

# **12th IET International Conference on Advances in Power System Control, Operation and Management (APSCOM 2022)**

IET Conference Publications 822

Hong Kong, China and Online  
7-9 November 2022

ISBN: 978-1-7138-7824-7

**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© (2022) by the Institution of Engineering and Technology  
All rights reserved.

Printed with permission by Curran Associates, Inc. (2023)

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: 845-758-2633  
Email: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

## TABLE OF CONTENTS

Design of a Four-Coil Wireless Power Transfer System with Load-Independent Constant Voltage Output.....	1
<i>Kaiyuan Wang, Yun Yang, Rui Liang, Hexiang Wang</i>	
A Novel Predicting Model of the Electric Vehicle Battery Considering the State of Health.....	5
<i>Yuan Mao, Junting Bao, Kaiyuan Wang, Youbing Zhang, Yang Zhang</i>	
Design of an Omnidirectional Wireless Charging Container.....	11
<i>Rui Liang, Siyang Liu, Xuewei Jin, Huihuan Wu, Heshou Wang, Kaiyuan Wang</i>	
Invisible Antenna for AMI Field Area Network .....	16
<i>John Chan, Aaron Ng, Terrance Lai, Candice Chow</i>	
Optimisation on Pollutants Emission Control with Developing Machine Learning Algorithms for Advanced Statistical Performance Monitoring.....	21
<i>Ka-Nok Cheuk</i>	
Design of a Wireless Charging System in DC Microgrids with Accurate Output Regulation and Optimal Efficiency .....	26
<i>Chenchen Li, Kaiyuan Wang, Yuan Mao</i>	
Secondary Side Parameter Estimation Method of Wireless Power Transfer Systems for Electric Vehicle Charging .....	31
<i>Hexiang Wang, Kaiyuan Wang, Yuan Mao</i>	
Swing Equation in Power Systems: Approximate Analytical Solution for the Dynamics of the System Inertia.....	36
<i>Abdul Ahad Jhumka, Yusra Bibi Ruhomally, Chandana Ramasawmy, Robert T. F. Ah King, Muhammad Zaid Dauhoo</i>	
Integration Analysis of VSG-Based IBRs on Power System Dynamics.....	42
<i>Tao Xue, Siqi Bu, Ulas Karaagac, Ilhan Kocar</i>	
Strategic Electrical Asset Maintenance by Reinforcement Learning.....	48
<i>Chao Huang, Siqi Bu</i>	
An Improved Multi-Vector Predictive Power Control of DFIGs Using Geometrical Modulation .....	53
<i>Yip Mum Cheng</i>	
Damping Contribution Analysis to Examine Subsynchronous Control Interactions Induced by PLL Control Loops in the Power Systems with Multiple Converter-Interfaced Generator.....	59
<i>Jiangfeng Zhang, Siqi Bu</i>	
Comparison Analysis of Deep Learning Forecasting Models with Hybrid Structure for Short-Term Wind Power Prediction.....	65
<i>Jonathan Wong, Ruoheng Wang, Siqi Bu</i>	
Risk Assessment of Power System Voltage Security for Operational Planning .....	71
<i>Jerry Yeung, Siqi Bu</i>	
Model Predictive Direct Torque Control of a Three-Phase Four-Switch Inverter Induction Motor Driving System.....	77
<i>Jialong Qu, Kerui Li</i>	

Evaluation Method of Fault Severity of Energy Storage Spring of Circuit Breaker Based on Multivariate Linear Function.....	83
<i>Yan Yabing, Wu Xiaozhong, Zhang Xiaorui, Gan Xing, Ouyang Fan</i>	
Design, Testing and Commissioning of Power System Stabilizer in Gas-Fired Generating Unit on the Hong Kong Electric Power System .....	89
<i>C. S. Wan, Y. K. Lam, P. Y. Wong, K. Sato, S. Noguchi</i>	
Optimization of Carbon Emission Flow Induced by Transmission Losses for Modern Power System Operation.....	95
<i>Zixuan Zhu, Siqi Bu</i>	
Holistic Approach for Asset Management of Medium Voltage Switchgear in HK Electric .....	101
<i>Yan Ka Wing Andrew, Law Hong Ming Dickson</i>	
Adoption of Electric Vehicles in the Transport Sector: Effect on Net Emission Reduction .....	109
<i>Shahneela Zohaib, Lasantha Meegahapola</i>	
SCADA Data Gateway Server to Provide Transmission Data to Distribution Control Centers .....	114
<i>S. J. Paulas, W. D. M. D. R. K. Gunarathne, C. M. Jayasinghe, A. D. De Silva</i>	
Research on Fingerprint Identification of Network Assets Based on CNN-GRU Neural Network Model .....	119
<i>Jingxin Zhang, Chao Xu, Zhi Cao, Mingyu Yang, Zhiru Zhang</i>	
Evaluation of Series Trippings in AADC Network .....	124
<i>Ahamed Mohamed Rayees, Omar Reyadh Al Ahmad, Mohamed Ahmed Sabra, Maitha Al Kaabi</i>	
A Method to Increase the Peak Power Delivery Period of a Cascade Hydropower Complex in Sri Lanka - A Case Study .....	129
<i>H. H. D Nalin, K. A. C Udayakumar</i>	
Data-Driven Based Coordinated Smart Inverter Control for Distributed Energy Resources .....	135
<i>Wei Qiu, He Yin, Yuru Wu, Siqi Bu, C. Y. Chung, Byungkwan Park, Teja V Kuruganti, Ajay P Yadav, Yaosuo Xue, Wenxuan Yao, Yilu Liu</i>	
Transient Reactive Power Output Capability Promoting Strategy of MMC-STATCOM Based on Variable DC Voltage .....	140
<i>T. Wu, W. Z. Zhong, L. J. Yu, J. B. Zhu</i>	
Impact of Electric Vehicles on Low-Voltage Networks: A Probabilistic Analysis.....	146
<i>Matthias Hungbo, Mingchen Gu, Lasantha Meegahapola</i>	
Centralized Battery Systems to Manage Voltage Under High Penetration of solar-PV and Electric Vehicles .....	152
<i>Shakya Nandan, Lasantha Meegahapola, Mingchen Gu</i>	
Short-Term Power Load Forecasting Based on Wavelet Transform and Deep Deterministic Policy Gradient.....	158
<i>Rongquan Zhang, Siqi Bu, Li Wang, Gangqiang Li, Yuxia Zheng, Lingling Luo, Fang Liu</i>	
Design and Analysis of Modal Resonance-Oriented Cyber-Attack Against Wide-Area Damping Control.....	164
<i>Zhaoyuan Wang, Siqi Bu</i>	

