Lecture Notes in Electrical Engineering

Volume 288

Board of Series editors

Leopoldo Angrisani, Napoli, Italy
Marco Arteaga, Coyoacán, México
Samarjit Chakraborty, München, Germany
Jiming Chen, Hangzhou, P.R. China
Tan Kay Chen, Singapore, Singapore
Rüdiger Dillmann, Karlsruhe, Germany
Gianluigi Ferrari, Parma, Italy
Manuel Ferre, Madrid, Spain
Sandra Hirche, München, Germany
Faryar Jabbari, Irvine, USA
Janusz Kacprzyk, Warsaw, Poland
Alaa Khamis, New Cairo City, Egypt
Torsten Kroeger, Stanford, USA
Tan Cher Ming, Singapore, Singapore
Wolfgang Minker, Ulm, Germany
Pradeep Misra, Dayton, USA
Sebastian Möller, Berlin, Germany
Subhas Mukhopadyay, Palmerston, New Zealand
Cun-Zheng Ning, Tempe, USA
Toyoaki Nishida, Sakyo-ku, Japan
Federica Pascucci, Roma, Italy
Tariq Samad, Minneapolis, USA
Gan Woon Seng, Nanyang Avenue, Singapore
Germano Veiga, Porto, Portugal
Junjie James Zhang, Charlotte, USA

For further volumes:
http://www.springer.com/series/7818
About this Series

“Lecture Notes in Electrical Engineering (LNEE)” is a book series which reports the latest research and developments in Electrical Engineering, namely:

- Communication, Networks, and Information Theory
- Computer Engineering
- Signal, Image, Speech and Information Processing
- Circuits and Systems
- Bioengineering

LNEE publishes authored monographs and contributed volumes which present cutting edge research information as well as new perspectives on classical fields, while maintaining Springer’s high standards of academic excellence. Also considered for publication are lecture materials, proceedings, and other related materials of exceptionally high quality and interest. The subject matter should be original and timely, reporting the latest research and developments in all areas of electrical engineering.

The audience for the books in LNEE consists of advanced level students, researchers, and industry professionals working at the forefront of their fields. Much like Springer’s other Lecture Notes series, LNEE will be distributed through Springer’s print and electronic publishing channels.
EITRT Committees

Honorary Chairs

Shi Zhongheng, Academician of China Academy of Engineering, China
Satoru Sone, Tokyo University, Japan
Buchheit Karlheinz, Siemens, Germany
Qian Qingquan, Southwest Jiaotong University, China
Terasawa Kiyoshi, Hitachi, Japan

General Chair

Jia Limin, Beijing Jiaotong University, China

Program Committee Chairs

Liu Zhigang, Beijing Jiaotong University, China
Li Zhong, University of Hagen, Germany
Li Yaohua, Institute of Electrical Engineering, Chinese Academy of Sciences, China
Holger Hirsch, University of Duisburg-Essen, UK

Organizing Committee Chairs

Zhao Minghua, China CNR Changchun Railway Vehicles Co., Ltd, China
Min An, University of Birmingham, UK
Wolfgang A. Halang, University of Hagen, Germany
Qin Yong, Beijing Jiaotong University, China
Kyandoghere Kyamakya, University of Klagenfurt, UK
Organizing Committee Members

Zhao Minghua, China CNR Changchun Railway Vehicles Co., Ltd, China
Wolfgang A. Halang, University of Hagen, Germany
Qin Yong, Beijing Jiaotong University, China
Min An, University of Birmingham, UK
Wang Shubin, China CNR Changchun Railway Vehicles Co., Ltd, China
Xu Chunmei, Beijing Jiaotong University, China
Diao Lijun, Beijing Jiaotong University, China
Cheng Xiaoqing, Beijing Jiaotong University, China

