British National Bibliography Arthur James Wells, 2000 *Fractional Order Intelligent Modeling for Lithium-Ion Batteries* YaNan Wang, YangQuan Chen, 2025-11-04 This book focuses on fractional order non integer order modeling FOM techniques coupled with deep neural network based intelligent modeling methods for lithium ion batteries LIBs and battery management systems BMS in general It provides the first one stop resource on FOM for LIBs with case studies using real operational data sets With the rapid growth of electric vehicles and energy storage systems battery technology has become critical to global energy solutions Fractional Order Intelligent Modeling for Lithium Ion Batteries Theory and Practice aims to provide several accurate and effective intelligent modeling algorithms for the next generation of advanced BMS Key topics include intelligent battery modeling fractional order modeling physics informed machine learning state estimation and degradation analysis By integrating AI and physics informed machine learning techniques with fractional order modeling methods this book presents several innovative solutions for next generation battery management systems This title will serve as an invaluable resource for researchers and advanced students in the fields of transportation energy storage and power systems as well as those studying electric vehicles control theory machine learning and fractional calculus based modeling *Modeling and Simulation of Lithium-ion Power Battery Thermal Management* Junqiu Li, 2022-05-09 This book focuses on the thermal management technology of lithium ion batteries for vehicles It introduces the charging and discharging temperature characteristics of lithium ion batteries for vehicles the method for modeling heat generation of lithium ion batteries experimental research and simulation on air cooled and liquid cooled heat dissipation of lithium ion batteries lithium ion battery heating method based on PTC and

wide line metal film self heating using sinusoidal alternating current This book is mainly for practitioners in the new energy vehicle industry and it is suitable for reading and reference by researchers and engineering technicians in related fields such as new energy vehicles thermal management and batteries It can also be used as a reference book for undergraduates and graduate students in energy and power electric vehicles batteries and other related majors **Control Oriented**

**Electrochemical Modeling of Lithium-ion Battery Cells for Applications in EVs, HEVs, and PHEVs** Sandeep Yayathi,2010 Lithium ion batteries provide a high energy density and a high power density source for use in many current PHEV and HEV designs Vehicle energy control strategies are highly dependent on battery performance during various low and high rate operational modes In this thesis an electrochemical model of a lithium ion cell is developed from the literature This model will be used in future development of a larger multi cell battery pack model for use in electric vehicle design and control This model captures the electrochemical reaction as well as heat and mass transfer within the cell A physics based modeling approach is undertaken in this research instead of a parametric modeling technique This approach will make the effect of battery parameters visible in both the model structure and corresponding system response It will make the design of control algorithms more robust to system variation The dynamic effects of the electrochemical reaction and heat and mass transfer within the cell captured by this model are a coupled phenomena which determine lithium ion battery performance and life The cell model is developed using SIMULINK software from The Mathworks In addition to development of the cell level model this thesis will outline the development of an experimental test setup In order to validate the model it is necessary to collect data from actual lithium ion cells under various charge and discharge profiles The experimental logistical and budgetary considerations are also taken into account The final configuration of the lab equipment is robust enough to handle testing of single lithium ion cells from low capacity to high capacity as well as entire battery pack modules for the development of vehicle level power management The automation and data collection for this test setup is accomplished with LabVIEW from National Instruments

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