

# **2024 8th International Conference on Power and Energy Engineering (ICPEE 2024)**

**Chengdu, China  
20-22 December 2024**



**IEEE Catalog Number: CFP24Y84-POD  
ISBN: 979-8-3315-3087-7**

**Copyright © 2024 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:    | CFP24Y84-POD      |
| ISBN (Print-On-Demand): | 979-8-3315-3087-7 |
| ISBN (Online):          | 979-8-3315-3086-0 |

**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)

CURRAN ASSOCIATES INC.  
**proceedings**  
.com

# 2024 8th International Conference on Power and Energy Engineering ICPEE 2024

## Table of Contents

|                            |    |
|----------------------------|----|
| Preface .....              | x  |
| Conference Committee ..... | xi |

---

### ❖ New Motor Models and Structural Control

|   |   |
|---|---|
| Feasible Region of Droop Gain of Power Synchronization Loop Based Wind Generator Under Rotor Speed Limitation ..... | 1 |
|---|---|

*Zhou Xing, Jing Ren, Shaoyun Ding, Lin Cheng, Gang Zhang, Yujun Li*

|   |   |
|---|---|
| Power Density Investigation of Distributed Magnetic Pole Permanent Magnet Planetary Machine ..... | 6 |
|---|---|

*Tanci Chen, Yulong Pei, Feng Chai, Wenbin Zhou*

|   |    |
|---|----|
| Analysis of Switching Mechanisms and Transient Stability of Virtual Synchronous Generators Considering Current Limiting ..... | 12 |
|---|----|

*Zengze Tu, Shaoze Zhou, Simin Wu, Jingrui Liu, Zheng Wei, Wei Wang*

|  |    |
|--|----|
| A Maximum Torque per Ampere Control Strategy for Brushless DC Motor Based on Direct Torque Control ..... | 18 |
|--|----|

*Zhisong Zhang, Tao Wen, Shuang Hai, Zhenguo Li*

|  |    |
|--|----|
| Fast Magnetic Field Analysis Method for Long Primary Double-sided Linear Induction Motors with Slot Considered ..... | 23 |
|--|----|

*Tianping Li, Liming Shi, Peilong Wang, Zixin Li*

|  |    |
|--|----|
| Mitigating sub synchronous oscillations in DFIG based wind farms connected to series compensated transmission lines using a damping filter ..... | 29 |
|--|----|

*Uvini Perera, Ramon Zamora, Amanullah Maung Than Oo*

|   |    |
|---|----|
| Inverse-System Based Hybrid Control for Wind Turbines in the Near-Rated Wind Speed..... | 35 |
|---|----|

*Wanting Li, Hua Geng, Jiaqi Li*

|   |    |
|---|----|
| A Novel Method for Determination of Unit Parameters in Power Systems Considering Frequency Spatial Distribution by Modal Analysis ..... | 43 |
|---|----|

*Pengpeng Kang, Xiaoyu Tian, Wenhui Zhai, Yiqian Sun, Xiqiang Chang, Guixing Yang, Pengfei Song, Ning Ma, Bingbing Guo*

## ❖ HVDC Transmission Systems and Line Protection

|   |    |
|---|----|
| A Characteristic Analysis Method for Reflection Coefficient Spectrum of Power Cable Based on Bispectral Estimation..... | 49 |
| <i>Zhirong Tang, Kai Zhou, Yeifei Xu, Hongzhou Zhang</i>  |    |
| A Non-invasive Defect Detection Method of XPLE Cable Based on PCA and S-transform.....                                  | 54 |
| <i>Jinxin Zhang, Fang Chen, Wei Luo, Defa Cao, Lingyong Li, Cunliang Wei</i>  |    |
| Application of PSO-optimized Chebyshev Window Function in Power Cable Defect Detection.....                             | 60 |
| <i>Chengfeng Wu, Yunxiao Zhang, Jinlin Zheng, Yuxiang Chen, Wanying Huang, Yingjian Cai</i>                             |    |
| An Improved FDR Defect Localization Method Based on K-means Clustering and Fractional Fourier Transform .....           | 65 |
| <i>Bai Huang, Jian Fang, Fan Yang, Xiang Lin, Fengxiang Zhou, Zhikai Pang, Biao Pang</i>                                |    |
| Research on Defect Diagnosis Method of Power Transformer Acoustic Vibration Method Based on Deep Learning.....          | 73 |
| <i>Gu Yuanbo, Zhao Chunming, Gao Hong, Chen Ning, Jiang Shengfei, Zhang Feng</i>  |    |

