Lithium-Ion Battery Pack Design For EV

PRIYA DHOTE[1], GAYATRI PADOLE[2], SHASHANK DONGARE[3], NIKHIL RAMTEKE[4], PROF. PRANALI LANGDE[5], ANAND GAJBHIYE[6]

[1, 3, 4, 5, 6] *(Department of Electronics and Telecommunication), J D College of Engineering & Management, Nagpur, Maharashtra.*

[2] *HoD, (Department of Electronics and Telecommunication), J D College of Engineering & Management, Nagpur, Maharashtra.*

Abstract— Electric vehicles are more popular than ICE vehicles. Because of the advantages. It will happen on the grounds that India is home to all things considered dirtied urban areas on the planet additionally EV energy wises multiple times more energy productivity when contrasted with ICE vehicles and it has multiple times fewer parts. The Battery System, which is the core of EVs, comprises cells, Battery Modules, and Battery Packs that are acknowledged by joining battery modules. with the amazing technology of the batteries of the lithium-ion batteries, it is possible to make the most usable batteries in the world. For changing over the ICE vehicles into Electrical vehicles it's fundamental to make the battery pack for that vehicle. For building or fostering the Battery pack we need to think about countless things.

Indexed Terms— MATLAB Simulation, Battery pack

I. INTRODUCTION

Fuel vehicles emit high levels of carbon dioxide and have a significant impact on the climate. To avoid this problem, authorities in the United Kingdom, France, Germany, the Netherlands, and other countries have recently produced electric vehicles, most of them from 2025 to 2040. An important limitation of electric vehicles is the range per charge. This is relevant for the entire vehicle in terms of energy thickness and weight. Lithium-ion batteries are heavier than other battery frames. Lithium-ion batteries have many other great elements. Like a high single-cell voltage above 4V.

In this paper, actually we design the battery pack for EV in the MATLAB Simulation. We learned about the battery pack design for the electric vehicle. To design the battery pack, we have to calculate the all parameters which we need to design the battery pack for the electrical vehicle.

Almost all-important aspects of a pure electric vehicle (EV) depend on the parameters of the high voltage battery. The battery design for the electric vehicle assumes four central input parameters. Chemistry, Voltage, Average energy consumption of the vehicle in one driving cycle Vehicle area

A battery consists of one or more electrochemical cells (battery cells) that convert chemical energy into electrical energy (during discharge) and convert electrical energy into chemical energy (during charging). The type of elements contained in the battery and the chemical reactions during the discharging and charging process determine the chemistry of the battery.

Battery packs need to consider their power and voltage in order to provide the DC voltage to drive the transmission of motors and other vehicles.

For long trips, you need a powerful battery pack. Battery-powered lithium particles were used to plan the powerful battery pack.

By connecting multiple lithium particle batteries evenly in series, you can create a high-voltage, high-output battery pack. The battery pack structure plan is created to support the battery pack. After creating the Li particle cell pack, you need to plan a warm schedule to control the temperature of the battery pack. So far, there are many heat conduction systems for heat dissipation, but here we will introduce the liquid cooling system of the lithium particle battery pack. The main part of the battery pack is the battery management system "BMS" that forms the core of the battery pack. It covers battery pack charging and discharging, cell balancing, SOC and SOH estimation, voltage measurement, current measurement, and

temperature measurement. BMS has its own calculation to perform all estimates and control the battery pack.

II. BATTERY PACK CALCULATION

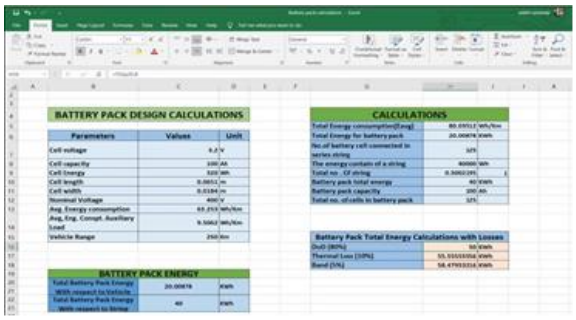
For the battery pack calculation we need know about the parameters to make the high voltage battery pack :

