USE OF SUPER CAPACITORS IN PERMANENT MAGNET SYNCHRONOUS MOTOR DRIVE FOR E-MOBILITY

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Introduction:

The growth of electric vehicles industry increasing day by day due to EV's greater efficiency, less emission, low noise level and no oil fuels required when compared to combustion engines. The battery holds the significant role in improving the performance of the EVs. As it is the main source of energy that drives an EV due to which need for reducing electrical losses and quick charging of battery is being developed. The performance of the battery can be improved with the means of battery management systems, helps in increasing the distance coverage of EVs on single charge. The use of electric drives has an advantage that it can also be used as an electric generator, hence utilized for regeneration of energy during braking. Electric power can also be generated by other forms, such as solar photovoltaic cells installation on top of the vehicles and also by the use of micro wind turbines. Due to the fast charging and discharging period, energy storage device like super capacitors are used with the help of a hybrid energy storage system. The super capacitors have low energy density and high power density enabling the use of these devices more handy. The stored energy can be utilized during the peak demand for current such as building up of initial torque.

Objectives:

Batteries are the go-to technology for powering electric vehicles of all kinds but super capacitors (ultra-capacitors) are increasing in capacity and performance to become a viable alternative in some applications.

Super capacitor technology is already well-established in stop-start and mild hybrid architectures. Unlike batteries uses an electrochemical process, are based on electrostatic techniques.

This provides fast charging with millions of charge-discharge cycles that batteries cannot be delivered and it’s not degraded over time. However, they cannot hold the charge for very long, so are an ideal companion to batteries in many e-mobility designs.

In stop-start and hybrid topologies, super capacitors are used to provide power to the power train quickly and easily without putting a strain on the battery pack. With kinetic energy recovery systems, the energy recovered from the braking or suspension system can be captured and reused easily without having to access the battery pack. This also

reduces losses, and over time improves the efficiency of the overall system and extends the range of drive.

The materials used for super capacitors are also improving, with new approaches such as curved grapheme or glass polymer mats, boosting the energy density. This is creating a class of devices some like to call a super capacitor, although the terms are interchangeable.

Methodology:

The main goal of the project is to Design of super capacitors in the electric vehicle to travel for longer distance. The system mainly consists of NTC thermostat (NEGATIVE THEMPERATURE coefficient) temperature sensor permanent magnet synchronous motor, lithium ion, battery, super capacitor.

The concepts of implementation and components used for the project is explained briefly

- The batteries are used to store charge when EV's kept in charging.
- Super capacitor is replaced instead of capacitors. They have rapidly charge or discharge a high amount of power without damaging its ability to store the energy.
- NTC thermostat will sense the temperature of the battery and protect from the damage of batteries.
- When the supply is given to the motor, the motor will convert electrical energy to the mechanical energy and the EV will be driven.

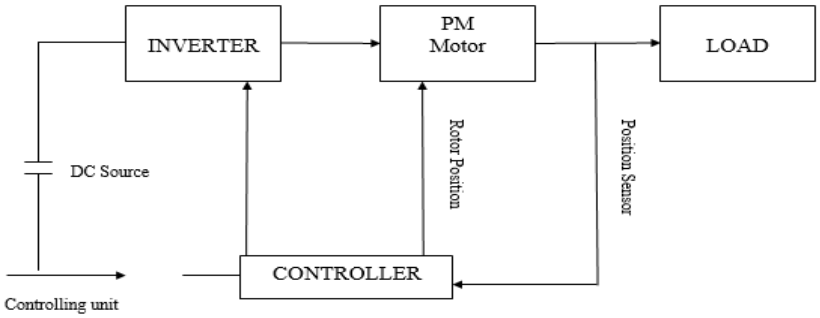


Fig: 1 Block Diagram of PMSM DRIVE

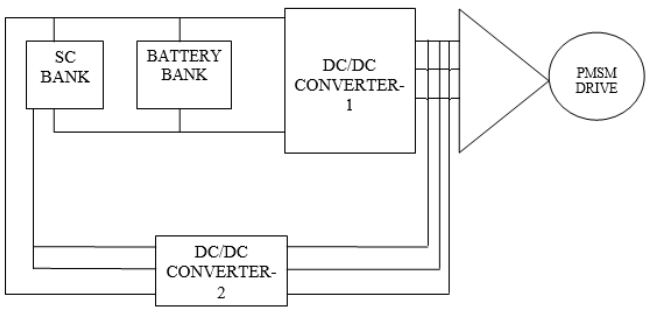


Fig: 2 PMSS System

Conclusion:

