

Can onboard energy storage devices reduce the catenary energy consumption?

Abstract: For improving the energy efficiency of railway systems, onboard energy storage devices (OESDs) have been applied to assist the traction and recover the regenerative energy. This article aims to address the optimal sizing problem of OESDs to minimize the catenary energy consumption for practical train operations.

Why is on-board energy storage device (oesd) used in railway systems?

and more energy storage has been utilized in railway systems to save energy cost. As a result, on-board energy storage device (OESD), due to its low energy loss, has been used by industry. However, the

Can onboard batteries save energy?

A relevant number of urban and regional rail vehicles with onboard batteries are in operation in Europe, America, and Asia at this time. Practical use of such storage devices has shown that energy savings, line voltage stabilization, and catenary-free operation can be effectively achieved.

What are on-board energy storage devices (hesds)?

As an emerging technology, on-board HESDs are usually composed of different types of energy storage devices, namely, batteries (BATs), supercapacitors (SCs), and flywheels, where the hybridization solutions to BATs and SCs are widely applied in electric vehicles and rail transportation [5,6].

Are on-board hesds effective for energy-saving operations?

Although the integration of on-board HESDs in the traction system are considered to be an important and effective method for energy-saving operations, the energy-saving performance can be greatly affected by other factors.

Should rail vehicles have onboard energy storage systems?

However, the last decade saw an increasing interest in rail vehicles with onboard energy storage systems (OESSs) for improved energy efficiency and potential catenary-free operation. These vehicles can minimize costs by reducing maintenance and installation requirements of the electrified infrastructure.

cussed, while on-board HESDs are not involved or only a few properties of energy storage devices as fixed parameters are taken into account. Numerous studies have been conducted to evaluate the energy-saving potential of on-board energy storage devices, as summarized in Table 1. Although the integration of on-board HESDs in the traction system are

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Lithium-ion batteries have been widely used in the power-driven system and energy storage system, while overcharge safety for high-capacity and high-power lithium-ion batteries has been constantly concerned all over the world due to the thermal runaway problems by overcharge occurred in recent years. Therefore, it is very important to study the thermal ...

On-board energy storage devices (OESD) and energy-efficient train timetabling (EETT) are considered two effective ways to improve the usage rate of regenerative braking energy (RBE) of subway trains. EETT is less costly but has lower ceilings, whereas OESD, although expensive, maximizes the reuse of RBE. ...

This paper investigates the benefits of using the on-board energy storage devices (OESD) and wayside energy storage devices (WESD) in light rail transportation (metro and tram) systems.

Running the energy storage device on board of a tram brings additionally following benefits: (i) a dramatic reduction of the peak power demand (ii) catenary free operation" on several hundred ...

of the energy storage in electrified railway systems is still a new research direction for both stationary energy storage and OESD [3]. Optimal sizing problem for stationary and substation-based energy storage has been studied with no constraints on weight and volume of the energy storage devices. In [27], energy

The purpose of the work in this paper is to achieve accurate SOC estimation of on-board energy storage devices by establishing a train energy flow model and using the ...

2 Fig. 1. Schematic of the energy flow for a typical train with on-board ESD in the whole journey. The work is extended in [13] and the monotonicity assumption is avoided by the proposed distance-

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This paper investigates the benefits of using the on-board energy storage devices (OESD) and wayside energy storage devices (WESD) in light rail transportation (metro and tram) systems. The analysed benefits are the use of OESD and WESD as a source of supply in an emergency metro scenario to safely evacuate the passengers blocked in a metro train ...

Storage technologies devices are very interesting solutions for improving energy saving and guaranteeing contemporaneously to enhance the electrical characteristics of Light Rail Transit (LRT) systems. Onboard Energy Storage System based on Lithium Ion Capacitor (LiC) devices represent a viable engineering solution for energy saving optimization. The authors suggest a ...

The optimal operation of rail vehicle with on-board energy storage device minimizing total energy consumption is discussed in this paper. Until now, not enough research deals with the optimal control of the

devices. The authors have developed the mathematical model based on a general optimization technique. In our study, the electric double ...

With the rapid development of energy storage devices (ESDs), this paper aims to develop an integrated optimization model to obtain the speed trajectory with the constraint of on-board ESD properties such as capacity, initial state of energy (SOE), and the degradation of the on-board ESD. ... in the case with on-board ESD, more than 11.6% of net ...

Abstract: Recently, Energy Storage Devices (ESDs) are introduced to railway vehicles in order to operate even in an emergency case such as power outage. However, no simultaneous design ...

