Metro energy storage braking

There are three major challenges to the broad implementation of energy storage systems (ESSs) in urban rail transit: maximizing the absorption of regenerative braking power, enabling online global optimal control, and ensuring algorithm portability. To address these problems, a coordinated control framework between onboard and wayside ESSs is proposed in ...

Razieh nejati fard, stationary super-capacitor energy storage system to save regenerative braking energy in a metro line Energy Convers. Manag., 56 (2012), pp. 206 - 214

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 ...

Metro traction power measurements sizing a hybrid energy storage system utilizing trains regenerative braking ... trains" braking resistors. In turn the stored energy could power upon demand ...

The transition towards environmentally friendly transportation solutions has prompted a focused exploration of energy-saving technologies within railway transit systems. Energy Storage Systems (ESS) in railway transit for Regenerative Braking Energy (RBE) recovery has gained prominence in pursuing sustainable transportation solutions. To achieve the dual ...

The recovery of regenerative braking energy has attracted much attention of researchers. At present, the use methods for re-braking energy mainly include energy consumption type, energy feedback type, energy storage type [3], [4], [5], energy storage + energy feedback type [6].The energy consumption type has low cost, but it will cause ...

The former does not consider the synchronization of motoring and braking trains, which cannot ensure the proper utilization of regenerative energy on the metro lines without energy storage systems.

SC The braking energy stored by the energy-storage system (J) E ... Regarding the regenerative braking energy utilization of metro trains, scholars mainly conduct research in three key areas: Train operation optimization, energy feedback technology, and energy storage technology [8]. References [9-11] pointed out that train operation ...

In this paper, the feasibility of using stationary super-capacitors to store the metro network regenerative braking energy is investigated. In order to estimate the required energy storage system (ESS), a very simple model for metro network is developed. Using the model of metro network for a particular station, a new approach is proposed to find an appropriate cost ...

In the regenerative braking energy field, Araúz et al. [15] carried out a review aimed to distinguish conventional and contemporary solutions for the appropriate management of regenerative energy; including a compilation of works, classified according to the studied technologies and the applied optimization techniques. This compilation helps to appreciate that ...

In the regenerative braking mode of metro trains, the energy-storage system and energy-feedback system absorb a portion of the regenerative braking energy. This reduces the energy sent back to the DC bus and the energy consumed by the brake resistor.

High electric energy consumption is one of the main challenges of metro systems, which the operators deal with. Among several energy saving methods, this paper focuses on the simultaneous application of speed profile optimization and energy storage systems, to efficiently utilize regenerative braking energy. With this approach, a substantial reduction in energy was ...

The speed simulation result of the metro when the flywheel energy storage system is not involved in the work is shown in Fig. 5(a). The speed simulation result of the metro when the flywheel energy storage system participates in the work is shown in Fig. 5(b). When the metro is in the idle state, the speed of the metro is maintained at 30 km/h.

Embedded energy storage sources such as SCs or batteries are used to perform recovery braking. They are a more viable alternative to recover energy during braking. This option is similar to the one used in an application with a high-start/stop frequency such as elevators driven by synchronous machines [36, 37].

Regenerative braking energy (RBE) utilization plays a vital role in improving the energy efficiency of electrified railways. ... "Optimal control of reversible substations and wayside storage devices for voltage stabilization and energy savings in metro railway networks," IEEE Trans ... J. A. Aguado, M. Reyes, and O. Martínez, "Optimal ...

In the urban mobility of big cities and metropolitan areas, the metro-transit system plays a fundamental role and it is one of the most energy-impactive. Considering the actual general upward interest for energy saving and sustainability in city transport, with the consumptions increasing and the technological evolution, new studies and projects on metro ...

The installation of stationary super-capacitor energy storage system (ESS) in metro systems can recycle the vehicle braking energy and improve the pantograph voltage profile. This paper aims to optimize the energy management, location, and size of stationary super-capacitor ESSes simultaneously and obtain the best economic efficiency and voltage profile of ...

In order to fully utilize the regenerative braking energy of metro trains and stabilize the metro DC traction busbar voltage, a hybrid regenerative braking energy recovery system with a dual-mode power management strategy is proposed. ... Research on regenerative braking energy storage and utilization technology for

high-speed railways," (in ...

In turn the stored energy could power upon demand selected stationary electrical loads in Metro stations of a non-safety critical character (such as lighting, ventilation, pumps, etc.) leading to very significant energy savings and to a corresponding reduction of greenhouse gases.

A hybrid Energy Storage System termed MetroHESS foresees the storage and reuse of regenerative train braking energy through an active combination of batteries covering base power electrical consumer loads in Metro stations and supercapacitors able to receive the energy power peaks from train braking.

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 ...

In case of electric trains, the excess energy of vehicle regenerative braking is mostly wasted as heat. Instead of an instantaneous waste, a later re-use of this energy requests the adoption of an electric storage system.

In order to verify the utilization effect of the flywheel energy storage array on the regenerative braking energy of the metro, a 1 MW regenerative energy utilization system ...

High electric energy consumption is one of the main challenges of metro systems, which the operators deal with. Among several energy saving methods, this paper focuses on the simultaneous application of speed profile optimization and energy storage systems, to efficiently utilize regenerative braking energy.

The experimental results show that HESS could stabilize the metro voltage within a safe voltage of 580 V and achieve 100% braking energy recovery by optimal energy distribution between two different types of energy storage systems, which are only 79.9% and 39.2% in other single energy storage system by contrast.

Effective real-time train regulation enables swift recovery from delays with satisfactory operational efficiency, energy savings and service quality. On the other hand, ...

This study proposes an energy management strategy (EMS) for a dual-mode hybrid locomotive equipped with a fuel cell, supercapacitors, and batteries, and intermittent ...

This paper focuses on the configuration of a stationary hybrid energy storage system, located in metro traction substations in turn located inside Metro stations. The recuperation energy of the metro braking phase is then reused to feed stationary electrical loads of metro stations.

Although future research advances, especially in energy storage technologies, are anticipated to improve the characteristics of current systems while reducing their costs, the broader use of regenerative braking in urban

metro transportation primarily requires greater collaboration and division. experiences between operators, manufacturers, and ...

With the development of the high-speed railway, the energy demand for high-speed railway traction power supply systems is increasing rapidly. To further saving energy and reducing consumption, it is necessary to improve the utilization mode of Regenerative Braking Energy (RBE) produced by the braking state in the process of the high-speed rail train operation.

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