Chapter 8
Modelling and Performance Analysis of Battery Thermal Management System for Electric Vehicles on MATLAB/Simulink

Gaurav Raj Pandey
https://orcid.org/0000-0002-0100-9248
Independent Researcher, India

Kheelraj Pandey
Amity University, Lucknow, India

Ashwani Sharma
https://orcid.org/0000-0003-2749-1666
Amity University, Lucknow, India

ABSTRACT

The battery pack in an electric car plays a vital role in converting direct current (DC) from the battery into alternating current (AC) to power the induction motor. It is a complex arrangement of batteries connected in series and parallel to meet the power requirements of electric vehicles. A Battery Management System (BMS) is employed to ensure safe and efficient operation. The BMS oversees and regulates the battery's performance by monitoring and managing voltage, current, temperature, and state of charge. This prevents any parameters from exceeding safe levels,

DOI: 10.4018/979-8-3693-4314-2.ch008

ensuring the longevity and safety of the battery. The Battery Thermal Management System (BTMS) involves monitoring the temperature of the battery packs and initiating the cooling process when the temperature rises. This prevents excessive heat that could lead to component failure. MATLAB/Simulink is used to develop BTMS that analyze and compare temperature and state of charge parameters with and without the integration of a cooling system connected to the battery pack, aiming to improve battery pack performance.

MODELLING AND PERFORMANCE ANALYSIS OF BATTERY THERMAL MANAGEMENT SYSTEM FOR ELECTRIC VEHICLES ON MATLAB/SIMULINK

The electric car's battery pack converts direct current (DC) from the battery into alternating current (AC) to power the induction motor through power electronic components, making it a vital component of the vehicle. The battery pack in electric vehicles is a sophisticated system comprised of multiple batteries that are interconnected both in series and parallel configurations. This setup is designed to meet the high-power demands of electric cars, necessitating careful monitoring and control to ensure the safe and optimal functioning of the battery pack. To ensure the safe and effective functioning of the batteries, a Battery Management System (BMS) is employed. The BMS oversees and regulates the battery's performance to guarantee safe and efficient operation. It is responsible for monitoring and managing voltage, current, temperature, and state of charge to prevent any parameters from exceeding safe levels, ensuring the battery's longevity and safety. The correct positioning and effective use of the Battery Management System (BMS) play a vital role in ensuring the peak performance and safety of the battery within an electric vehicle. It is imperative to place the BMS in a strategic location within the vehicle to monitor and regulate the battery's functions efficiently. Additionally, the proper utilization of the BMS is essential in managing the charging and discharging processes of the battery to maximize its lifespan and overall performance. The thermal management of BMS involves monitoring the temperature of battery packs. When the temperature rises, a control signal is sent to the coolant circuit, initiating the cooling process to regulate the temperature. This is crucial in preventing excessive heat that could lead to component failure. The temperature of the battery pack is measured during charging, discharging, and while the electric vehicle is in operation. To improve battery pack performance, MATLAB/Simulink is used to develop battery thermal management systems that analyze and compare temperature and state of charge (SoC) parameters with and without the integration of a cooling system connected to the battery pack.

Leakage Minimization in CMOS VLSI Circuits: A Brief Review

Saurabh Chaudhuryand Rohit Lorenzo (2016). *Design and Modeling of Low Power VLSI Systems (pp. 71-99).*

www.irma-international.org/chapter/leakage-minimization-in-cmos-vlsi-circuits/155050