Technical Program Committee Members

Buchheit Karlheinz, Experts of Siemens, Germany
Cai Changjun, Guangzhou Metro Corporation, China
Chai Jianyun, Tsinghua University, China
Chang Zhencen, China CNR Changchun Railway Vehicles Co., Ltd, China
Clave Roberts, University of Birmingham, UK
Li Zhong, University of Hagen, Germany
Holger Hirsch, University of Duisburg-Essen, Germany
Fang Youtong, Zhejiang University, China
Feng Jianguhua, China CSR Zhuzhou Electric Locomotive Research Institute, China
Gao Shibin, Southwest Jiaotong University, China
Gong Ming, China CSR Sifang Co., Ltd, China
Kyandoghere Kyamakya, University of Klagenfurt, Germany
Jia Limin, Beijing Jiaotong University, China
Jiang Jiuchun, Beijing Jiaotong University, China
Ye Jianqiao, Mechanical Engineering Department of Engineering, Lancaster University, UK
Li Yaohua, Institute of Electrical Engineering, Chinese Academy of Sciences, China
Liu Baoming, China CNR Qingdao Sifang Locomotive & Rolling Stock Research Institute, China
Liu Zhigang, Beijing Jiaotong University, China
Mark Hooper, Faculty of Engineering and Computing, Coventry University, UK
Qin Yong, Beijing Jiaotong University, China
Chen Rui, Loughborough University, UK
Satoru Sone, Tokyo University, Japan
Wang Simon, School of Aeronautical and Automotive Engineering, Loughborough University, UK
Ling Tungchai, University of Birmingham, UK
Wang Litian, China Railway Electrification Survey and Design Institute Co., Ltd, China
Wolfgang A. Halang, University of Hagen, Germany
Yang Zhongpin, Beijing Jiaotong University, China
Zhao Minghua, China CNR Changchun Railway Vehicles Co., Ltd, China
# Contents

## Part I Electrical Traction and Power Supply of Rail Transportation

1. **Application of Affinity Propagation Clustering Algorithm in Fault Diagnosis of Metro Vehicle Auxiliary Inverter**
   
   Junwei Gao, Zengtao Ma, Yong Qin, Limin Jia and Dechen Yao
   
   Page 3

2. **A Soft-Switching Control Method of Isolated LC Series Resonant Transformer Full Bridge DC–DC Converter**
   
   Meng Jiang and Wei Li
   
   Page 11

3. **Study on Efficiency Optimization of Medium Frequency Transformers for Rail Transit Traction System**
   
   Juanjuan Zhang, Yumei Du, Zixin Li, Ping Wang and Yaohua Li
   
   Page 21

4. **Primary Permanent Magnet Linear Motors for Rail Transit**
   
   Ruiwu Cao and Ming Cheng
   
   Page 31

5. **An Maximal Clique Mining Algorithm for Highway Network Optimization Problem**
   
   Zipeng Zhang, HongGuo Wang, Yanhui Ding and Zengzhen Shao
   
   Page 41

6. **Design of a 6 kW Battery Charger Based on Full-Bridge Phase-Shifted ZVZCS PWM Converter**
   
   Tao Sun, Zhigang Liu, Chao Li, Lei Wang and Lijun Diao
   
   Page 51

7. **Diagnostics of Transformer Windings Deformation Based on Transfer Function**
   
