REPORT

ELECTRIC VEHICLE BATTERY MANAGEMENT

EEE4016- ELECTRIC VEHICLES

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INTRODUCTION

A Battery Management System (BMS) is totally electronic system in battery pack linked with battery of a vehicle such as car. We understand the connection between battery's State of Charge (SOC) and State of Estimation (SOE) for lithium-ion battery under many working conditions. So the strategy of SOC and SOE estimation assists with diminishing the computational difficulty to the processor utilized in BMS and hence it is appropriate for implementation in Electric vehicle applications. The report on the battery management system will cover the aspects related to the recent developments and trends of battery chemistry technologies, technologies regarding batteries and technologies replacing batteries. Technologies of move and charge and wireless power drive will help alleviate the overdependence of batteries.

OUTLINE

- The electric vehicle model is a complete representation of an electric vehicle shown by using MATLAB/Simulink built using powertrain block sets. It includes vehicle dynamics and electrical system each containing sub systems that relates to vehicle body and tyres.
- The battery pack contains 30 number of cells in series and 2 number of cells in parallel each. The simulation is done taking the manual tuning of the PID controller tracks the reference speed. The power losses are less and hence the efficiency is increased as compared to normal IC vehicles or HEV.
- Different Test Sequences has been implemented and have different conditions like for balancing Charging and driving. Test Sequence 1 include Driving Condition, Balancing Condition and Charging Conditions with Transition Occurring at specific time intervals. Test Sequence 2 includes Driving and Charging Condition. Test Sequence 3 includes only Charging.
- The primary plot between Voltage and Time (hours) with value of current indicate discharge characteristics when discharged at the same current value. Further after observing the battery discharge correlation that the battery range is declining remarkably on increasing current discharge rates.

