

# **11th IET International Conference on Developments in Power System Protection 2012**

**(DPSP 2012)**

**IET Conference Publications 593**

**Birmingham, United Kingdom  
23-26 April 2012**

**ISBN: 978-1-62276-105-0**

**Printed from e-media with permission by:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571



**Some format issues inherent in the e-media version may also appear in this print version.**

Copyright© (2012) by the Institution of Engineering and Technology  
All rights reserved.

Printed by Curran Associates, Inc. (2012)

For permission requests, please contact the Institution of Engineering and Technology  
at the address below.

Institution of Engineering and Technology  
P. O. Box 96  
Stevenage, Hertfordshire  
U.K. SG1 2SD

Phone: 01-441-438-767-328-328  
Fax: 01-441-438-767-328-375

[www.theiet.org](http://www.theiet.org)

**Additional copies of this publication are available from:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: 845-758-0400  
Fax: 845-758-2634  
Email: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

# TABLE OF CONTENTS

|                                                                                                                                                 |            |
|-------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>The Directional Reactive Power Undervoltage Protection - A Protection Concept for Connecting Decentralized Renewable Energy Sources.....</b> | <b>1</b>   |
| <i>O. Janke</i>                                                                                                                                 |            |
| <b>Distributed Energy Resources - Testing Issues .....</b>                                                                                      | <b>6</b>   |
| <i>T. Schossig</i>                                                                                                                              |            |
| <b>Voltage Control of Distribution Networks with Distributed Generation.....</b>                                                                | <b>11</b>  |
| <i>F. T. Dai</i>                                                                                                                                |            |
| <b>Demonstration of Energy Management System for Smart Grids.....</b>                                                                           | <b>17</b>  |
| <i>G. P. Baber, F. Kawano, T. Asano, S. Naoi, Y. Noro</i>                                                                                       |            |
| <b>Smart Grids Rely on Relays.....</b>                                                                                                          | <b>23</b>  |
| <i>K. Hamilton</i>                                                                                                                              |            |
| <b>Voltage Control on Unbalanced LV Networks Using Tap Changing Transformers .....</b>                                                          | <b>27</b>  |
| <i>Y. Li, P. A. Crossley</i>                                                                                                                    |            |
| <b>Communication Networks for Domestic Photovoltaic Based Microgrid Protection.....</b>                                                         | <b>33</b>  |
| <i>M. P. Nthontho, S. P. Chowdhury, S. Winberg, S. Chowdhury</i>                                                                                |            |
| <b>An Efficient Dynamic Control of Modern Renewable Distributed Generators for Intentional Islanding Operation.....</b>                         | <b>39</b>  |
| <i>F. Hardan</i>                                                                                                                                |            |
| <b>New Type of Protection and Control Method for Smart Distribution Grid .....</b>                                                              | <b>45</b>  |
| <i>Houlei Gao, Qingle Pang, Yanqiu An</i>                                                                                                       |            |
| <b>A Transmission Utility's Experience to Date with Feeder Unit Protection Systems .....</b>                                                    | <b>50</b>  |
| <i>Wen An, N. Tart, D. Barron, M. Bingham, A. Hackett</i>                                                                                       |            |
| <b>A Transmission Utility's Experience to Date with Transformer Protection Systems .....</b>                                                    | <b>56</b>  |
| <i>Wen An, N. Tart, D. Barron, A. Hackett</i>                                                                                                   |            |
| <b>IEC 61850 Testing in Edition 2 - A Systematisation .....</b>                                                                                 | <b>62</b>  |
| <i>T. Schossig</i>                                                                                                                              |            |
| <b>IEC60255-121: The New Standard for Type-testing Distance Relays: Are the Proposed Tests Feasible and is it Worth the Effort?.....</b>        | <b>66</b>  |
| <i>S. Schwabe, B. Bastigkeit</i>                                                                                                                |            |
| <b>High-resistance Grounding Fault Detection and Location in DC Railway System.....</b>                                                         | <b>71</b>  |
| <i>C. Y. Dong, J. H. He, X. K. Wang, J. F. Xu, L. Yu, Z. Q. Bo</i>                                                                              |            |
| <b>Operation and Design of a Protection Relay for Transformer Condition Monitoring .....</b>                                                    | <b>76</b>  |
| <i>M. Moscoso, S. Hosseini, G. J. Lloyd, K. Liu</i>                                                                                             |            |
| <b>Network Rail and IEC 61850, A User's Perspective of the Standard.....</b>                                                                    | <b>82</b>  |
| <i>N. R. Burnham</i>                                                                                                                            |            |
| <b>Assessment of Transformer Relay Algorithms and Settings in Laboratory Using Transient Simulation Data.....</b>                               | <b>87</b>  |
| <i>L. H. Verney, J. G. Rolim</i>                                                                                                                |            |
| <b>Overall Differential Protection for Pump Storage Power Plant with Tapped-delta Design of the Unit Transformer .....</b>                      | <b>93</b>  |
| <i>Z. Gajic, J. Menezes, T. Mjos, A. Wolden, L. Elseth, A. Graftas</i>                                                                          |            |
| <b>New Algorithm for Determination of Faulty Feeder in Distribution Network .....</b>                                                           | <b>99</b>  |
| <i>P. Balcerek, M. Fulczyk, E. Rosolowski, J. Izykowski, P. Pierz</i>                                                                           |            |
| <b>Development of Stability Protection Framework in Oman Electricity Transmission System.....</b>                                               | <b>105</b> |
| <i>O. H. Abdalla, T. Al-Khusaibi, A. Al-Bitashi, A. Kumar, I. Svalova, P. Watson, A. Svalovs</i>                                                |            |
| <b>Novel Unit Protective Relaying Techniques for Teed Circuit Based on Sequential Overlapping Derivative Transform.....</b>                     | <b>111</b> |
| <i>D. Mourad, E. H. S. Eldin, A. M. Abd-Elaziz</i>                                                                                              |            |
| <b>Application of a Subharmonic Protection Relay .....</b>                                                                                      | <b>117</b> |
| <i>M. Peterson, R. Midence, J. Perez, A. Mulawarman</i>                                                                                         |            |
| <b>A Novel Distance Protection Algorithm in Frequency Domain Based on Parameter Identification .....</b>                                        | <b>123</b> |
| <i>J. L. Suonan, Y. Zhong, G. B. Song</i>                                                                                                       |            |
| <b>Synchrophasors - Can We Use Them for Protection? .....</b>                                                                                   | <b>129</b> |
| <i>A. P. Apostolov</i>                                                                                                                          |            |
| <b>A Novel Algorithm for Differential Protection of Untransposed Transmission Line Using Synchronized Measurements .....</b>                    | <b>135</b> |
| <i>A. S. Dahane, S. S. Damhare</i>                                                                                                              |            |

