

# **2023 IEEE International Conference on Advanced Power System Automation and Protection (APAP 2023)**

**Xuchang, China  
8-12 October 2023**



**IEEE Catalog Number: CFP2363M-POD  
ISBN: 979-8-3503-0667-5**

**Copyright © 2023 by the Institute of Electrical and Electronics Engineers, Inc.  
All Rights Reserved**

*Copyright and Reprint Permissions:* Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

***\*\*\* This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.***

IEEE Catalog Number:	CFP2363M-POD
ISBN (Print-On-Demand):	979-8-3503-0667-5
ISBN (Online):	979-8-3503-0666-8

**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) 758-2633  
E-mail: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

## TABLE OF CONTENTS

A Thyristor-Controlled Superconducting Current Limiting Module on Mitigation of Commutation Failure in LCC-Based HVDC Systems .....	1
<i>Haonan Wang, Minghao Huyang, Qihuan Dong, Wujie Chao, Shenxing Shi, Xinzhou Dong</i>	
A Novel Inverter Topology on Mitigation of Commutation Failure in LCC-Based HVDC Systems.....	9
<i>Haonan Wang, Minghao Huyang, Qihuan Dong, Wujie Chao, Shenxing Shi, Xinzhou Dong</i>	
Traveling Wave Differential Protection Applied to Renewable Energy and Flexible DC Connected Lines.....	16
<i>Binshu Chen, Yuanyuan Dai, Xinzhou Dong, Haozong Wang, Xinyuan Li, Tianxiao Huang</i>	
Research on Relay Protection of 10kV Distribution Network Considering the Operating Characteristics of Virtual Power Plant.....	21
<i>Yishen Wang, Dan Wu, Shenxing Shi, Wenzhong Li, Qingrong Zheng, Xinzhou Dong</i>	
A Single-Phase to Ground Fault Location Method Based on Last-Squares Parameter Estimation in Arc-Suppression-Coil Grounding System.....	27
<i>Kun Liu, Bin Wang, Yeyan Qin</i>	
A Weak Fault Adaptive Traveling Wave Protection Method for Bus and Transmission Line .....	32
<i>Zhenwei Guo, Jiemei Huang, Qian Huang, Yingcai Deng, Yi Luo, Zebo Huang</i>	
Calculation of Unbalanced Power Flow in Distribution Networks with Photovoltaic Systems.....	37
<i>Haidong Yu, Yang Liu, Yuhang Zhang, Bin Wang, Shidong Zhang, Min Huang</i>	
A Frequency Support Strategy of Multiple Wind Power Plants Based on Consensus Algorithm .....	42
<i>Heejung Seo, Sungwoo Kang, Deokki You, Minhyeok Chang, Gilsoo Jang</i>	
The Impact of Cross Line Different-Phase Successive Faults on Fault Detection Devices.....	47
<i>Lisheng Li, Haidong Yu, Yuxuan Jin, Bin Wang, Yang Liu, Linli Zhang</i>	
An Internal Fault Model of a Transformer Bank Using the UDM of Matlab/Simulink .....	51
<i>Ji-Sun Lee, Woo-Seok Seo, Sang-Hee Kang</i>	
Pilot Protection Scheme for Collection Line of All-DC Offshore Wind Transmission System.....	57
<i>Tianyu Liang, Zhiguo Hao, Yuning Zhang, Fan Xie</i>	
Analysis of Transient Process of Photovoltaic System in a New Power System.....	64
<i>Zhaohui Chen, Xiaobing Ding, Wei Liu, Xu Chen, Yichen Shang, Shenxing Shi, Xinzhou Dong</i>	
Digital Twin Application for the Evaluation of Protection Performance in IEC-61850-Based Digital Substations .....	69
<i>Peng Y Lak, Sopheap Key, Seong-Min Yoon, Soon-Ryul Nam</i>	
Modeling of Tree Contact Faults in Distribution Networks .....	74
<i>Yang Liu, Haidong Yu, Yibo Sheng, Bin Wang, Lisheng Li, Linli Zhang</i>	
Upward Streamer Behaviour on ESE Lightning Rod Employing Field Electron Emission Model Under Lightning Impulse Voltage .....	79
<i>Kyung-Hoon Jang, Sang-Won Seo, Dong-Jin Kim</i>	