1. Battery cells
2. Cell Voltage
3. Cell Capacity
4. Nominal Voltage
5. Average Energy Consumption
6. Auxiliary Load Energy Consumption
7. Energy Consumption for Battery Pack
8. Vehicle Range
9. Total Energy for Battery pack

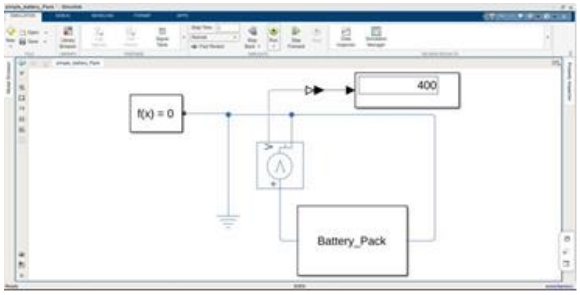
With the cell parameters and the core requirements for the battery (nominal voltage, average energy consumption, and vehicle range), we calculate the main parameters of the high voltage battery.

Battery pack total energy Ebp [Wh]
Ebp=Eavg·Dv
Number of battery cells connected in series Ncs
Ncs=Ubp/Ubc
Energy content of a string Ebs [Wh]
Ebs=Ncs·Ebc
Number of strings of the battery pack Nsb
Nsb=Ebp/Ebs
Battery pack total energy Ebp [Wh]
Ebp=Nsb·Ebs
Battery pack capacity Cbp [Ah]
Cbp=Nsb·Cbc
The total number of cells of the battery pack Ncb
Ncb=Nsb·Nc

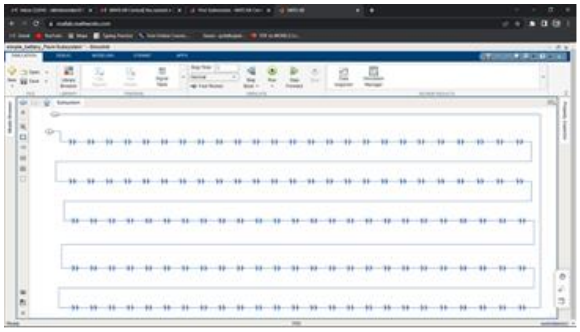
III. BATTERY PACK CALACULATIONS ON EXCEL



IV. DESIGN BATTERY PACK MATLAB MODEL



V. SERIES CONNECTION OF LI-ION BATTERIES IN MATLAB MODEL



VI. CONCLUSION

This paper has mainly studied the battery pack formed by lithium-ion cells with different degradation levels in series for EV application. Through Various experimental tests and simulation, the characteristics of series connected battery pack has been analyzed and discussed. To design battery packs and ensure the safe operation, the information and knowledge of cell inconsistency is necessary

REFERENCES

[1] J. Warner, The Handbook of Lithium-Ion Battery Pack Design, Chemistry, Components, Types and Terminology, 1st Edition, Elsevier Science, 2015. [17] T. P. J. Crompton, Battery Reference Book, 3rd Edition, 2000: Newnes.

[2] S. Dhameja, Electric Vehicle Battery Systems, Newnes, 2001.

[3] A. Emadi, Advanced Electric Drive Vehicles, 2017: CRC Press.

[4] J. Larminie and J. Lowry, Electric Vehicle Technology Explained, 2nd Edition, Wiley, 2012.

[5] G. Pistoia, Lithium-Ion Batteries: Advances and Applications, Newnes, 2013.

[6] P. Miller, "State of the art and future developments in lithium-ion battery packs for passenger car applications," Johnson Matthey Technology Rev., vol. 1, no. 59, pp. 4-13, 2015.

[7] M. Zheng, B. Qi and H. Wu, "A Li-ion battery management system based on CAN-bus for electric vehicle," in 3rd IEEE Conference on Industrial Electronics and Applications, Singapore, 2008.

[8] M. Brandl, H. Gall, M. Wenger, V. Lorentz, M. Giegerich and F. Baronti, "Batteries and battery management systems for electric vehicles," in Design, Automation & Test in Europe Conference & Exhibition (DATE), Dresden, 2012.

[9] H. Zhu, Z. Wu, W. Dalong and S. Jiayao, "Design and Implementation of Distributed Battery Management System," Advanced Materials Research, Vols. 608-609, pp. 1039-1042, 2012.