

The feedback-based technical scheme of Metro regenerative braking energy can effectively solve the rapid transfer and comprehensive utilization of regenerative electric energy and can effectively alleviate the reverse impact of regenerative electric energy on traction power supply system. In order to quantify the feedback power capacity and optimize the train ...

This paper proposes a novel hybrid energy storage system (HESS) for the regenerative braking system (RBS) of the front-wheel induction motor-driven battery electric vehicle. The HESS is an amalgamation of multiple hybrid supercapacitors (HSCs) and lithium-ion battery cells. An artificial neural network (ANN)-based RBS control mechanism was used to ...

The application of multiple energy storage systems (MESS) in urban railway can recover the regenerative braking energy of trains, and the coordinated control strategy affects the energy-saving and voltage-stabilizing effect of MESS. This paper takes the dual energy storage systems of urban railway as an example to introduce the composition of the system. ...

A brake voltage following energy management strategy of ESS is proposed to adjust the charging and discharging threshold voltage based on the analysis of train operation states to realize the maximum usage of the ESS. The utilization of a supercapacitor energy storage system (ESS) to store regenerative braking energy in urban rail transit can achieve an ...

This study concludes that among the storage technologies, supercapacitor ESS appears to be the most suitable followed by Lithium-ion batteries and flywheels. Electrified urban railway systems are large consumers of energy in urban areas and thus, there is a need for energy saving measures in this transportation sector. Recuperation of train's regenerative ...

An improved braking energy recovery strategy based on ideal braking force distribution (curve I) was proposed for the regenerative braking system (RBS) of a small four-wheel drive (FWD) EV and shown to be able to effectively achieve the Regenerative braking function under different braking conditions while ensuring braking efficiency and braking stability.

@article{Ceraolo2018EnergySS, title={Energy storage systems to exploit regenerative braking in DC railway systems: Different approaches to improve efficiency of modern high-speed trains}, author={Massimo Ceraolo and Giovanni Lutzemberger and Enrico Meli and Luca Pugi and Andrea Rindi and Giuseppe Pancari}, journal={Journal of energy storage ...

two methods, the advantage of energy storage is that it endows regenerative braking energy with a time attribute [12]. And compared with other forms of energy storage, supercapacitors (SC) have higher power

density, longer service life and can be used in a wide range of temperature, making them more suitable for application in urban rail trains ...

This paper proposes an integrated regenerative braking energy utilization system (RBEUS) to improve regenerative braking energy (RBE) utilization in electrified railways. The proposed RBEUS uses a traction substation energy storage system and two sectioning post converters to achieve coordinated RBE utilization in three consecutive traction substations via power ...

In this paper, a fast battery cycle counting method for grid-connected Battery Energy Storage System (BESS) operating in frequency regulation is presented. The methodology provides an approximation for the number of battery full charge-discharge cycles based on historical microcycling state-of-charge (SOC) data typical of BESS frequency regulation operation. An ...

Since the energy storage capacity of battery is much greater than the coil spring, the electric energy storage method always participates in energy recovery throughout the entire braking process. The total recycled energy ( $E_{sum1}$ ) is the sum of the deformation energy of the coil spring and the feedback energy to the power battery.

DOI: 10.1016/J.JPOWSOUR.2019.04.083 Corpus ID: 197318007; Energy transfer and utilization efficiency of regenerative braking with hybrid energy storage system @article{Zhao2019EnergyTA, title={Energy transfer and utilization efficiency of regenerative braking with hybrid energy storage system}, author={Wanzhong Zhao and Gang Wu and ...

The research focuses on Regenerative Braking System (RBS) of Series Hybrid Energy Storage System (SHESS) with battery and ultracapacitor (UC), which serves the deceleration as the ...

The application of Lithium-ion batteries as an energy storage device in EVs is considered the best solution due to their high energy density, less weight, and high specific power density. ... Recalibration of Coulomb counting method is done using EKF and State of Available power is estimated by ANFIS. 2.5.4. Support Vector Machine (SVM)

A large amount of braking energy will be generated during the braking process of the train, which contains a large number of harmonics. If this part of the energy is fed back to the traction network, it will have an impact on the traction network and affect the power quality of the traction network []. At the same time, this part of energy cannot be effectively used by trains ...

Semantic Scholar extracted view of "Effect of energy-regenerative braking on electric vehicle battery thermal management and control method based on simulation investigation" by Jin Huang et al. ... Experimental results show that the proposed control method of a hybrid energy storage system (HESS) achieves a satisfactory performance, including ...

This paper focuses on the implementation of regenerative braking in an electric vehicle equipped with a brushless DC (BLDC) motor. The paper signifies the advantages of regenerative braking and discusses the control design and simulation of a hybrid energy storage system (HESS) with a new method of energy management comprising lithium battery (BT), ...

An integration of current over time is used to define the value of SoC in coulomb counting methods. Coulomb counting is a widely used algorithm because of its simplicity and reliability [10]. Means to improve the coulomb counting methods are proposed in [11], [12] by considering the capacity change from self-discharge, temperature and current rate.