A Study on the System Strength Evaluation Index Considering the Interaction Between Renewable Energy .....	83
<i>Beomju Kim, Seunghyuk Im, Byongjun Lee</i>	
Backup Solution for Traveling Wave Differential Protection Under Synchronization Failure.....	86
<i>Haozong Wang, Qihuan Dong, Wenzhong Li, Binshu Chen, Xinzhou Dong, Pengfei Lv, Zhihuai Shu, Kun Liu, Zebing Shi</i>	
Fault Analysis of DCSST MV Side Bipolar Short Circuit.....	92
<i>Kaixin Zhang, Shenxing Shi, Xinzhou Dong</i>	
An Improved Grid-Forming Control Strategy of Energy Storage System for Enhancing Low-Voltage Ride Through Capability .....	97
<i>Congbo Wang, Yue Yu, Wencheng Xu, Sumei Liu</i>	
Optimal Design of Sensor Arrays in Electromagnetic Tomography for Non-Destructive Treeing Detection in XLPE Cables.....	102
<i>Yingqiang Shang, Jun Xiong, Ziyi Zheng, Wu Lu, Yuyang Jiao, Xianwei Ma</i>	
Thermal Analysis and Comparative Study of Power Conversion System Main Topology Using SiC MOSFETs.....	106
<i>Wei Han, Xin Dai, Shang Cao, Meng Jiang, Jingwei Zhang</i>	
A Phase-Trajectory-Based Out-of-Step Detection Scheme and Its Verification in RTDS .....	111
<i>Guosong Wang, Haiyang Wang, Songhao Yang, Mingshun Liu, Zhiguo Hao</i>	
Method for Determining the Minimum Capacity Scale of Generators Under Voltage Stability Constraints.....	116
<i>Qi Jia, Long Peng, Xin Wang, Wuzhi Zhong, Shiyun Xu, Peng Yang</i>	
A Pilot Protection Principle Based on the Structure Similarity of Transient Energy Waveform for Hybrid HVDC System.....	121
<i>Chao Gao, Junjie Hou, Yan Li, Yanfang Fan, Guobing Song, Ruonan Liu, Runbin Cao</i>	
A Novel DC Line Pilot Protection Scheme Based on Additional Current-Limiting Control of HB-MMC .....	127
<i>Xiaohua Qin, Yanfang Fan, Junjie Hou, Yan Li, Runbin Cao</i>	
Adaptability Analysis of Directional Element for Inverter Interfaced System Considering Fault Control Strategy .....	133
<i>Junjie Hou, Wentao Yang, Yan Li, Yanfang Fan, Guobing Song, Runbin Cao, Dongxiao Cai, Teng Liu</i>	
Traveling Wave Protection for the AC Transmission Lines Between MMC Stations and Renewable Energy Sources.....	139
<i>Xinyuan Li, Wenzhong Li, Binshu Chen, Haozong Wang, Qihuan Dong, Xinzhou Dong</i>	
Research on Single-Ended Protection for Wind Power Full-DC Transmission System Based on Generalized S Transform .....	144
<i>Panlong Li, Junjie Hou, Yan Li, Yanfang Fan, Guobing Song, Runbin Cao, Weihuang Huang, Zhu Guo</i>	
Research on Fault Control Strategy for Two Terminal Weak Feed Systems Considering Step-Down V/f Control .....	150
<i>Junjie Hou, Qiangqiang Gao, Guobing Song, Yanfang Fan, Yan Li</i>	