|                                                                                                                                                               |            |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>Out of Step Detection Using Synchronized Swing Impedance and Resistance Measurement.....</b>                                                               | <b>139</b> |
| <i>V. A. Ambekar, S. S. Dambhare</i>                                                                                                                          |            |
| <b>Effect of Fault Resistance and Grid Short Circuit MVA on Impedance Seen by Distance Relays on Lines Fed from Wind Turbine Generating Units (WTGU).....</b> | <b>143</b> |
| <i>S. Srivastava, U. J. Shenoy, A. C. Biswal, S. Ganesan</i>                                                                                                  |            |
| <b>Directional Relays for Distribution Networks with Distributed Generation .....</b>                                                                         | <b>149</b> |
| <i>T. D. Le, M. Petit</i>                                                                                                                                     |            |
| <b>Assessment of the Reliability of Loss of Mains Protection Incorporating Satellite Communications .....</b>                                                 | <b>155</b> |
| <i>A. A. Makki, A. Dysko, M. Lee, W. Hung</i>                                                                                                                 |            |
| <b>Impact of Synthetic Inertia from Wind Power on the Protection/Control Schemes of Future Power Systems: Simulation Study.....</b>                           | <b>161</b> |
| <i>F. Gonzalez-Longatt</i>                                                                                                                                    |            |
| <b>A Multi-state Model for Assessing the Impact of Insufficient Wide-area Situational Awareness .....</b>                                                     | <b>167</b> |
| <i>M. Panteli, P. A. Crossley, D. S. Kirschen</i>                                                                                                             |            |
| <b>Wide-area Situational Awareness (WASA) System Based Upon International Standards .....</b>                                                                 | <b>173</b> |
| <i>S. Matsumoto, Y. Serizawa, F. Fujikawa, T. Shioyama, Y. Ishihara, S. Katayama, T. Kase, A. Ishibashi</i>                                                   |            |
| <b>Wide-area Measurements to Improve System Models and System Operation.....</b>                                                                              | <b>179</b> |
| <i>G. Zweigle, R. Moxley, B. Flerchinger, J. Needs</i>                                                                                                        |            |
| <b>Using a Real Time Digital Simulator with Phasor Measurement Unit Technology .....</b>                                                                      | <b>184</b> |
| <i>D. S. Ouellette, M. D. Desjardine, R. Kuffel</i>                                                                                                           |            |
| <b>Improvements to Transformer Differential Protection - Design and Test Experience .....</b>                                                                 | <b>190</b> |
| <i>M. Moscoso, G. J. Lloyd, K. Liu, Z. Wang</i>                                                                                                               |            |
| <b>Enhancing Differential Protection Stability During CT Saturation with Transient Bias.....</b>                                                              | <b>196</b> |
| <i>O. Bagleybter, S. Subramanian</i>                                                                                                                          |            |
| <b>Experience with Accumulated Phase Angle Drift Measurement for Islanding Detection .....</b>                                                                | <b>200</b> |
| <i>C. An, G. Millar, G. J. Lloyd, A. Dysko, G. M. Burt, F. Malone</i>                                                                                         |            |
| <b>Impact of IEC 61850 on the Engineering of Protection Schemes .....</b>                                                                                     | <b>206</b> |
| <i>A. P. Apostolov</i>                                                                                                                                        |            |
| <b>Currents Sensors for Advanced Integration of Protection, Control, and Metering Functions .....</b>                                                         | <b>212</b> |
| <i>L. A. Kojovic</i>                                                                                                                                          |            |
| <b>When Existing Recommendations for PST Protection Can Let You Down .....</b>                                                                                | <b>218</b> |
| <i>Z. Gajic, M. Podboj, B. Traven, A. Krašovec</i>                                                                                                            |            |
| <b>High Frequency Fault Location Method for Transmission Lines Based on Artificial Neural Network and Genetic Algorithm Using Current Signals Only .....</b>  | <b>224</b> |
| <i>R. K. Aggarwal, S. L. Blond, P. Beaumont, G. Baber, F. Kawano, S. Miura</i>                                                                                |            |
| <b>Supervised Shutdown Algorithm for an Off-shore Wind Power Plant to Meet the Required Ramp Rate of a Grid Code in a Storm-driven Situation .....</b>        | <b>230</b> |
| <i>Yeon-Hee Kim, Jin-Shik Lee, Yong-Cheol Kang</i>                                                                                                            |            |
| <b>New Concept of Power Based Pole Slip Protection for Dispersed Generators in Smart Grid Environment .....</b>                                               | <b>235</b> |
| <i>A. Burek, J. Krata, J. Altonen</i>                                                                                                                         |            |
| <b>A New Multi-criteria Fuzzy Logic Transformer Inrush Restraint Algorithm .....</b>                                                                          | <b>241</b> |
| <i>D. Bejmert, W. Rebizant, L. Schiel, L. Staszewski</i>                                                                                                      |            |
| <b>A New Method to Identify Inrush Current by Composite Calculation .....</b>                                                                                 | <b>247</b> |
| <i>L. Liu, J. H. He, H. Zhang, Z. Q. Bo</i>                                                                                                                   |            |
| <b>IEC 61850 Communications Based Transmission Line Protection .....</b>                                                                                      | <b>252</b> |
| <i>A. P. Apostolov</i>                                                                                                                                        |            |
| <b>Use of IEC61850 in a 400kV Cable Monitoring System .....</b>                                                                                               | <b>258</b> |
| <i>L. Crompton, P. McManus, N. T. Beng, K. Waite</i>                                                                                                          |            |
| <b>Electric Traction System Rationalisation Via Integrated Protection and Control IEC 61850 Extended Station Bus Solution .....</b>                           | <b>263</b> |
| <i>O. G. Nenadovic</i>                                                                                                                                        |            |
| <b>Development of Process Bus for Busbar Protection and Voltage Selection Scheme .....</b>                                                                    | <b>269</b> |
| <i>Y. Tanaka, S. Oda, K. Adachi, H. Noguchi</i>                                                                                                               |            |
| <b>Modification of In-service Substation Based on IEC 61850 .....</b>                                                                                         | <b>274</b> |
| <i>Renhui Dou, Jing Vu, Jianfeng Lu</i>                                                                                                                       |            |
| <b>A Multi-agent System for Protection Coordination of Radial Systems in the Presence of Distributed Generation.....</b>                                      | <b>279</b> |
| <i>P. C. Maiola, J. G. Rolim</i>                                                                                                                              |            |
| <b>Measured Impedance by Distance Relay for Inter Phase Faults in the Presence of SVC on Double-circuit Lines.....</b>                                        | <b>285</b> |
| <i>S. Jamali, A. Kazemi, H. Shateri</i>                                                                                                                       |            |