   Lei Yin, Zhensheng Wu and Junfeng Gui
   
   Page 65

8. **Clamped Three-level Inverter Midpoint Potential Control Method**
   
   Haijie Jia, Xuedong Jiang, Lei Wang, Zheming Jin and Qifeng Li
   
   Page 73
<table>
<thead>
<tr>
<th>No.</th>
<th>Title</th>
<th>Authors</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>Design and Research for the Low-Loss Passive Snubber Circuit Used in the Metro High Frequency Auxiliary Converter</td>
<td>Yao Fu, Lijun Diao, Huiqing Du, Haijie Jia and Lei Wang</td>
<td>83</td>
</tr>
<tr>
<td>10</td>
<td>Research on Parallel Characteristics of Lithium Iron Phosphate Batteries for Dual Electric Multiple Units</td>
<td>Yanru Zhang, Jiuchun Jiang, Weige Zhang, Wei Shi, Zeyu Ma and Fangdan Zheng</td>
<td>95</td>
</tr>
<tr>
<td>11</td>
<td>Discussion on the Application of Energy-Saving Traction Power Supply Device</td>
<td>Zhiwei Han, Gang Zhang, Zhigang Liu and Fuqiang Mu</td>
<td>105</td>
</tr>
<tr>
<td>12</td>
<td>Research on Applicability of Lithium Titanate Battery for Low-Floor Vehicles</td>
<td>Sijia Liu, Jiuchun Jiang, Zhanguo Wang, Zeyu Ma, Wen Chen and Ting Zhao</td>
<td>115</td>
</tr>
<tr>
<td>13</td>
<td>Research of the Lithium Battery-Based Energy Storage System for Light Rail Vehicle</td>
<td>Xiaoguang Jia, Zhigang Liu, Wenhui He, Zheming Jin and Lijun Diao</td>
<td>127</td>
</tr>
<tr>
<td>14</td>
<td>Research of Fault Location Method for Metro Traction Power Supply System</td>
<td>Xiaoming Song, Jinghan He, Tony Yip, Brian Kirby and Xia Yang</td>
<td>137</td>
</tr>
<tr>
<td>15</td>
<td>Study and Implementation of Closed Loop Control Based on Double Synchronous Rotating Frame for EMU Auxiliary Inverter with Unbalanced Load</td>
<td>Huiqing Du, Zhigang Liu, Yao Fu, Lei Wang and Lijun Diao</td>
<td>147</td>
</tr>
<tr>
<td>16</td>
<td>Fluid and Thermal Analysis of Power Li-Ion Battery Pack and Experimental Verification</td>
<td>Dafen Chen, Jiuchun Jiang, Yaojuan Duan, Zhanguo Wang and Feng Wen</td>
<td>161</td>
</tr>
<tr>
<td>17</td>
<td>A Novel Real-Time Tension Monitoring Method for Overhead Contact System</td>
<td>Xin Meng, Jinghan He, Xiaojun Wang and Guomin Luo</td>
<td>171</td>
</tr>
<tr>
<td>18</td>
<td>Locomotive DC600 V Power Supply Design and Control Redundancy Improvement</td>
<td>Yan Xia, Chunmei Xu and Lei Wang</td>
<td>179</td>
</tr>
</tbody>
</table>
19 The Research on BEV-Based Urban Passenger Transport Environment .................................................. 189
ZhiQiang Rao, ZiJian Zhuang and Bin Ning

20 Design and Verification of Hybrid Power Box of 100 % Low-Floor LRV ........................................ 199
Li Ming, Li Minggao, Shi Junjie, Yang Guang and Shao Nan

21 Measurement and Simulation of the Electromagnetic Transients of Lifting Pantograph for an Electric Multiple Units Train ........................................ 213
Dan Shi, Mingli Wu, Honghe Zhang, Teng Li, Hui Wang and Kejian Song

22 Calculations of Leakage Impedance of Rail to Earth in Ballastless Track by Finite Element Method ..................... 223
Teng Li, Mingli Wu, Fan He and Kejian Song

Part II System Safety and Emergency Management

23 Research on Transport Capacity of Urban Rail Transit Based on RailSys ........................................ 235
Yanjie Wang and Xi Zhang

24 Contribution Rates Calculation for Regulations About Urban Rail Vehicle Inspection and Repair Based on AMSAA Model ........................................ 243
Jianwei Li, Minzheng Yuan, Yong Qin, Limin Jia and Zongyi Xing