Energy storage systems (ESS) are highly attractive in enhancing the energy efficiency besides the integration of several renewable energy sources into electricity systems. While choosing an energy storage device, the most significant parameters under consideration are specific energy, power, lifetime, dependability and protection [1]. On the ...

braking process of the hydraulic energy storage braking energy regeneration system under various operating conditions. He separated the four working situations of the hydraulic energy storage brake energy regeneration system's vehicle braking process into four categories: coasting, medium intensity, emergency, and gradual deceleration braking.

The regenerative braking of electro-hydraulic composite braking system has the advantages of quick response and recoverable kinetic energy, which can improve the energy utilization efficiency of the whole vehicle [[1], [2], [3]]. Nowadays, the energy storage component for the regenerative braking mostly adopts the power supply system composed of pure battery, ...

The combination of energy storage system (ESS) and HSRS shows a promising potential for utilization of regenerative braking energy and peak shaving and valley filling. This ...

The proposed centralized-decentralized control strategy for regenerative braking energy utilization and power quality improvement in the modified AC-fed railway system with energy-storage-based smart electrical infrastructure can enhance the ability to withstand and rapidly recover from disruptions. This paper proposes a centralized-decentralized control ...

To achieve accurate and efficient braking deceleration control, this research focuses on energy recovery process with ultracapacitor (UC). According to the statistical ...

This paper deals with design and simulation of a hybrid electrical energy storage (HEES) for Esfahan urban railway under regenerative braking condition. The HEES presented in this paper, is comprised of battery and supercapacitor. The capacity of the supercapacitor and battery is calculated based on regenerative braking energy from each train considering other ...

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Energy loss during charging for each cell is computed as  $E_{ch,loss} = (E_{ch,fresh} - E_{ch,i}) / E_{ch,fresh} \times 100$ , where  $E_{ch,fresh}$  is the energy for the fresh cell and  $E_{ch,i}$  is the amount ...

With the continuous increase of electric multiple unit (EMU) train service life, the train will be out of operation, but there are still some parts on the train can work normally. When EMU trains operate in regenerative braking state, a large amount of energy will be returned to the traction grid. In this paper, the decommissioned train equipment is selected, and the energy ...

capacitor and the brake demand, to calculate the energy harnessed from the braking power. With the proposed machine learning techniques, there has been a 59% increase in energy extraction compared to fuzzy logic and artificial neural network methods used for regenerative energy extraction.

through better kinetic energy capturing. Regenerative braking is investigated in Kumar et al. [18]. however that paper focuses on adjusting the braking effort from both the conventional braking and the regenerative braking so that the driver feels no difference with reference to the braking method. However in this paper

Examples and simulation results show that the OSA with the proposed P& C-Method can realize effective recovery of whole absorbed braking energy and have high energy-savings/weight ratio. On-board energy storage system (ESS) is an important technical solution of energy-savings in urban rail transit (URT). On-board Energy storage array configure is a key ...

Table 3 presents the techno-economic comparisons of the energy storage technologies covered in this section. - "Review of Energy Storage Systems in Regenerative Braking Energy Recovery in DC Electrified Urban Railway Systems: Converter Topologies, Control Methods & ...

The introduction and development of efficient regenerative braking systems (RBSs) highlight the automobile industry's attempt to develop a vehicle that recuperates the energy that dissipates during braking [9], [10]. The purpose of this technology is to recover a portion of the kinetic energy wasted during the car's braking process [11] and reuse it for ...

This paper will present the regenerative braking quantification, design control, and simulation of a hybrid energy storage system (HESS) for an electric vehicle (EV) in extreme conditions. The EV is driven by two 30-kW permanent magnet synchronous motors. The HESS contains a Li-Ion battery and ultracapacitor (UC) storage element sources as well as a ...

The rapid growth of the automotive sector has been associated with numerous benefits; however, it has also brought about significant environmental deterioration of our planet. Consequently, attention on minimizing the impacts of this industry have led to the development of kinetic energy recovery systems known as regenerative

braking systems (RBS). RBSs ...

This study presented a novel design of regenerative braking, which helps to save energy and electricity in electric vehicles (EVs). The simulation results showed that the ...

2 ¶ In order to better balance the energy recovery and braking safety and stability in the composite braking process, this study takes the electromechanical composite braking system ...

solution is the use of Energy Storage Systems (ESSs) placed onboard of the vehicle or at the substation / trackside in order to accumulate the excess regenerated braking energy and release it later during the vehicle's acceleration process as shown in Fig. 3, [14], [19], [39]-[46]. Fig. 3: Energy Storage System Method.

Semantic Scholar extracted view of "Prototype production and comparative analysis of high-speed flywheel energy storage systems during regenerative braking in hybrid and electric vehicles" by Koray Erhan et al. ... a method of regenerative braking of an electric scooter was developed. Regenerative braking of electric vehicles is the basis for ...

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