|                                                                                                                                                                      |            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>Time-varying Waveform Analysis for Power Transformer Protection Using Frequency Shift Empirical Mode Decomposition .....</b>                                      | <b>291</b> |
| <i>M. Bazargan, Wuxing Liang, Chengxin Li, Junyong Liu, Jiashi Yang, Liangzhong Yao</i>                                                                              |            |
| <b>Superiority of Decision Tree Classifier on Complicated Cases for Power System Protection.....</b>                                                                 | <b>297</b> |
| <i>O. Ozgonenel, D. W. P. Thomas, T. Yalcin</i>                                                                                                                      |            |
| <b>Migration Paths for IEC 61850 Substation Communication Networks Towards Superb Redundancy Based on Hybrid PRP and HSR Topologies .....</b>                        | <b>303</b> |
| <i>M. Goraj, R. Harada</i>                                                                                                                                           |            |
| <b>IEC 61850 Substation Experiences.....</b>                                                                                                                         | <b>309</b> |
| <i>M. Childers, M. Borrielli</i>                                                                                                                                     |            |
| <b>IEC 61850 Experience in the Portuguese Transmission System to Date and Foreseeable Applications in the Future: A Case Study and Future Outlook.....</b>           | <b>314</b> |
| <i>F. Matos, R. Paulo</i>                                                                                                                                            |            |
| <b>Design and Operation of the IEC61850 9-2 Process Bus Used for the Protection System .....</b>                                                                     | <b>320</b> |
| <i>X. Sun, M. A. Redfern, P. A. Crossley, L. Yang, H. Y. Li, U. B. Anombem, A. Wen, R. Chatfield, J. Wright</i>                                                      |            |
| <b>Use of Transmission Protection Technology in Distribution Relays.....</b>                                                                                         | <b>326</b> |
| <i>P. Sankarakumar, K. Venkataraman</i>                                                                                                                              |            |
| <b>Performance Evaluation of Current Differential Relays Over a Wide Area Network .....</b>                                                                          | <b>331</b> |
| <i>P. Beaumont, F. Kawano, A. Kawarada, T. Kase, H. Sugiura, F. Lam, J. Hurd, P. Worthington, D. Richards, P. Merriman</i>                                           |            |
| <b>Current Sensors for Improved Capacitor Bank Protection .....</b>                                                                                                  | <b>337</b> |
| <i>A. Dos Santos, J. Lourenco, J. F. Martins, P. Monteiro, L. A. Kojovic</i>                                                                                         |            |
| <b>Improving Open-loop Medium-voltage Feeder Self-healing.....</b>                                                                                                   | <b>343</b> |
| <i>C. A. McCarthy, M. J. Meisinger</i>                                                                                                                               |            |
| <b>Flexible Protection Architectures Using Distributed Optical Sensors.....</b>                                                                                      | <b>349</b> |
| <i>P. Orr, G. Fusiek, C. D. Booth, P. Niewczas, A. Dysko, F. Kawano, P. Beaumont, T. Nishida</i>                                                                     |            |
| <b>Recent Developments in Standards and Industry Solutions for Cyber Security and Secure Remote Access to Electrical Substations.....</b>                            | <b>355</b> |
| <i>M. Goraj, J. Gill, S. Mann</i>                                                                                                                                    |            |
| <b>Assessing the Reliability of Adaptive Power System Protection Schemes.....</b>                                                                                    | <b>363</b> |