A Non-Pilot Protection Scheme for Transmission Lines Connected to Inverter-Interfaced Power Source.....	156
<i>Bo-Liang Jin, Xin-Zhou Dong</i>	
Automatic Graph Modeling of Power Transformer Management Data .....	162
<i>Wenqi Huang, Jiayi Zhang, Wei Xi, Yachen Tang, Qinyu Feng, Guangyi Liu</i>	
MMC Circulation Suppression Optimization Strategy Based on Quasi-PI <sup>λ</sup> R Controller.....	167
<i>Xiangfang Chen, Junmin Zhang</i>	
Smart Tripping and Closing Strategy for Line-To-Line Un-Grounding Faults of the Wind Farm Double-Circuit Transmission Line .....	173
<i>Sen Hu, Chao Xie, Fengting Li, Chunya Yin, Gaohang Zhang, Yan Li</i>	
Security Constrained Economic Dispatch Based on Shift Factor Adaptive Calculation.....	177
<i>Wenqi Huang, Tianlin Yang, Zhen Dai, Yachen Tang, Xuanang Li, Guangyi Liu</i>	
Graph-Based Automatic Identification and Correction of Bus Topology in 500kV Substations.....	182
<i>Peng Li, Yachen Tang, Wenqi Huang, Ming Duan, Jiaxuan Hou, Jiayi Zhang</i>	
A Health Status Evaluation Method for Gateway Device Based on Chip-Board-Device Information and Fuzzy Synthesis Method.....	187
<i>Yuqian Wang, Jun La, Haiyan Hong, Ziyang Jing, Lixiang Ruan, Xinyu Li, Ancheng Xue</i>	
Inter-Turn Fault Identification Method of Shunt Reactor Based on RMS Value Characteristics of Inductance in Linear Flux Region .....	193
<i>Dongxing Wang, Jirui Chen, Xu Li, Zhenliang Yang, Biao Zhao, Lin Gan</i>	
Substation Transformer Abnormality Diagnosis Technology Based on Multi-Source Information Fusion .....	200
<i>Li Chen, Ying Chen, Bifu Qian, Ziyi Zhao, Jituo Chen</i>	
Data Compression for Differential Protection of Distribution Network: A Wavelet Approach.....	203
<i>Zhenkang Qi, Anning Sun, Xinzhou Dong</i>	
Process and Protection Action of Commissioning Fault of Offshore Wind Farm Grid-Connected Transmission Lines.....	208
<i>Yabing Yan, Xu Chu, Qi Liu, Hui Li, Liqiang Xu</i>	
PV Injection Power Estimation Method Based on Voltage Sensitivity Analysis Optimized by SA-BPSO Algorithm.....	215
<i>Minchun Zhang, Jian Wang, Jinxin Ouyang, Shoudong Xu, Mingyi Li</i>	
Optimal Configuration of MESS in Distribution Network Fault Recovery by Considering the Impulse of Loop Closing Current.....	220
<i>Mingyi Li, Jian Wang, Jinxin Ouyang, Shoudong Xu, Minchun Zhang</i>	
Fault Location Method for Distribution Lines Based on Coordination of Primary and Secondary Devices .....	226
<i>Zonglei Yang, Chao Xie, Fengting Li, Chunya Yin, Gaohang Zhang</i>	
A Simulation-Based Method for Distribution Line Localized Protection Device Development.....	230
<i>Hui Liu, Haigang Wang, Sijie Zhu, Jinjin Ding, Feng Zhang, Yu Xia, Shenxing Shi</i>	
VSC-HVDC Line Reclosing Strategy Based on Parallel Branch Trial .....	235
<i>Jian Wen, Chao Xie, Fengting Li, Chunya Yin, Gaohang Zhang</i>	

Adaptive Reclosing Strategy for Distribution Network Based on Three-Phase Additional Inductance .....	240
<i>Xiaocong Zheng, Chao Xie, Fengting Li, Chunya Yin, Gaohang Zhang</i>	
An Intelligent Tripping-And-Reclosing Strategy for Grounding Faults on Double-Circuit Wind Power Outgoing Lines.....	246
<i>Jiangbo Jiang, Chao Xie, Fengting Li, Chunya Yin, Gaohang Zhang, Yan Li</i>	
The Definition of Effective Inertia and Its Analysis on the Low Inertia System Connected Via HVDC.....	251
<i>Jeonghoo Park, Namki Choi, Byongjun Lee</i>	
Performance Improvement for Pilot Protection of Double Circuit Lines on the Same Tower Based on Power Converse Accurate Identification .....	256
<i>Kai Huang, Bo Jiao, Yang Yu, Hongliang Liu, Quan Hao, Yiqing Liu</i>	
Accurate Detection Method for Voltage Traveling Wave Based on L1-Regularization and Least Squares Optimization .....	261
<i>Zhaohui Chen, Xu Chen, Xiaobing Ding, Wei Liu, Tao Tang, Xiaohan Li, Weiguo Yu</i>	
Single Phase Grounding Fault Line Selection Method of Resonant Grounding System Based on Recurrence Quantification Analysis and Fuzzy C-Means Clustering.....	266
<i>Mingzhao Song, Ye Tian, Zeqiao Ma, Xuesong Yao, Xuan Liu</i>	
The New Principle of New Power System Line Transient Protection Based on Time-Frequency Catastrophe Characteristics .....	271
<i>Bo. Zhang, Rrongrong. Zhan, Zhaoyi. Sha, Congbo. Wang, Kai. Xu</i>	
Fault Section Location of Collector Line in Wind Farm Based on LightGBM Algorithm.....	278
<i>Yuqing Gao, Tong Bai, Lingang Yang, Yaolu He, Huifang Wang</i>	
A Coordinated Optimization Control Strategy for Transient Stability of the Multi-Infeed HVDC Power Grid .....	283
<i>Yujie Zhang</i>	
Copula Theory Based Calculation Method of Fault Probability Under Typhoons Disaster .....	289
<i>Shaofeng Liu, Ning Chen, Ji Tang, Aomeng Yang, Chen Yu, Yanzhang Liu</i>	
Stochastic Optimal Allocation of Photovoltaic and Storage Capacity in Distribution System for New Energy Accommodation.....	294
<i>Yi Huang, Ankang Miao, Minzhen He, Han Wu, Anyu Wang, Yue Yuan</i>	
An Online Fault Location Method for DC Distribution Networks Using Adaptive Kalman Filter.....	300
<i>Yu Zexue, Hao Zhiguo, Wang Ting</i>	
Research on Coordinated Control Strategy for AC Fault Ride-Through of Wind-Solar-Thermal-Storage Combined Flexible-Direct Transmission System .....	305
<i>Yaguang Zhang, Bingyuan Yang, Bo Xie, Jiaxing Li</i>	
An Auxiliary Directional Relay of Distribution Network with Photovoltaic Source Based on Harmonic Energy.....	316
<i>Jingtiao Zhao, Xiaoyan Zhang, Wenqiang Xie, Ruihuang Liu, Xiaotong Du</i>	
Control Parameters Optimization for MMC-HVDC Transmission System with New Energy Weak AC Grid .....	321
<i>Guangqiang Peng, Jiyang Wu, Lixin Chen, Zhidi Huang, Jia Li, Haoli Chen, Yuansheng Liang</i>	

