MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

Department of Electrical and Electronics Engineering

PE Lab – V Semester

MINI PROJECT ABSTRACT

TITLE

Regenerative Braking System Simulation using Simulink

Submitted by

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Abstract

The growing demand for energy-efficient transportation has accelerated research in electric vehicle (EV) technologies.

Among various innovations, regenerative braking systems (RBS) have emerged as a sustainable solution for energy recovery during braking events. This project focuses on the modeling and simulation of a regenerative braking system using MATLAB/Simulink.

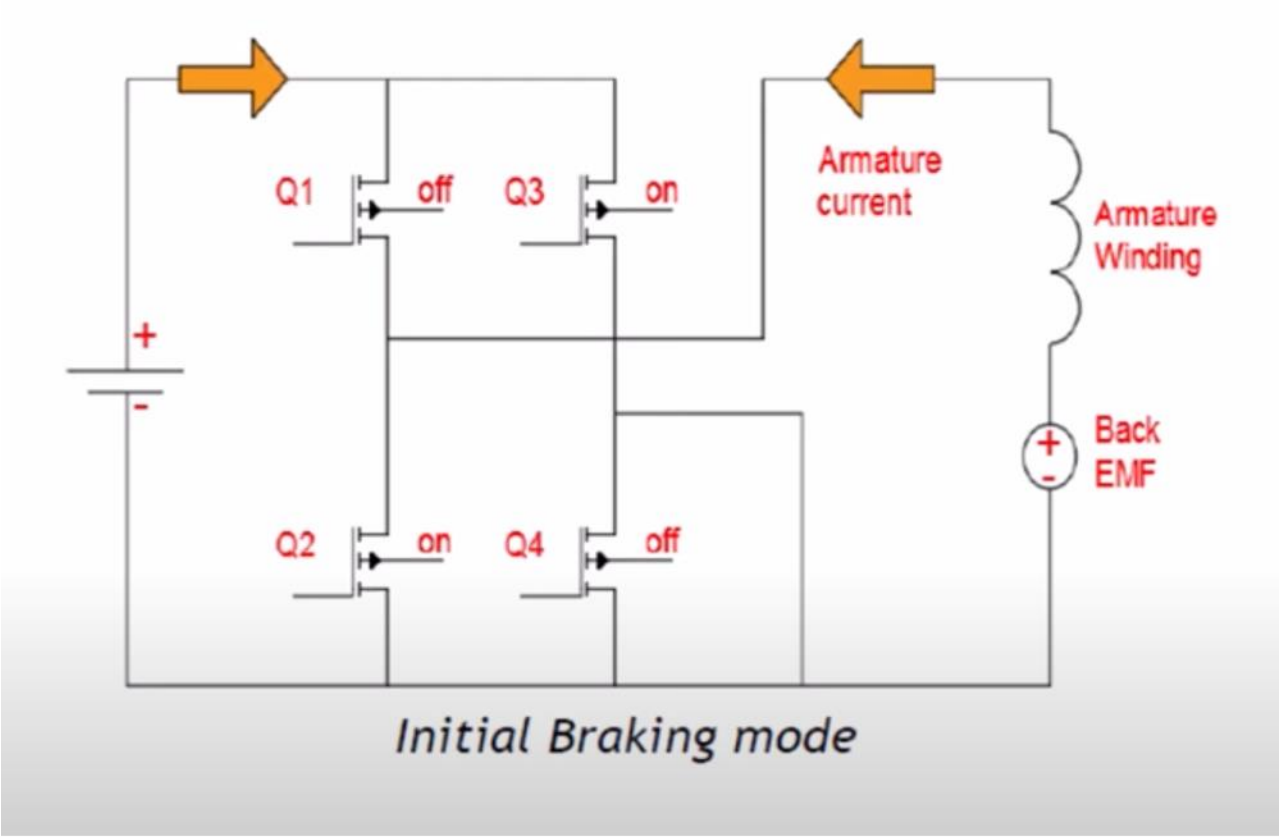
A DC motor is employed to replicate the traction motor of an electric vehicle, and an H-bridge inverter circuit is designed for controlled power flow between the motor and the energy storage system. During motoring mode, the motor draws energy from the battery to drive the vehicle, whereas in braking mode, the motor operates as a generator, converting kinetic energy into electrical energy and feeding it back into the storage unit.