| <i>Adrianti, I. Abdulhadi, A. Dysko, G. Burt</i>                                                                                                                     |            |
| <b>Smart Power Grids - A Perfect Solution, Or Just a Fashion.....</b>                                                                                                | <b>369</b> |
| <i>A. Wiszniewski, J. Szafran, B. Brusilowicz</i>                                                                                                                    |            |
| <b>Performance Triangle in Digital Substation Architectures.....</b>                                                                                                 | <b>373</b> |
| <i>S. C. Potts, S. H. Richards, A. Varghese</i>                                                                                                                      |            |
| <b>A Network Sever-based Simulator for Protective Relays.....</b>                                                                                                    | <b>379</b> |
| <i>Sung-Rok Yoo, Sang-Hee Kang, Jae-Myeon Kim</i>                                                                                                                    |            |
| <b>Voltage Unbalance Protection VT and Relay Errors Effect on Unbalanced Voltage Detection; Considerations for System Relaying, Stability and Developments .....</b> | <b>383</b> |
| <i>V. Hiremathad</i>                                                                                                                                                 |            |
| <b>Full H7 Compliant Trip Circuit Supervision Using Numerical Relays.....</b>                                                                                        | <b>390</b> |
| <i>A. Hassall, J. Wright, A. Wixon, D. Stearn, D. Johnson, P. Newman, N. Pavaiya, M. Stockton</i>                                                                    |            |
| <b>The Comparison and Analysis for Loss of Excitation Protection Schemes in Generator Protection .....</b>                                                           | <b>394</b> |
| <i>Z. P. Shi, J. P. Wang, Z. Gajic, C. Sao, M. Ghandhari</i>                                                                                                         |            |
| <b>Impact of Low Burden on Measurement Transformer Accuracy Under Steady State Conditions.....</b>                                                                   | <b>400</b> |
| <i>V. Leitloff</i>                                                                                                                                                   |            |
| <b>Fault Location Method Using Measurements of Differential Relays for Parallel Transmission Lines with Series Capacitor Compensation at Both Ends .....</b>         | <b>404</b> |
| <i>M. Saha, J. Izykowski, E. Rosolowski</i>                                                                                                                          |            |
| <b>Neutral Voltage Displacement (NVD) Protection Applied to Condenser Bushings (Capacitor Cones).....</b>                                                            | <b>410</b> |
| <i>A. Hassall, A. Forsyth, J. Wright, A. Wixon, M. Stockton, P. Newman, D. Johnson, D. Stearn, N. Pavaiya</i>                                                        |            |
| <b>Equivalent Capacity of the Lower Voltage Ride Through for Wind Farm from Overcurrent Protection in Power Collection Lines .....</b>                               | <b>416</b> |
| <i>Bin Wang, Xinzhou Dong, Zhiqian Bo</i>                                                                                                                            |            |
| <b>Adaptive Setting of Protective Relays in Microgrids in Grid-connected and Autonomous Operation .....</b>                                                          | <b>421</b> |
| <i>M. Khederzadeh</i>                                                                                                                                                |            |
| <b>Preservation of Overcurrent Relays Coordination in Microgrids by Application of Static Series Compensators .....</b>                                              | <b>425</b> |
| <i>M. Khederzadeh</i>                                                                                                                                                |            |
| <b>Wide-area Protection in Smart Grids .....</b>                                                                                                                     | <b>430</b> |
| <i>M. Khederzadeh</i>                                                                                                                                                |            |