25 Failure Mode Criticality Analysis of Metro Door System ........................................ 251
Jun Xia, Li sha Pan, Xiao qing Cheng, Yong Qin and Zong yi Xing

26 Reliability Analysis of the Sliding Plug Door System Based on Bayesian Network ........................................ 259
Lingli Mao, Zhaoyi Su, Jing Long, Limin Jia and Zongyi Xing

27 The Prediction of Derailment Coefficient Based on Neural Networks ........................................ 267
Xiulian Yu, Guangwu Liu, Yong Qin, Yuan Zhang and Zongyi Xing
28 Research on Hazard Evaluation of Urban Rail Train Based on the Extension Theory
Guiling Liao, Yong Qin, Yuan Zhang, Xiaoqing Cheng and Zongyi Xing

29 Reliability Analysis of Metro Door System Based on Fuzzy Reasoning Petri Net
Ping Liu, Xiaoqing Cheng, Yong Qin, Yuan Zhang and Zongyi Xing

30 Fault Criticality Evaluation of Metro Door Based on WLSM and FWGM
Jin Bao Ren, Jing Long, Yong Qin, Zong Yi Xing and Jun Xia

31 Risk-Based Maintenance Optimization of Metro Vehicle Door System
Xiang Guo, Lisha Pan, Limin Jia, Yuan Zhang and Zongyi Xing

32 Using Asynchronous Hot Standby Spare in Time-Stamped, Fault-Tolerant, Real-Time System
Mahmoud Jannesari Ladani and Ahmad Kezemi Gazanchaei

33 Formal Modeling and Analysis of Radio Block Center Handover
Xiaohui Hu, Jun Ma, Yong Chen and Xin Li

34 Fault Diagnosis for Rail Vehicle Suspension Systems Based on Fisher Discriminant Analysis
Xiukun Wei, Sheng Wu, Jianlong Ding, Limin Jia, Qu Sun and Minzhen Yuan

35 Analysis of Related Factors Influencing Reliability of Railway Signaling Systems Based on Fuzzy Analytical Hierarchy Process
Hongxia Chen and Min An

36 Application of GA-LSSVM in Fault Diagnosis of Subway Auxiliary Inverter
Junwei Gao, Ziwen Leng, Yong Qin, Limin Jia and Dechen Yao

37 The City Rail Safety Detection Sensor Network Platform Using Online Track Detection
Shaohuang Pang, Weiping Zhao, Honghui Dong, Wenlong Peng and Jianxiao Chen
Part III  Rail Transportation Computer Technology

38 Research for Algorithm of the Super Low Delay Image Coding in Airborne Photo-Electricity Survey Equipment .... 357
Qihu Li, Yunfeng Wen and Ruicai Jia

39 A Novel Recursive Algorithm for Training RBF Networks .... 365
Peng Zhou and Zhu Yang

40 Argumentation Pattern: An Approach to Issuing Software Reliability Case ........................................... 373
Boxuan Wang and Minyan Lu

41 Control Modeling and Signal Processing of a Library Self-Delivery Robot and Its Applications ................. 383
Shuping Dang, Meizun Meng, Daniel Mathews and Rinat Kakimzhanov

42 Analysis of Moore’s Law on Intel Processors ............... 391
Jia Chen

43 A Reliable QoE-aware Framework for Cloud Service Monitoring and Ranking ......................................... 401
Yuchao Zhang, Hongfu Liu, Bo Deng and Fuyang Peng

44 Learning Distance Metrics with Feature Space Performance for Image Retrieval .................................... 411
Xin Luo, Guowen Wu and Kenji Kita

45 A Fine-Grained Authentication Model Based on Perceptual Hashing and Grid Descriptor for Remote Sensing Image .... 423
Kaimeng Ding and Yuhai Wang

46 Adaptive Tuning Algorithm Used in Multi-Join Query Optimization ....................................................... 431
Zhou Jiang, Lianzhong Liu and Zheren Li

