Contents

Part A. Energy Management in the Train Operation

Reducing power peaks and energy consumption in rail transit systems by simultaneous train running time control
T. Albrecht ..................................................................................................... 3

Power management control in DC-electrified railways for the regenerative braking systems of electric trains
Y. Okada, T. Koseki & K. Hisatom ............................................................. 13

Impact of train model variables on simulated energy usage and journey time
P. Lukaszewicz ............................................................................................ 25

A study of the power capacity of regenerative inverters in a DC electric railway system
C. H. Bae, M. S. Han, Y. K. Kim, S. Y. Kwon & H. J. Park ....................... 35

Train operation minimizing energy consumption in DC electric railway with on-board energy storage device
K. Matsuda, H. Ko & M. Miyatake .............................................................. 45

Computer-aided design of ATO speed commands according to energy consumption criteria
M. Dominguez, A Fernandez, A.P. Cucala & L.P. Cayuela ......................... 55

Charge/discharge control of a train with on-board energy storage devices for energy minimization and consideration of catenary free operation
M. Miyatake, K. Matsuda & H. Haga .......................................................... 65

Evaluation of energy saving strategies in heavily used rail networks by implementing an integrated real-time rescheduling system
M. Luethi ..................................................................................................... 75
Part B. Power Supply System Analysis, Design and Planning

Online temperature monitoring of overhead contact line at the new German high-speed rail line Cologne-Rhine/Main
N. Theune, T. Bosselmann, J. Kaise, M. Willsch, H. Hertsch & R. Puschmann ................................................................. 87

Electric traction energy metering on German Railways and the impact of European standardisation on the energy billing process in Germany
K. Weiland ............................................................................................................. 95

Development of feeder messenger catenary with the auxiliary wire
K. Nishi, Y. Sato & T. Shimada ........................................................................ 101

Catenary and autotransformer coupled optimization for 2x25kV systems planning
E. Pilo, L. Rouco & A. Fernandez ................................................................. 113

Investigation into the computational techniques of power system modelling for a DC railway
A. Finlayson, C. J. Goodman & R. D. White .................................................. 123

Optimal design of power supply systems using genetic algorithms
J.R. Jimenez Octavio & E. Pilo ..................................................................... 135

Application of linear analysis in railway power system stability studies
S. Danielsen, T. Toftevang & O.B. Fosso ....................................................... 145

Fast estimation of aggregated results of many load flow solutions in electric traction systems
L. Abrahamsson & L. Söder ........................................................................ 157

DC protection calculations – an innovative approach
R. Leach, D. Tregay & M. Berova ................................................................. 171

Author index ........................................................................................................ 187
Preface

In recent years, energy consumption has become a crucial concern for every transportation mode. However, it is in electrified railways where energy savings have shown a bigger potential due to (i) regenerative braking, allowing the conversion of kinetic energy into electric power, and (ii) vehicle interconnection, which permits other trains to use regenerated power. In the future, increasing energy efficiency and the emission reductions could lead railways to a significant gain of modal share. Hence, an important effort has been done by the industry, the operators, the research centers and governments to face this challenge. The proceedings of the last editions of COMPRAIL conferences on railways clearly reflect this sustained effort and main achievements of the past years.

This book gathers selected research papers published in the Computer in Railways (COMPRAIL) series (IX, X and XI), which have been updated for this edition. Although the book is focused on infrastructure, in many cases it is not possible to analyze separately the train operation and the infrastructure’s behaviour, particularly when the overall energy efficiency is taken into consideration. The analysis of the impact of regenerative braking is a good example of that, as it depends on all theses aspects: the on-board electronic system and its control, the way the train is driven, the other trains in the area (scheduling), the electrical characteristics of the traction network, the presence of reversible substations (substations with inverters) and energy storage devices, etc. Accordingly, a number of papers describing important issues related to energy management and train operation have also been included.

This book is organized in two parts. The first focuses on energy management issues in train operation and spans topics such as train driving, scheduling, regenerative braking and on-board energy storage; the second deals with infrastructure including topics such as catenary design and monitoring, traction power systems analysis, computational issues in simulations and optimization.

Readers will find in this volume important papers dealing with a variety of topics of current interest.

Finally, I would like to thank the authors for their revision of the papers as well as the team of WIT Press that has worked in the edition of this book.

The Editor