|                                                                                                                                                                            |            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>Detection of Blackouts by Using K-means Clustering in a Power System .....</b>                                                                                          | <b>434</b> |
| <i>O. Ozgonenel, D. W. P. Thomas, T. Yalcin, I. N. Bertizlioglu</i>                                                                                                        |            |
| <b>Detection of High Impedance Fault in MV Distribution System .....</b>                                                                                                   | <b>440</b> |
| <i>S. Subramanian, K. Venkataraman</i>                                                                                                                                     |            |
| <b>Enhanced Protection for Inverter Dominated Microgrid Using Transient Fault Information.....</b>                                                                         | <b>446</b> |
| <i>X. Li, A. Dysko, G. Burt</i>                                                                                                                                            |            |
| <b>Smart Grids Facilitate the Implementation of Sophisticated System Protection Schemes (SPS) .....</b>                                                                    | <b>451</b> |
| <i>M. Khederzadeh</i>                                                                                                                                                      |            |
| <b>Development of a Next Generation Protection and Control Platform .....</b>                                                                                              | <b>456</b> |
| <i>T. Kase, K. Hamamatsu, T. Kagami, Y. Sumida, T. Sugamoto, T. Kawasaki, G. P. Baber, P. G. Beaumont</i>                                                                  |            |
| <b>Decentralized Coordinated Robust Controller Design for Multimachine Power System Based on Multi-agent System.....</b>                                                   | <b>461</b> |
| <i>Chunxia Dou, Jinzhao Yang, Zhiqian Bo, Yefei Bi, Ting Gui, Xiaogang Li</i>                                                                                              |            |
| <b>Protection Issue Discussion of DC Network Development: Circuit Breaker Or Fault-tolerant Converter.....</b>                                                             | <b>467</b> |
| <i>J. Yang</i>                                                                                                                                                             |            |
| <b>Optimal Allocation of Distributed Generation to Minimize Relay Operating Times .....</b>                                                                                | <b>473</b> |
| <i>H. H. Zeineldin</i>                                                                                                                                                     |            |
| <b>Automated Test Solutions for Multifunctional Protection Relays.....</b>                                                                                                 | <b>478</b> |
| <i>Zhen Li, Sunping Sheng, S. Richards, P. Sankarakumar</i>                                                                                                                |            |
| <b>A New Multiterminal Fault Location Algorithm Embedded in Line Current Differential Relays.....</b>                                                                      | <b>483</b> |
| <i>B. Kasztenny, B. Le, N. Fischer</i>                                                                                                                                     |            |
| <b>Transmission Line Distance Protection with Dynamic Thermal Line Rating Support .....</b>                                                                                | <b>489</b> |
| <i>L. Staszewski, W. Rebizant, B. Venkatesh</i>                                                                                                                            |            |
| <b>Fallback Algorithms for Line Current Differential Protection Applied with Asymmetrical Channels Upon the Loss of Time Reference.....</b>                                | <b>495</b> |
| <i>B. Kasztenny, N. Fischer, B. Le</i>                                                                                                                                     |            |
| <b>Comprehensive and Quantitative Analysis of Protection Problems Associated with Increasing Penetration of Inverter-Interfaced DG .....</b>                               | <b>501</b> |
| <i>K. Jennett, F. Coffele, C. Booth</i>                                                                                                                                    |            |
| <b>Low-impedance Bus Differential - Security and Reliability in Complex Bus Arrangements.....</b>                                                                          | <b>507</b> |