Research on Reclosing and Fault Location Methods for 1000kV UHV Overhead-GIL Hybrid Lines.....	327
Wenzheng Li, Baowei Li, Zaigang Li, Xin Shi	
Comparative Analysis of the New Energy Development in Major International Economies.....	333
Shuwen Xiao, Xiaoning Kang, Jinxu Cui, Shiduo Jia, Bowen Tian	
Transient Protection Based on Phase Difference.....	338
Zebing Shi, Jinfu Xu, Jiang Yu, Xiaobing Ding	
Transient Stability Analysis of Power System Considering Traction Load .....	343
Xiaofeng Jiang, Xiaoyan Han, Lei Liu, Gang Chen, Hao Wang	
Reactive Power Optimization Control Strategy of AC Weak Grid Considering Small Hydro-Power Access.....	349
Qunmin Yan, Ruiqing Ma, Juanjuan Zhu, Chen An	
Protection Configuration and Circuit Optimization Schemes of 220kV Line Transformer Group .....	356
Yinyin Li, Hengchu Shi, Hao You, Xiaofan Chen, Qiaowei Yang, Wenbo Shi	
Research on Two Stage Zero Sequence Inverse Time Current Protection and Its Setting Method .....	360
Lu Xiaoyi, Zheng Tao, Kong Jingkai, Dai Yuxin, Li Pengyu, Chen Weiru	
Design of Distributed Detection System for High Voltage Intelligent Breaker Secondary System Based on Dynamic Closed Loop .....	365
Xiao Su, Ming Liu, Hua Liao, Jiechang Qiu	
A Study on Transmission Line Protection Using Incident Current.....	370
E. Xu, H. Wang, Y. Zhang	
Allocation and Optimal Operation Strategy of Distributed Energy Storage with High Ratio PV .....	377
Tianyu Wang, Tianjun Jing, Zikai Feng, Jie Wang, Xin He, Zhiming Zhao	
State Evaluation of Secondary Equipment Based on Matter-Element Extension Theory .....	382
Jianglei Suo, Feng Wang, Jia Zhu, Qian Tan, Kai Chen, Ge Liu	
Design of Automatic Identification System for Substation Monitoring Interface Based on Machine Vision .....	387
Ang Li, Wei Zhang, Na Zhao, Wenzhuo Li, Haiyan Zhang, Xiaoping Liu, Jinhu Zhang	
Model Predictive Control Strategy for Stable Power Transmission of DWPT System Based on Mutual Inductance Identification.....	393
Weikun Wang, Tao Jin, Yun Wen, Yunzhi Lin, Jun Ma	
Investigation of Fracture Mechanism and Performance Optimization of Grading Electrode Applied in HVDC System.....	399
Zhen Wang, Xuemei Xiang, Henglei Zhang, Zhongyuan Yang, Yueying Zhang	
Improvement on Hausdorff Distance and Its Application to the Backup Protection Scheme for Hybrid HVDC System.....	404
Zijiang Wang, Dongjie Li, Feng Xiong, Zhaoyi Zhang, Ben Shang, Youping Fan	
Research on Health Status Evaluation of Measurement and Control Devices by Fusing Chip-Board-Device Information.....	411
Jun La, Yuqian Wang, Ziyang Jing, Lixiang Ruan, Xinyu Li, Ancheng Xue	
Research on Voltage Detection Method of UPQC Based on NF-FLL.....	417
Xuejie Wang, Fuyin Ni, Wenxin Ma	