TSPM-CNN Based Power System Transient Stability Assessment Using a New Data Extraction Method .....	170
<i>Jiaqi Zhou, Siqi Bu</i>	
Short-Term Wind Speed Prediction Based on Variational Modal Decomposition and Improved BP Neural Networks.....	176
<i>Heng Wang, Xiaodong Yu, Yue Zhang, Yanling Hao, Kai Zhang</i>	
Damping Torque Analysis for Mechanical Oscillation of PMSG Based Wind Generation System .....	182
<i>Xianyu Zhou, Siqi Bu</i>	
Research on Flexible Energy Mutual Aid Strategy of Distribution Network Based on Energy Storage Balance Control.....	188
<i>Lipeng Wang, Gang Wang, Hu Liu, Ling Qin, Guowei Xie</i>	
Cyber-Physical Contingency and Vulnerability Assessment Using Double Power Flow Method .....	194
<i>Dongmeng Qiu, Rui Zhang, Al Hussein Dabashi, Zhuoran Zhou, Xin Zhang</i>	
The Challenge of Integrating Renewable Energy into the “Small Island” Power System of Mauritius .....	200
<i>Jean Roland Fayolle, Yoganardenn Appasamy, Mohamed Ally Rujbally</i>	
Protecting Privacy in Microgrids Using Federated Learning and Deep Reinforcement Learning .....	205
<i>Wenzhi Chen, Hongjian Sun, Jing Jiang, Minglei You, Piper; William J. S.</i>	
A Hierarchical Event-Driven Emergency Control Method Utilizing Battery Energy Storage System.....	211
<i>Nan Gu, Yuchen Zhang, Ke Meng, Zhao Yang Dong</i>	
Forecast of Rural Electric Energy Substitution Potential Based on Nonlinear Regression-Neural Network.....	217
<i>Peng Li, Liuyang Cai, Wenjing Zu, Qinchen Yang, Hongkai Zhang, Shiwei Xia</i>	
Optimal Planning of Mobile Energy Storage in Active Distribution Network .....	223
<i>Wenpei Li, Zizheng Wang, Bin Xiang, Hu Xiong, Jiayuan Li, Shiwei Xia</i>	
Optimized Control Strategy of Green Buildings with PV Generation and Energy Storage Integration .....	228
<i>Yidian Gao, Kaiqi Sun, Wei Qiu, Yuanyuan Sun</i>	
Distributed Feedback Optimization in Fully Inverter Based Islanded Microgrids for Accurate Reactive Power Sharing and Fast Response in P - f Droop .....	234
<i>Y. Cheng, T. Liu, D. J. Hill</i>	
Bidding Strategy of Wind Storage Combined System Participating in Electricity-Carbon Combined Marked Under Double Carbon Target .....	240
<i>Keyuan Fu, Zhiheng Li</i>	
All Operating Conditions Simulation Model of Distributed Photovoltaic Power Station Based on PSCAD .....	246
<i>Hong Xie, Lijuan Fan, Yu An, Ze Wei, Junliang Liu, Xiong Du</i>	
Control and Simulation Analysis of 120kW Charging Pile .....	252
<i>Yu An, Zhuo Cheng, Hongxin Li, Shiqi Zhu, Junliang Liu, Ze Wei, Xiong Du</i>	
Modular Multi-Level Converter Grid-Connected Oscillation Suppression Measures Based on Virtual Impedance .....	257
<i>Lijuan Fan, Hongxin Li, Zhuo Cheng, Jialong Li, Junliang Liu, Ze Wei, Xiong Du</i>	