| <i>C. Labuschagne, R. Moxley, E. Jessup, J. Needs</i>                                                                                                                      |            |
| <b>Protective Relay Traveling Wave Fault Location .....</b>                                                                                                                | <b>512</b> |
| <i>N. Fischer, V. Skendzic, R. Moxley, J. Needs</i>                                                                                                                        |            |
| <b>Protection and Stability Assessment in Future Distribution Networks Using PMUs.....</b>                                                                                 | <b>515</b> |
| <i>Feng Ding, C. D. Booth</i>                                                                                                                                              |            |
| <b>ANN Based Wide Area Protection of Power Systems.....</b>                                                                                                                | <b>521</b> |
| <i>F. Namdari, L. Hatamvand, M. Nourizadeh</i>                                                                                                                             |            |
| <b>Influence of the Voltage Regulation on the Local Stability Margin of the Receiving Node.....</b>                                                                        | <b>526</b> |
| <i>B. Brusilowicz, W. Rebizant, J. Szafran</i>                                                                                                                             |            |
| <b>A Study on Over-excitation Protection Algorithm and Time Over-current with Voltage Restraint Algorithm Using 345 kV Power System Modeling Data of South Korea .....</b> | <b>532</b> |
| <i>Park Chul Won, Ban Woo Hyeon, Kim Yoon Sang</i>                                                                                                                         |            |
| <b>Development of Adaptive Autoreclosure Algorithm in Transmission Lines .....</b>                                                                                         | <b>538</b> |
| <i>Jeong-Yong Heo, Chul-Hwan Kim, R. K. Aggarwal</i>                                                                                                                       |            |
| <b>Effects of Renewable Distributed Generation (RDG) on Voltage Dip Mitigation in Microgrids.....</b>                                                                      | <b>544</b> |
| <i>O. Ipinimo, S. Chowdhury, S. P. Chowdhury</i>                                                                                                                           |            |
| <b>Earth Fault Analysis Using Measured Data from Fault Experiments in Actual Distribution Network.....</b>                                                                 | <b>550</b> |
| <i>J. Orságová, D. Topolánek, P. Toman</i>                                                                                                                                 |            |
| <b>Using of Additional Earthing of Affected Phase for Limiting of the Touch Voltage During Earth Faults in MV Large Compensated Networks .....</b>                         | <b>555</b> |
| <i>P. Toman, J. Dvorak, J. Orsagova, D. Topolanek</i>                                                                                                                      |            |
| <b>Secure Differential Protection Using Unique Algorithms .....</b>                                                                                                        | <b>560</b> |
| <i>M. Peterson, R. Midence, J. Perez</i>                                                                                                                                   |            |
| <b>Fundamental Principles of Transformer Thermal Loading and Protection.....</b>                                                                                           | <b>566</b> |
| <i>J. Perez</i>                                                                                                                                                            |            |
| <b>Calculating Loadability Limits of Distance Relays.....</b>                                                                                                              | <b>572</b> |
| <i>C. Rincon, J. Perez</i>                                                                                                                                                 |            |
| <b>Neural Network Integrated with Regression Methods to Forecast Electrical Load.....</b>                                                                                  | <b>578</b> |
| <i>S. M. Badran</i>                                                                                                                                                        |            |
| <b>Synchronized Double-ended Fault Location Algorithm for Power Distribution Systems .....</b>                                                                             | <b>584</b> |
| <i>Ke Jia, D. Thomas, M. Sumner</i>                                                                                                                                        |            |

