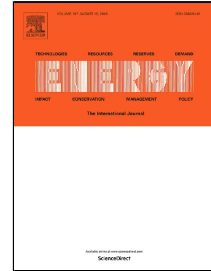


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Study on the Performance Improvement of Urban Rail Transit System

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# Study on the Performance Improvement of Urban Rail Transit System

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**Abstract:** The performance improvement is closely related to the energy-saving operation of urban rail transit system and the improvement of service quality, which involves the optimization of infrastructures, the application of advanced train control technology, the highly efficient transportation organization, and the recycle and utilization of regenerative energy, etc.. With the energy consumption as an entry, we first discuss the performance of urban rail transit system, determinate the corresponding performance evaluation indexes, and establish the top-down decomposition architecture of global performance. Then, we analyze the performance emergence mechanism of urban rail transit system, and build the difference equations of calculating train behavior in the constant power and natural characteristic regions and the mathematical model of train behavior optimization. The simulations are used to analyze the influence of train light-weighting, train control, and the load ratio on the energy efficiency of train operation, which can help to improve the system performance. Finally, we discuss the recycle and utilization of regenerative energy generated from train braking, the energy-saving operation of the environment control systems, and the optimization of train stop scheme, etc.. The research shows that the potential of improving the performance of urban rail transit system is enormous, and deserves more attention.

**Key words:** urban rail transit system; train operation; performance improvement; energy-efficiency; train control; transportation organization

## 1. Introduction

Urban rail transit systems play an important role in human activity, economic development, and social progress, In comparison to other traffic modes, urban rail transit systems has advantages of safety, punctuality, high efficiency and environmental friendship. With the rapid development of the economy and urbanization in China, a large number of subway lines have been built in recent several decade years to meet a dramatic growth of urban transportation demand. At the same time, a large amount of electric energy was consumed by urban rail transit systems each year.

Currently, the study of the performance improvement of the existing urban rail transit system in the world is mainly conducted around the energy saving and consumption reduction, a large number of outstanding results has been achieved. In regard to infrastructure optimization, many studies focused on how to reduce the weight and aerodynamic drag of high-speed train so that high-speed train can move in energy saving [1, 2]. Train light-weighting has a positive effect on its own energy-saving operation because it can make a train lighter than before so that its kinematic performances

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