Construction and Applications of Knowledge Graph of Relay Protection Device Defects Based on Ne04J and Structured Data.....	421
<i>Shaoming Zheng, Peng Dong, Juan Du, Dan Liu, Hongzhi Su, Shuhong Wang, Chang Tao, Jinzhou Yang, Ancheng Xue</i>	
Research on Protection Circuit Breaker for Photovoltaic Grid Connection with Collaborative Measurement and Control Design of Photovoltaic Inverter .....	426
<i>Jingtao Xu, You Yue, Chuangang Ou, Daohu Fan</i>	
Modified Isolated Modular Multilevel Converter for Bipolar DC Distribution System.....	433
<i>Chang Niu, Zhenlan Dou, Lianghui Dong, Xianggen Yin, Jinmu Lai, Yaoqiang Wang</i>	
Abnormal Detection Method of High-Voltage Switchgear Cabinet in Power Distribution Room Based on SSD-MobileNet .....	440
<i>Kai Chen, Xiang Su, Ling Ji, Tingfang Tan, Ge Liu</i>	
Review on Icing Fault Prediction for Overhead Transmission Lines .....	444
<i>Xiaolu Bai, Jianshuang Lv, Decheng Cai, Yiyang Shen, Hui Hou, Yan Wang</i>	
Differential Protection for Double-Ended Weak-Infeed Transmission Lines Based on Time-Domain Integral Value of Traveling Waves.....	449
<i>Chen Zhaojun, Ding Xiaobing, Gan Qingzhong, Chen Xu, Li Xinyuan, Shi Shenxing, Dong Xinzhou</i>	
A Strategy of Adaptive Reclosure for AC Lines on the Inverter Side of AC/DC Hybrid Grid.....	454
<i>Minghao Huyang, Haonan Wang, Chaoping Deng, Wujie Chao, Junwei Huang, Xinzhou Dong</i>	
Comparison of Different Power Flow Models in Power System Cascading Outage Simulation .....	459
<i>Mingshun Liu, Yiben Lu, Songhao Yang, Guosong Wang, Zhiguo Hao, Baohui Zhang</i>	
An Accurate Under Frequency Load Shedding Method for the Active Distribution Grid with Distributed Generators.....	463
<i>Guosong Wang, Mingshun Liu, Yeji Jiang, Songhao Yang, Zhiguo Hao</i>	
Simulation-Based Insights into Resistive Superconducting Fault Current Limiter Integration for Enhanced Stability in a German Power Distribution Network .....	467
<i>Qihuan Dong, W. T. B. De Sousa</i>	
A Grounding Fault Protection Method for Low Resistance Grounded Distribution Networks Based on Capacity Current.....	475
<i>Gang Wang, Houlei Gao, Fang Peng, Tong Yuan, Lin Li</i>	
A Method for Locating Latent Faults in Medium Voltage Cables Based on the Traveling Wave Dual Terminal Principle .....	481
<i>Ruirui Zhang, Mingyue Wang, Yongliang Liang</i>	
Research on Shore DC Grids Considering Increasing Penetration of Renewables .....	489
<i>Yu Guan, Yanyu Yang, Xiaoyan Xu, Jianjun Ma, Yu Liu</i>	
Energy Harvesting Analysis and Sensing Application of Cantilever Structure Based on Aeolian Vibration and Piezoelectric Effect.....	493
<i>Yisong Gao, Fangda Fu, Lincong Chen, Qinzhuh Chen, Zhiming Wang, Zejie Tan, Yang Ni</i>	
Energy Storage Planning Method to Improve the Resiliency of Distribution Network Under Disaster Weather.....	500
<i>Hongzhou Chen, Xiaofu Xiong, Jizhong Zhu, Jiahui Lian</i>	