|                                                                                                                                          |            |
|------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>Improvement of Power Transformer Differential Protection Using Wavelet Analysis of Power System Frequency .....</b>                   | <b>589</b> |
| <i>H. Abniki, H. Monsef, M. T. Nabavi-Razavi</i>                                                                                         |            |
| <b>Impedance Based Fault Location Method for Phase to Phase and Three Phase Faults in Transmission Systems .....</b>                     | <b>596</b> |
| <i>H. Shateri, S. Jamali</i>                                                                                                             |            |
| <b>Intelligent Fuse-saving.....</b>                                                                                                      | <b>601</b> |
| <i>C. A. McCarthy, M. J. Meisinger</i>                                                                                                   |            |
| <b>Coordinated Optimization Among Multi-cycle Generation Schedules .....</b>                                                             | <b>606</b> |
| <i>Zhenglin Yang, Lili Li</i>                                                                                                            |            |
| <b>Protection and Control System for Cophase Supply Traction Substation.....</b>                                                         | <b>611</b> |
| <i>Zhengqing Han, Xingyu Cao, Shibin Gao, Zhiqian Bo</i>                                                                                 |            |
| <b>Innovative Injection-based 100% Stator Earth-fault Protection .....</b>                                                               | <b>616</b> |
| <i>T. Bengtsson, Z. Gajic, H. Johansson, J. Menezes, S. Roxenborg, M. Sehlstedt</i>                                                      |            |
| <b>The Visual Specification Method Making Specifying IEC 61850 Based System Easier .....</b>                                             | <b>622</b> |
| <i>M. C. Janssen</i>                                                                                                                     |            |
| <b>Protection System Tests .....</b>                                                                                                     | <b>628</b> |
| <i>P. G. McLaren, J. Tang, D. Ouellette, M. Steurer, P. Forsyth</i>                                                                      |            |
| <b>A Novel Transmission Line Pilot Protection Principle Based on Current Model Recognition .....</b>                                     | <b>634</b> |
| <i>J. L. Suonan, C. Ma, X. N. Kang</i>                                                                                                   |            |
| <b>Design and Realization of Large Grid Online Decision-making Support System for Accident Treatment.....</b>                            | <b>640</b> |
| <i>Xin Shan, Ze-Mei Dai, Yi-Jun Yu, Zhe Zhang, Yong Zhang, Jing Zhang</i>                                                                |            |
| <b>Risk Awareness and Decision Support Technique for Bulk Power System .....</b>                                                         | <b>645</b> |
| <i>Jinjun Lu</i>                                                                                                                         |            |
| <b>Fault Diagnosis of Double Circuit Lines on the Same Tower Based on Six-sequence Component and Expert System .....</b>                 | <b>650</b> |
| <i>Tao Zhang, Qing Chen, Zhanjun Gao, Debin Huang, Yi Tang</i>                                                                           |            |
| <b>Application on Testing Technique for Real-time Dynamics Monitoring System .....</b>                                                   | <b>655</b> |
| <i>Yunpeng Ge</i>                                                                                                                        |            |
| <b>Study on Online Calculation Method of Transmission Line Parameters.....</b>                                                           | <b>658</b> |
| <i>Tangsheng Xun, Li Wang, Song Zhang, Linlin Zhang, Jin Kong, Wei Cong</i>                                                              |            |
| <b>Short Circuit Current Calculation of Doubly Fed Induction Generator .....</b>                                                         | <b>662</b> |
| <i>Jie Ma, Debin Huang, Yi Tang, Changjing Wu, Luhua Xing, Qing Chen</i>                                                                 |            |
| <b>Coordinated Control Strategy Based on Photovoltaic Generation Integration.....</b>                                                    | <b>667</b> |
| <i>Junyu Wang, Xianliang Teng, Xiaobai Zhang</i>                                                                                         |            |
| <b>Fault Detection of a Series Compensated Line During the Damping Process of Inter-area Mode of Oscillation.....</b>                    | <b>671</b> |
| <i>F. K. A. Lami, P. Lefley</i>                                                                                                          |            |
| <b>A New Control Method of Wind Energy in Power System .....</b>                                                                         | <b>676</b> |
| <i>M. Kheshti, Xiaoning Kang</i>                                                                                                         |            |
| <b>A Novel Transmission Line Pilot Protection Principle Based on Frequency-domain Model Identification of Distributed Parameter.....</b> | <b>681</b> |
| <i>J. L. Suonan, C. Q. Wang, Z. B. Jiao</i>                                                                                              |            |
| <b>Optimal Protection Devices Allocation and Coordination in MV Distribution Networks.....</b>                                           | <b>687</b> |
| <i>F. Pilo, G. G. Soma, S. Ruggeri, G. Celli</i>                                                                                         |            |
| <b>Arc Suppression Coil Preset Compensation Method by Using Injection Signal .....</b>                                                   | <b>693</b> |
| <i>Wei Cong, Jin Kong, Tangsheng Xun, Lin Lin Zhang</i>                                                                                  |            |
| <b>On-line Security Assessment and Control Decision Support for Large Amount Wind Power Integrated Power System .....</b>                | <b>699</b> |
| <i>Bi Jun Li, Tai Shan Xu, Yong Jie Fang, Feng Xue, Yusheng Xue</i>                                                                      |            |
| <b>New Method of Detection of Current Transformer Saturation .....</b>                                                                   | <b>705</b> |
| <i>D. J. Bak, X. Z. Dong, B. Wang, S. X. Shin, W. Rebizant</i>                                                                           |            |
| <b>Fault Type Classification in Transmission Line Using STFT .....</b>                                                                   | <b>710</b> |
| <i>Jun Han, Won-Ki Kim, Jae-Won Lee, Chul-Hwan Kim</i>                                                                                   |            |
| <b>A Wide Area Synchrophasors Based Controlled Islanding Scheme Using Bioinformatics Toolbox .....</b>                                   | <b>715</b> |
| <i>F. Hashiesh, H. E. Mostafa, I. Helal, M. M. Mansour</i>                                                                               |            |
| <b>Inverse Time Overcurrent Protection for Traction Transformer .....</b>                                                                | <b>721</b> |
| <i>Shuping Liu, Panhong Li, Shibin Gao, Zhiqian Bo</i>                                                                                   |            |
| <b>Protection Scheme for Out-of-phase Short-circuit Fault of Traction Feeding Network.....</b>                                           | <b>725</b> |
| <i>Zhengqing Han, Zhihui Dong, Shibin Gao, Zhiqian Bo</i>                                                                                |            |