Research on Improvement of Regulation Ability of New Power System in Guizhou Province..... <i>Jiang Hu, Wenchuan Meng, Hua Gao, Xianggang He, Zhi Rao, Siyang Sun, Wenxia Liu</i>	262
Analysis of Inertia Response Characteristics of New-Type Power System..... <i>Hongxin Li, Jiapeng Li, Lijuan Fan, Yibo Ding, Yu An, Zhao Xu</i>	268
An Improved Error Decoupling Approach for Wind Power Prediction Result Analysis..... <i>Luxi Hao, Yangwu Shen, Yuhua Hu, Limengqian Zheng, Weijia Wen, Jianxing Ye, Xiandong Zeng, Ding Wang</i>	273
Characteristics and Impact Analysis of Grid Inertia Spatiotemporal Distribution..... <i>Jinghan Yang, Siqi Bu</i>	279
Correlation Analysis of Neutral Direct Current of Transformers Caused by Metro Stray Current..... <i>Chen Long, Huang Kaimin, Wei Kunxuan, Gao Demin, Wang Aimin, Lin Sheng</i>	285
A Distribution Network PV and SOP Joint Planning Method Considering Evolution Driving Factors .....	290
<i>Linhao Ye, Min Xu, Zuogang Guo, Ke Wang, Jinyong Lei, Zhiyong Yuan</i>	
A High-Resistance Unbalance Fault Identification Method for High-Proportion New Energy Access System .....	295
<i>Dan Liu, Kan Cao, Yiqun Kang, Jindong Yan, Fan Xiao, Minghao Wen, Ping Xiong</i>	
Transformer State Assessment and Implementation Based on Online Monitoring .....	301
<i>Tao Tang, Anan Zhang, Wei Qiu, Liang Zhang, Wenfu Hu</i>	
Transformer Online Monitoring and Intelligent Diagnosis System Design .....	307
<i>Wenfu Hu, Anan Zhang, Wei Qiu, Liang Zhang, Tao Tang</i>	
Energy Storage Modular Multilevel Converter Topology and Its Fault Ride Through Control Strategy.....	313
<i>Shuangfei Yang, Man Chen, Yongqi Li, Yuebin Zhou, Zhenkai Hu, Wenming Gong, Yuewu Wen</i>	
An Improved Reconfiguration Technique of Solar PV Arrays Using Sliding Puzzle Pattern .....	319
<i>C. Janani, B. Chitti Babu, K. Vijayakumar</i>	
Fault Phase Selection Method for High Voltage Transmission Line of High Proportion Renewable Energy System.....	325
<i>Fan Xiao, Yiqun Kang, Ping Xiong, Dan Liu, Kan Cao, Xiaoniu Wang, Yu Chen, Minghao Wen</i>	
Synergistic Resilient Strategy of Integrated Electric and Gas System: An ADMM-Based Dispatch Framework Considering Joing Working Group.....	331
<i>Hanchen Liu, Ping Ju, Chong Wang, Zhao Xu</i>	
Common-Mode Voltage Suppression of Indirect Four-Bridge Matrix Converter Based on Dual-Space Vector Modulation.....	336
<i>Yougui Guo, Fazheng Liu, Min Wu</i>	
Intelligent Model for Managing Energy Efficiency of Public Sector by Using Machine Learning and IoT System.....	342
<i>Dheeraj Singh, Aman Kumar Singh, Mohit Goyal, Anand Singh, Deependra Sinha</i>	
A Novel Peer-To-Peer Electricity Market Mechanism with the Participation of Electricity Retailers .....	348
<i>Ze Hu, Ka Wing Chan, Siqi Bu, Ziqing Zhu, Xiang Wei</i>	

A Novel Solar Energy Management System Based on Digital Twin Technique .....	354
<i>Songjie Zhang, Zhenyu Wang, Jovian Man-Chit Cheung, Elaine Wai Ling Yip, Zhao Xu, Donglian Qi</i>	
Aggregation and Optimal Dispatch of Flexible Resources in Multi-Energy Microgrid.....	359
<i>Lei Wang, Jian Huang, Jiansheng Hou, Lanxin Shao, Qiaofeng Wu, Yikai Sun</i>	
Towards Congestion Management in Distribution Networks: A Dutch Case Study on Increasing Heat Pump Hosting Capacity .....	365
<i>Sen Zhan, Tongyou Gu, Wouter Van Den Akker, Willemijn Brus, Anne Van Der Molen., Johan Morren</i>	
Centre for Smart Grid Analysis with Real Time Simulation Platform .....	371
<i>Shek Ho Wong, Man Hon Chow, Man Hin Chow</i>	
A Comprehensive Review of Data Centre Integrated with Renewable Energy.....	375
<i>Zhan Li, Minghao Wang, Zhao Xu, Guoxin Tang</i>	
AMI System - Integrated Approach in System Design, Challenges & Project Implementation Optimization in High Urban Density City.....	381
<i>Lei Chen, Yu Xia</i>	
HK Electric's AMI Journey to a Full Deployment of Smart Meter and Advanced Metering Infrastructure (AMI).....	387
<i>Alex Lee</i>	

#### **Author Index**