Xiaqing Zhang, Qiang Yue and Zhongtang He
48 The Research on Distortion Correction Algorithm of Unwrapping the Cylinder Image of Panoramic Annular Lens .................................................. 449
Qiuxiang Liao

49 A Novel Control Strategy of Permanent Magnet Synchronous Machine Drive Under Field-Weakening Operation .............. 457
Xiangyang Wu, Kekang Wei and Shihua Bi

Part IV Rail Transportation and Automatic Control

50 Research on the Balise Uplink Signal Process Method Based on the Noise Feature Extraction and Adaptive Noise Cancellation ................................................. 469
Yanning Zhang and Huibing Zhao

51 Research on the Relation Between the Wind Direction of Vehicle Air Condition and Cooling Efficiency of the Cab ........ 479
Bin feng Guo, Hong chao Wang and Yan ling Wang

52 Vocational Skills Comprehensive Evaluation Method of Track Maintenance Workers ......................................................... 487
Dongyao Jia and Shengxiong Zou

53 Middleware-Based Distributed CTCS-3 Simulation Platform .... 497
Lianbao Yang, Tianhua Xu and Zhenxian Wang

54 Study on Express-Slow Routes Mode of Foreign Subway ......... 507
Senhui Li, Xingchen Zhang, Junhua Chen and Jixuan Liu

55 Optimized Design of Urban Rail Vehicle Grounding System .... 517
Ling Gao, Ruichang Qiu, Lei Wang and Haijie Jia

56 Analysis of the Property of Heavy Haul Railway’s Traffic Flow Based on Hybrid Cellular Automaton ................................. 525
Wentan Deng and Huibing Zhao

57 Research on AC Drive Test System Based on Vector Control .... 537
Zhe Zhang, Zhi-gang Liu, Lei-ting Zhao and Li-jun Diao

58 Process Design and Analysis of Emergency Decision Support System for High-Speed Rail Transport Organization ............ 547
Guoxing Han, Yong Qin, Tao Zhu, Jie Xu, Fei Dou and Kai Yan
<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
<th>Authors</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>59</td>
<td>Subway Vehicle Bearing Fault Diagnosis Methodology Research Based on PNN Neural Network and Wavelet Package</td>
<td>Xi Li, Yuan Zhang and Limin Jia</td>
<td>555</td>
</tr>
<tr>
<td>60</td>
<td>Study on the Best Transfer Station Selected in Beijing Subway Network</td>
<td>Qi Liu, Xingchen Zhang, Junhua Chen and Bin Xu</td>
<td>565</td>
</tr>
<tr>
<td>61</td>
<td>A New Approach to Diagnose Rolling Bearing Faults Based on AFD</td>
<td>Yu Liang, Li min Jia, Guo qiang Cai and Jin zhao Liu</td>
<td>573</td>
</tr>
<tr>
<td>62</td>
<td>Train Control Management System Safety Assessment</td>
<td>Changyuan Liu, Xiaoming Li and Panpan Yang</td>
<td>583</td>
</tr>
<tr>
<td>63</td>
<td>Research on Disruption Management of Single Machine Scheduling</td>
<td>Lei Xiao</td>
<td>593</td>
</tr>
<tr>
<td>64</td>
<td>A Study on Parking Problems and Countermeasures of Urban Central Commercial District</td>
<td>Xianyong Miao and Manzhen Duan</td>
<td>601</td>
</tr>
<tr>
<td>65</td>
<td>Research on Structural Modeling Technique of Vehicles Outward Based on AVI</td>
<td>Bing Wang, Dudu Guo, Wenlei Sun and Gulbahar Tohti</td>
<td>609</td>
</tr>
</tbody>
</table>

Erratum to: Using Asynchronous Hot Standby Spare in Time-Stamped, Fault-Tolerant, Real-Time System
Mahmoud Jannesari Ladani and Ahmad Kazemi Gazanchaei

E1