|                                                                                                                                          |            |
|------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>Study on Backup Protection for Traction Transformer.....</b>                                                                          | <b>729</b> |
| <i>Shuping Liu, Xiaoxiang Hu, Shibin Gao, Zhiqian Bo</i>                                                                                 |            |
| <b>Transient Fault Information Based Multifunctional Integrated IED in Smart Substation.....</b>                                         | <b>733</b> |
| <i>S. B. Luo, G. J. Lu, S. Y. Tian, Y. Hong, B. H. Zhang, B. J. Yun</i>                                                                  |            |
| <b>Analysis of Single-ended Traveling-wave Fault Location Based on Continuous Wavelet Transform Inferred from Signal.....</b>            | <b>738</b> |
| <i>L. U. Iurinic, A. S. Bretas, E. S. Guimarães, D. P. Marzec</i>                                                                        |            |
| <b>Protection of Domestic Solar Photovoltaic Based Microgrid.....</b>                                                                    | <b>744</b> |
| <i>M. P. Nthontho, S. P. Chowdhury, S. Winberg, S. Chowdhury</i>                                                                         |            |
| <b>The Offline Accident of the Large-scale Wind Generator System and Its Protection &amp; Control Scheme.....</b>                        | <b>750</b> |
| <i>Xinzhou Dong, Shenxing Shi, Bin Wang, D. Bak, Runbin Cao, Li Ren, Lan Lan, Shi'En He</i>                                              |            |
| <b>Emergency Control Scheme for Transient Stability Using Synchronized Measurement.....</b>                                              | <b>755</b> |
| <i>Xiaochen Du, P. Crossley</i>                                                                                                          |            |
| <b>Power System Fault Diagnosis Based on Power Grid.....</b>                                                                             | <b>760</b> |
| <i>Zhanjun Gao, Nuo Gao, Lei Wang, Zhaoifei Li</i>                                                                                       |            |
| <b>On Modeling and Simulating the Differential Protection of Power Transformers in ATP.....</b>                                          | <b>764</b> |
| <i>K. A. Tavares, K. M. Silva</i>                                                                                                        |            |
| <b>Prevention and Protection of Single-phase-to-ground Fault in Power Distribution System with Neutral Non-effectively Grounded.....</b> | <b>770</b> |
| <i>Shenxing Shi, Xinzhou Dong</i>                                                                                                        |            |
| <b>Author Index</b>                                                                                                                      |            |