Energy Storage Planning and Configuration of Active Distribution Network Based on Load Ordered Clustering .....	509
<i>Xiangyang Du, Junjie Cheng, Xiaofu Xiong, Meijia Xue, Yang Ni</i>	
Coordinated Scheduling Strategy of Emergency Resources to Enhance Interdependent Power-Gas System Resilience Prior to Disasters .....	518
<i>Yufei He, Xiaofu Xiong, Pengfei Yu, Wei Wang, Hongzhou Chen, Hongjiang Wu</i>	
High-Precision Wide-Range Current Transformer Based on Compensation Algorithm .....	529
<i>Yuefei Xu, Qinghua Wu, Minghao Ye, Jingmao Wen, Jiaqing Ma, Taiying Zheng</i>	
A Novel Principle of Current Differential Protection for Renewable Energy Station .....	535
<i>Chen Lan, Song Huang, Jindao Zhang, Jing Meng, Huaiyu Zhang, Xiaodong Zheng</i>	
Study on Single-Phase Grounding Current Protection of Distribution Line in Neutral Grounding System Via Arc Suppression Coil.....	540
<i>Jingji Shi, Shenxing Shi, Xinzhou Dong</i>	
High Sensitivity Differential Protection for AC Line in MMC-HVDC System .....	550
<i>Qian Zhao, Haotian Cheng, Xiaodong Zheng, Zhongping Liu, Huaiyu Zhang, Yinjing Xiao, Haoran Liu, Huayanran Zhou</i>	
High Impedance Fault Detection Method Based on Traveling Wave Full Waveform Fault Characteristics .....	556
<i>Yang Li, Yilin Chen, Feng Deng</i>	
Differential Protection Sensitivity Enhancement Scheme for AC Transmission Lines Connecting to VSC-HVDC Station .....	561
<i>Huaiyu Zhang, Zhongping Liu, Hulin Liu, Yong Hou, Chen Lan, Xiaodong Zheng</i>	
A Dynamic State Estimation Method Based on Robust Cubature Kalman Filter and Super Phasor Measurement Units.....	566
<i>Yajie Liu, Zhaoyang Jin, Lei Ding</i>	
Impact of Overhead Grounding Wire Arrangement on Induced Voltage of Adjacent Pipelines.....	571
<i>Xin Hu, Yifei Wang, Xiaojuan Xi, Yanxun Guo</i>	
A Pilot Protection for Transmission Lines Connected to Wind Power Plants .....	576
<i>Hao Wang, Xiaopeng Li, Wenyue Zhou, Yipeng Luo</i>	
Transmission Line Differential Protection Based on Numerical Solution of Partial Differential Equations.....	580
<i>Zhiquan Liu, Yu Liu, Dayou Lu, Yanyu Yang, Rui Fan</i>	
Comparative Evaluation of Different Grounding Methods on the DC Side During Steady-State Operation of Low-Voltage DC Distribution Network .....	585
<i>Xiaoli Qi, Fang Peng, Houlei Gao, Zhihua Zhang, Kun Wang</i>	
Characterization of Frequency Spatial Distribution of Power System Under Disturbance Scenario .....	590
<i>Guifang Zhao, Lei Ding, Mingyu Liu</i>	
Synchronization Damping of Grid-Forming Converter Under DC Voltage/Frequency Mapping Control.....	596
<i>Wenhui Yang, Lei Ding, Xuesong Gao, Xinyun Wang, Lei Song</i>	

A Novel Control Strategy of Wind-Energy Storage Integrated System to Suppress Wind Power Fluctuation.....	604
<i>Zhiming Zhang, Lei Ding, Anxiang Hou, Weiyu Bao</i>	
Electromagnetic Transient Simulation Modelling and Analysis of Electric Vehicle Charging Stations .....	610
<i>Jiawei Yang, Hongfei Chen, Xiaoqiang Meng, Tianqi Ge, Xin Guan, Yongjie Luo</i>	
Impact Analysis of SCR on Different Modes Dominated by Heterogeneous Synchronous Control of Converters .....	614
<i>Bowen Li, Jinmin Cheng, Xinyao Zhu, Yuqiao Jia</i>	
Analytical Assessment of Reactive Power Support Capacity for DFIGs Under Voltage Drop Failure .....	620
<i>Jintian Lin, Wen Hua, Jiancheng Zhang</i>	
Transient Characteristics Analysis of High Impedance Ground Fault in High-Speed Railway Traction Network.....	625
<i>Haodong Hu, Qi Wang, Sheng Lin</i>	

#### **Author Index**