T. Y. B. Tech (Electrical and Computer Engineering)

Trimester: V **Subject: Electric vehicle technology**

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Roll No: 37 **Batch: A2**

Experiment No: 02

Name of the Experiment: EV battery simulation in Matlab.

Performed on **Submitted on:**	**Marks**	**Teacher's Signature with date**

Aim: To understand EV battery simulation using Matlab.

Resources: Matlab 2022, Simscape toolbox

Theory: Simulating electric vehicle (EV) batteries in MATLAB involves modelling the behaviour of battery cells to predict their performance under different conditions.

- Battery Modelling
- State of Charge (SOC) Estimation
- State of Health (SOH) Estimation
- Thermal Modelling
- Charging and Discharging Algorithms
- Validation and Verification

Procedure:

Start Simulink: Open MATLAB and start Simulink by typing simulink in the MATLAB command window.

Create a New Model: In the Simulink window, click on "File" -> "New" -> "Model" to create a new Simulink model.

Add Battery Blocks: Drag and drop battery blocks from the Simulink library browser onto the model canvas. Depending on the level of detail you require, you can choose from simple blocks like the "Battery" block or more complex blocks like "State-Space Battery" or "Equivalent Circuit Battery" blocks.

Connect Blocks: Connect the battery blocks with appropriate connections to represent the flow of signals and energy within the battery system. For example, connect the battery block's electrical ports to the rest of the powertrain model or charging system.

Parameterize Blocks: Double-click on the battery blocks to open their block parameters dialog boxes. Enter the relevant parameters such as battery capacity, internal resistance, voltage characteristics, temperature coefficients, and other parameters based on your chosen battery model and data.

Add Control Algorithms: If your simulation involves control algorithms for charging, discharging, thermal management, or other functions, you can add control blocks from the Simulink library browser and connect them to the battery blocks.

Define Simulation Parameters: Set the simulation parameters such as simulation time, solver options, sample time, and other relevant settings by clicking on "Simulation" -> "Configuration Parameters" in the Simulink menu.

Define Inputs and Conditions: Define input signals such as driving profiles, charging profiles, ambient temperature, and other environmental conditions required for your simulation. You can use MATLAB workspace variables, imported data, or Simulink blocks to generate these signals.

Run Simulation: Click on the "Run" button in the Simulink toolbar to start the simulation. Monitor the simulation progress and check for any errors or warnings in the simulation console window.

Analyze Results: After the simulation completes, use Simulink's built-in visualization tools to analyze and plot simulation results. You can visualize battery voltage, current, state of charge (SOC), temperature, power flow, and other relevant variables over time.

Iterate and Optimize: Iterate on your model, fine-tuning parameters, adjusting control algorithms, and optimizing the design based on simulation results. Repeat the simulation process as needed to refine your model and achieve desired performance.

Documentation and Reporting: Document your Simulink model, including block diagrams, parameter settings, simulation results, and analysis findings. Prepare a report or presentation summarizing your simulation methodology, results, and conclusions.

Reference link: YouTube.com/watch?v=d7L_gv344Ic&ab_channel=CSElectricalAndElectronics

Conclusion- The MATLAB simulation of the EV battery reveals dynamic SoC behaviour, temperature effects, and efficiency profiles, providing crucial insights for optimising battery management strategies and enhancing overall electric vehicle performance and longevity.