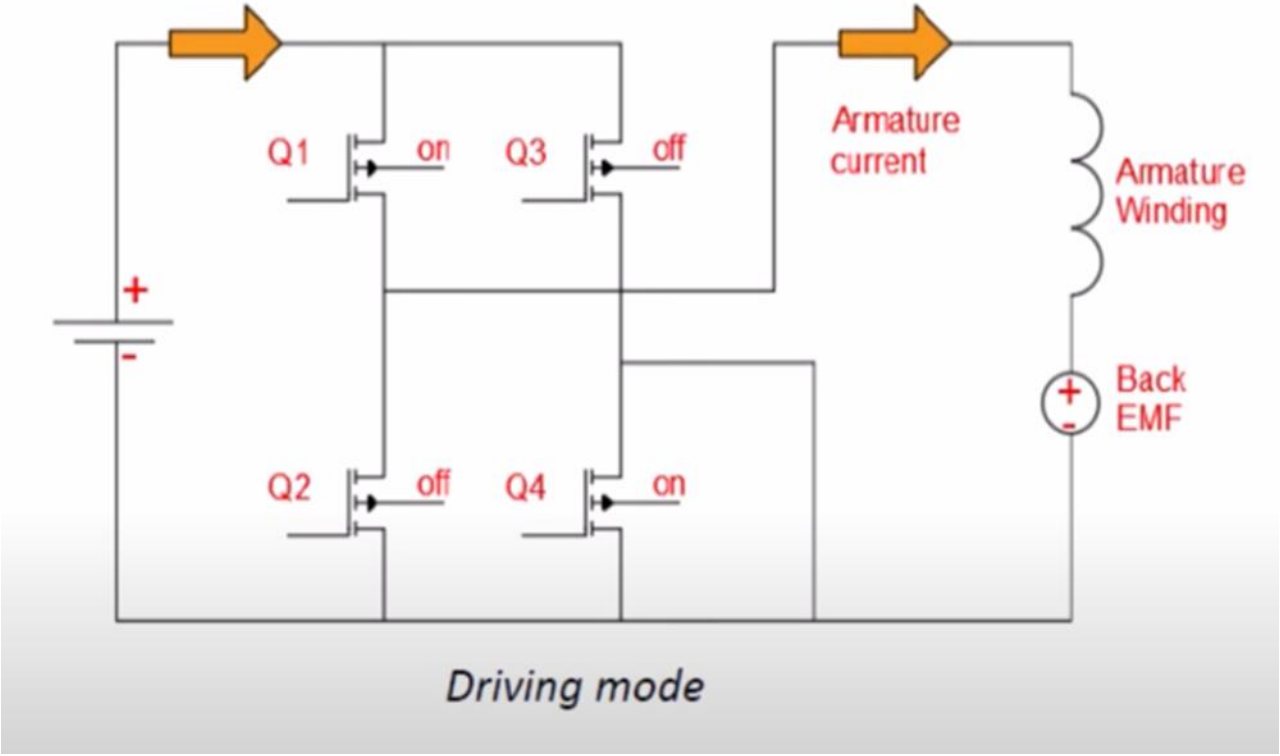
The simulation incorporates battery dynamics, pulse generation control, and torque variations to analyze system response under different operating conditions.

Performance parameters such as motor speed, torque, armature current, state of charge (SOC), and battery voltage are continuously monitored. Results demonstrate effective energy recovery, thereby enhancing vehicle range and efficiency.

This project highlights the importance of regenerative braking in reducing energy wastage, minimizing wear on mechanical braking components, and contributing to the development of sustainable electric mobility solutions.

Circuit Diagram





Initial Braking Mode:

In this mode, the DC motor operates as a generator. Switches Q2 and Q3 are ON, while Q1 and Q4 are OFF. The kinetic energy of the vehicle is converted into electrical energy, and the resulting armature current flows back toward the battery. This process enables energy recovery instead of wasting it as heat, thereby charging the battery during braking.

Driving Mode:

In driving mode, the motor functions conventionally, drawing power from the battery to produce motion. Switches Q1 and Q4 are ON, while Q2 and Q3 are OFF. The current flows from the battery through the motor's armature winding, producing torque to drive the vehicle. Here, the system works in motoring mode, delivering energy from the battery to the wheels.