SYSTEM MODELLING/EXPLAINATION

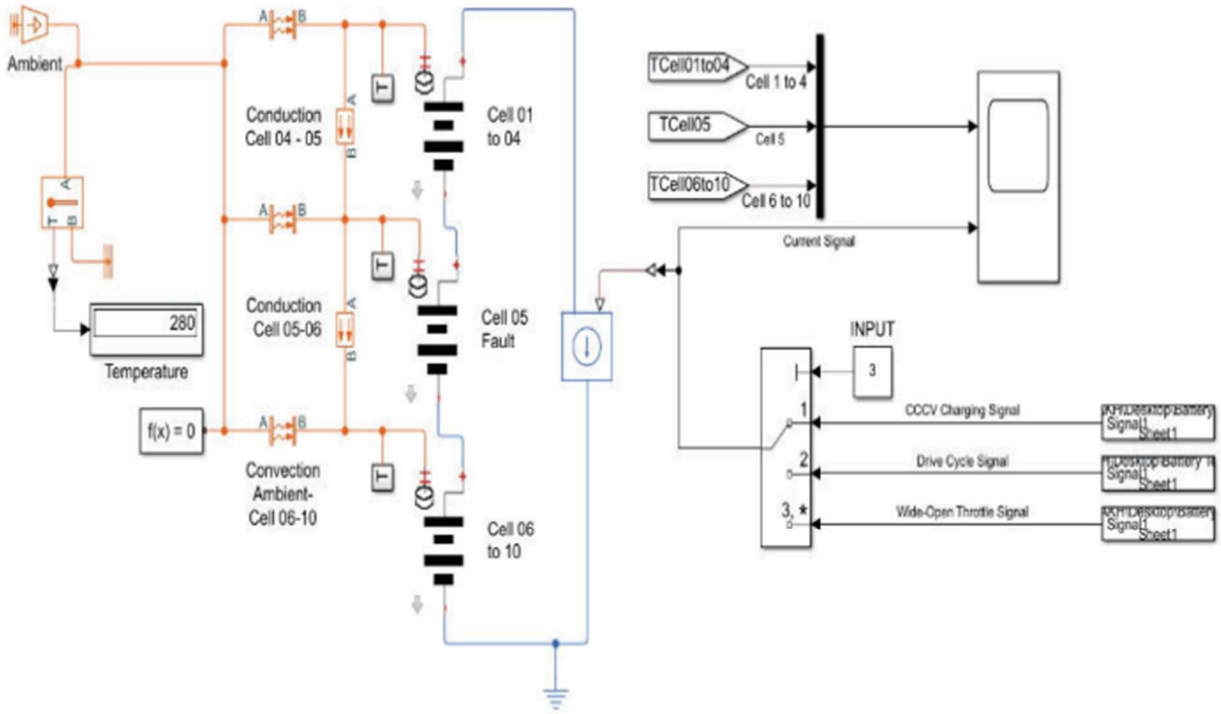

Figure 23. Thermal Modelling of battery pack

Source: Google

EV has more advantages over conventional ICE vehicles including energy efficiency, instantaneous power, quite operation and much more. The battery performance is mainly dependent upon the working ambient temperature. The simulation of thermal behaviors show the impact of a faulty cell on performance and cell temperatures. In order to achieve determined performance variation in temperature and cell capacity in the battery pack leads to change in thermal behavior which as a result leads to under-utilization under charging or vice-versa deteriorating the battery pack life.

RECENT TRENDS/LITERATURE SURVEY

- The battery should give a stable output with different acceleration and it should have a higher C rate. Long life cycle is more important for electric vehicle battery and the maintenance cost also decreases.
- Li-polymer has the highest energy density with respect to the Li-ion but considering the battery safety, Li-polymer is dangerous to use in electric vehicle because in a collision or over-heat or over-charge, the battery can be exploded.

- There are lot of battery types that can be used as electric vehicle batteries: - Lead acid batteries, Lithium-ion battery (Li-ion), Nickel metal hydride battery (Ni-MH), Lithium polymer battery (Li-Po) and Fuel cell technology.
- **Lead-acid battery**: - It is the most widely used type for in automobiles and have a lower energy density as compared to other more modern battery types. Normally lead-acid batteries are rated at room temperature and operates well around this temperature. Reduction in temperature results in performance decline and higher temperature results in shortening of battery life.
- **Lithium-ion battery**: - It is the lightest metal with the highest negative sub-atomic particles and lowest atomic weight. Li-ion and NiMH batteries produces equivalent amount of energy. Charging and discharging of Li-ion batteries typically faster than Lead-acid and NiMH batteries.
- **Ni-MH Battery**: - It is the most widely used battery for laptops, camcorders and mobile phones. They have low maintenance cost, design flexibility, high power and energy density. Besides, they are safer to use than Li-ion batteries, but still for EV Li-Ion batteries are most preferred than Ni-MH batteries because of its faster charging.
- **Future Batteries**: - To meet the energy requirements compete with the energy crisis in the future the electric vehicle batteries must be developed similar to the fossil fuel. High energy density, high current density and wide range of temperature must be there in the future electric vehicle batteries along with the cost of the batteries being reduced.

New battery	Negative Electrode	Positive Electrode	Electrolyte	Challenges
Lithium + sulfur	Lithium Metal	Sulphur with Carbon	Organic based	Safety & life time
Lithium + Fluorine	Lithium Metal	Me_xF_y	Solid state polymer	High temperature required Perfect material distribution in the atomic structure
Lithium + Air	Composite carbon	Li & Ni plates	Solid polymer	Life time & safety

Source: Google

BODY OF THE REPORT

Every battery has an internal resistance and with time the resistance increases because of the battery chemistry. Since the battery is the main power source of running electric vehicle so the energy stored in an EV should be maintained properly to maximize the range of the vehicle. In an EV, there are 100's of batteries and if one get a fault, then it would affect the whole system. So battery management system is needed so that the safety and reliability of the battery can be maintained. A comprehensive battery management system should have the following functionalities: -

a) Data acquisition
b) Safety protection
c) State of battery determination
d) Controlling of battery charging and discharging
e) Cell balancing
f) Thermal management
g) Sending information about the battery status and authentication to the user interface.
h) Communication between each battery component
i) Extending the battery life
j) Regenerative energy management

CONCLUSION

- We observed through the simulation that the battery SOC shows a linear and a slow discharge Rate, and Charging Peak at 950 sec because of Regenerative Braking in Vehicle.
- Power losses in EVs are very less than conventional because they use complex gear system.
- Efficiency of EV is more compared to HEV or ICE vehicles.

REFERENCE

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