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To improve the energy-efficiency of transport systems, it is necessary to investigate electric trains with on-board hybrid energy storage devices (HESDs), which are applied to assist the traction and recover the regenerative energy. In this paper, a time-based mixed-integer linear programming (MILP) model is proposed to obtain the energy-saving ...

In this paper, a decoupled model of a train including an on-board hybrid accumulation system is presented to be used in DC traction networks. The train and the accumulation system behavior are modeled separately, and the results are then combined in order to study the effect of the whole system on the traction electrical network. The model is ...

The on board energy storage system with Ultracaps for railway vehicles presented in this paper seems to be a reliable technical solution with an enormous energy saving potential. Bombardier Transportation has equipped one bogie of a prototype LRV (light rail vehicle) for the public transportation operator RNV in Mannheim with a MITRAC Energy Saver. ...

This paper presents an analysis on using an on-board energy storage device (ESD) for enhancing braking energy re-use in electrified railway transportation. A simulation model was developed in the ...

1 Introduction. Modern railways feeding systems, similar to other conventional power delivery infrastructures, are rapidly evolving including new technologies and devices [] most of the cases, this evolution relates to the inclusion of modern power electronics and energy storage devices into the networks [2, 3] or in vehicles [].Nonetheless, some researchers are ...

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The battery is used as a buffer, and continuous overcharge is avoided. On the other hand, such measures involve different levels of powertrain hybridization, including micro, mild/medium, and power-assist/full hybrid electric vehicles (HEV). ... the energy storage device of mild- and medium-HEVs will see a strong increase in energy throughput ...

With the fast development of energy storage technology, more applications of Energy Storage Devices (ESDs) have been found in rail transportation in recent years. This paper aims to address the optimal sizing problem of on-board Hybrid Energy Storage Devices (HESDs) which are installed to assist train traction and recover the regenerative braking energy.

Optimal Sizing of On-Board Energy Storage Devices for Electrified Railway Systems Chaoxian Wu, Shaofeng Lu*, Fei Xue, Lin Jiang and Minwu Chen Abstract--For improving the energy ...

In recent years, the energy storage devices have enough energy and power density to us... Energy Saving Speed and Charge/Discharge Control of a Railway Vehicle with On-board Energy Storage by Means of an Optimization Model - Miyatake - 2009 - IEEJ Transactions on Electrical and Electronic Engineering - Wiley Online Library

1.2 Railway Energy Storage Systems. Ideally, the most effective way to increase the global efficiency of traction systems is to use the regenerative braking energy to feed another train in traction mode (and absorbing the totality of the braking energy) [].However, this solution requires an excellent synchronism and a small distance between "in traction mode" and "in ...

Energy storage device testing is not the same as battery testing. There are, in fact, several devices that are able to convert chemical energy into electrical energy and store that energy, making it available when required. ... Cell mismatch can occur due to battery overcharge, discharge shorts, or simply because of aging.

For improving the energy efficiency of railway systems, on-board energy storage devices (OESDs) have been applied to assist the traction and recover the regenerative energy.

stationary or on-board energy storage devices (ESD). The costs of the on-board ESDs may be higher than of way-side ESDs because they have to be embedded on every train instead of being placed at certain stations [9]. The drawback of the stationary ESD [10-12] is that the regenerated energy is sent via contact lines, which results in line losses.

Regenerative energy, generated by the braking train, is considered to store into its individual on-board energy storage devices and provided for the follow-up traction operations. Some parameters, including the comfort criterion and increased train mass due to the installation of energy storage devices, are all taken into account in the energy ...

Lithium-ion batteries currently represent the most suitable technology for energy storage in various applications, such as hybrid and electric vehicles (HEVs and BEVs), portable electronics and energy storage systems. Their wide adoption in recent years is due to their characteristics of high energy density, high power density and long life cycle. On the other ...

To make the most of regenerative braking energy, an energy-saving model with on-board energy storage devices was designed, to coordinately optimize train trip time and recommended speed profiles ...

Cai [17] installed CO₂ gas sensors in the experimental device for LIBs overcharging to achieve early detection of TR. Essl et al. [18] experimentally verified that early-stage battery fault diagnosis using gas sensors is feasible, ... The energy storage cabinet is composed of multiple cells connected in series and parallel, and the safe use of ...

With the increasing energy consumption of urban rail transportation, the on-board hybrid energy storage system, which integrates various energy storage technologies, can effectively recycle the regenerative braking energy. ... Chen, H.X., Wang, Y.S.: Research on new control scheme and strategy of on-board hybrid energy storage device for urban ...

Zhang et al. [30] carried out a series of overcharge tests for ternary ... to evaluate the energy-saving potential of on-board energy storage devices, as summarized in Table 1. Although the ...

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