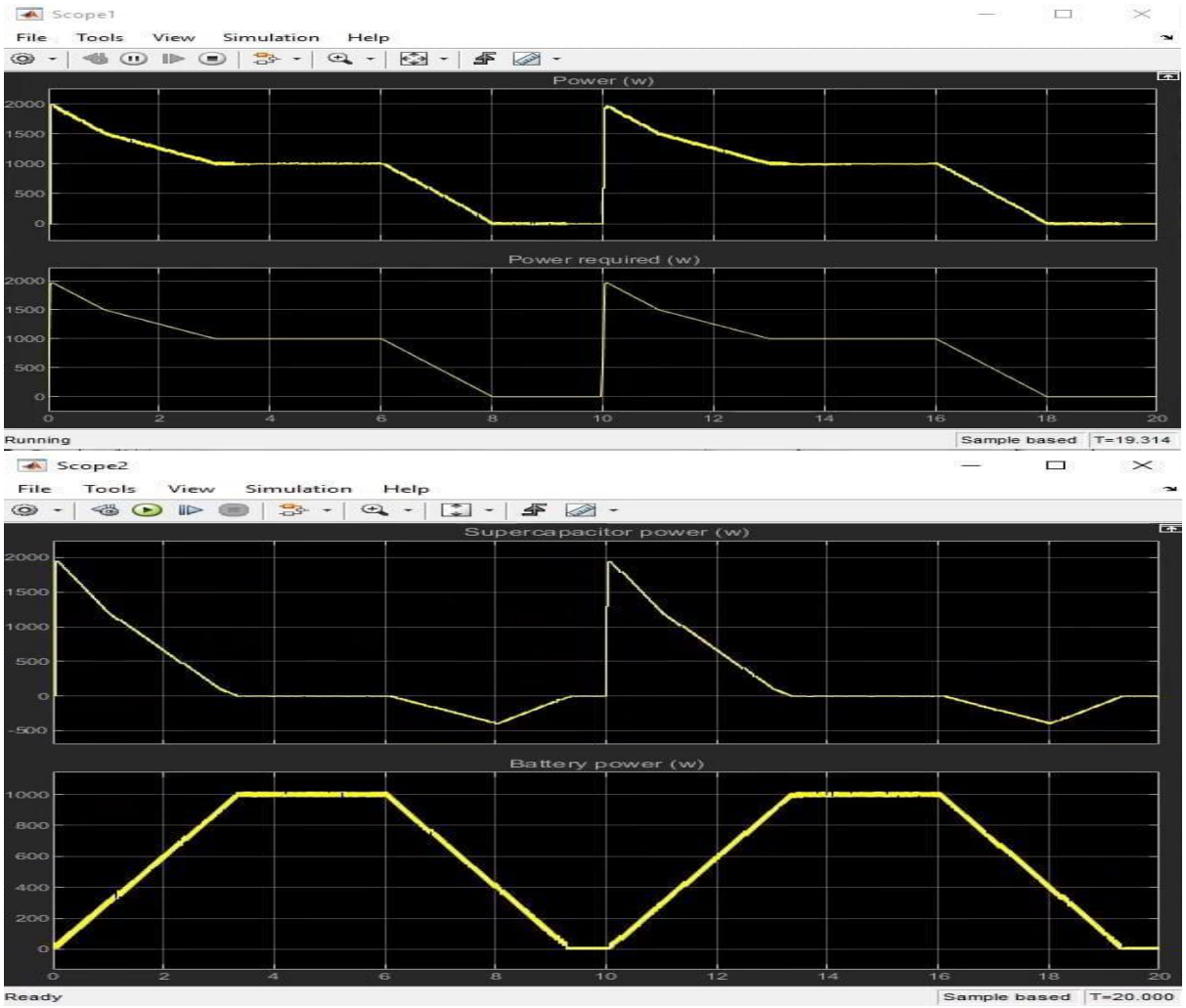
In this an EMS is proposed which allows controlling the energy provided by and supplied to the storage system consisting of batteries and super capacitors in a way to increase the autonomy of batteries and control system for evaluating the proposed system a PMSM is used as traction motor supplied by the batteries and super capacitor bank though an inverter. This model is simulated in the Mat Lab software.

The EMS allows to exploit the advantages of super capacitor characteristics like high charging and discharging. It will extend the life of batteries, increase the charging cycles of batteries, continuous acceleration, and there-acceleration high current, regenerative braking system used in super capacitor.

The PMSM is used to driver's EVs using an inverter fed by a variable Voltage DC Bus. The latter is provided by observers that estimate the position and the speed values.

Due to variation of the dc-link voltage using feed-forward compensation to eliminate disturbances.

The variation of the DC Link voltage aims to make an EV with a topology battery and super capacitor be able to regenerative to provide energy for super capacitor in aid of batteries during speed transients.



Scope for future work:

1. To supply excessive electricity and bridge electricity gaps
2. Used in wind turbines, electric powered and hybrid vehicles
3. Regenerative braking to launch the electricity in acceleration
4. To begin electricity in begin-prevent systems
5. Regulate voltage in the electricity grid
6. To seize and help the electricity in decrease hundreds and lifted hundreds
7. Back-ups the electricity in a brief discharging state.
8. Industrial and digital applications

Reference:

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