## ❖ Control Models and Reliability Assessment in Digital Power Systems

|   |     |
|---|-----|
| Fault Analysis of Transformer Winding Based on Frequency Response Method .....                              | 78  |
| <i>Zhou Dan, Yao Congwei, Cai Linglong, Jiang Shuo, Rao Zhangquan, Pang Xiaofeng, Zhou Lijun, Min Xiyao</i> |     |
| Optimization of Wind Turbine FRT Strategy under LCC-HVDC Commutation Failure .....                          | 83  |
| <i>Decai Li, Yiyang Zhu, Xiao Lei, Shangjin Yang, Guangheng Pang, Yani Wu</i>                               |     |
| Research on transformer winding fault diagnosis method based on multi-signal source excitation.....         | 89  |
| <i>Yong Kang, Junxian Dong, Nan Chen, Jihui Chen</i>  |     |
| Power system transient stability prediction with a CNN trained with steady-state input variables .....      | 94  |
| <i>M. Ramirez-Gonzalez, F. R. Segundo Sevilla, P. Korba</i>   |     |
| The Power Transfer Limit of Converter with Different Reactive Power Control .....                           | 99  |
| <i>Yinsheng Su, Nanyu Wang, Guanghu Xu, Qin Gao, Tongpeng Mu, Haicheng Yao, Bao Li, Yujun Li</i>            |     |
| Equivalent Circuit Analysis of Open-Loop Modal Resonance .....  | 106 |
| <i>Nanfeng Gao, Xiao Wang, Tianyu Su, Changlong Dai, Qiang Fu</i>   |     |
| Power Planning Methods Considering Boundary Uncertainties.....  | 111 |
| <i>Man Jin, Jianan Si, Boning Yu, Zhenli Deng, Fangzhao Deng, Hujun Li</i>                                  |     |
| Research on the Construction Strategy of Knowledge Graph for Pre control of Power Operation Risks ...       | 117 |
| <i>Wu Xiaoxi, Amin Fu, Yang Yi, Li Ang</i>  |     |

|   |     |
|---|-----|
| Analysis and Control of the Power-Type Virtual Synchronous Generator Based on a Phase-locked Loop ..... | 124 |
| <i>Zixuan Su, Qi Xiong, Hongyuan Wu, Yong Chen, Huan Guo</i>  |     |

|   |     |
|---|-----|
| Electrothermal Coupling Model of IGBT Power Module Considering Thermal Coupling ..... | 130 |
| <i>Shaolin Song, Yigeng Huangfu, Fan Li, Xiaopeng Wang, Lei Tao, Longzhi Xu</i>       |     |

## ❖ Voltage Control and Load Forecasting in Power Systems

|   |     |
|---|-----|
| Research on the Impact of Transmission Network Voltage on Load Power and Line Loss Based on Bat Algorithm ..... | 137 |
| <i>Qin Wei, Chen Zhengyu, Long Yingkai, Wang Qian, Song Wei, He Weisheng, He Wenke, Shao Yuhuan</i>             |     |

|   |     |
|---|-----|
| The Correlation Analysis between New Energy Output Characteristics and Power Grid Voltage Risk Based on the CRITIC Method ..... | 142 |
| <i>Tingxiang Liu, Pinkun He, Libin Yang, Zhengxi Li, Junxiong Ma, Ziming Wang, Feng Xiao</i>                                    |     |

|   |     |
|---|-----|
| Method for Increasing Equivalent Damping in DC Voltage Synchronization Control Based on an Additional High-Pass Filter Forward Path ..... | 147 |
| <i>Hongmei Gao, Yong Li, Xiangcheng Meng, Jiahe Xu, Zhihao Wang, Jun Zhang, Mingliang Mu, Haozhi Qi, Shuguang Song</i>                    |     |

|   |     |
|---|-----|
| Swarm Intelligence Based Optimal Design of Local Volt/Var Control Function for Distributed Energy Resources ..... | 153 |
| <i>Zhengfa Zhang, Yuqing Dong, Jiaojiao Dong, Jin Dong, Boming Liu, Yayu Yang, Teja Kuruganti, Yilu Liu</i>       |     |

|   |     |
|---|-----|
| Synergistic supply-preservation technology for multiple types of power sources and energy storage systems ..... | 159 |
| <i>Hongqi Shen, Shushan Han, Yu Chen, Heng Zhang, Chang Liu, Chuanjie Fu, Yang Song, Yixi Zhang, Heng Chen</i>  |     |

|  |     |
|--|-----|
| Fault diagnosis of transformer winding online monitoring based on BP neural network..... | 167 |
| <i>Yong Kang, Nan Chen, Wang Shi, Junting Li, Liwei Zhou, Hongbo Wang</i>                |     |

## ❖ Power Electronic Devices Design and Electrical Performance Simulation

|   |     |
|---|-----|
| Decentralized Active Disturbance Rejection Control of Mult-Active Bridge Converter based on Cascaded Linear-Nonlinear Extended State Observer ..... | 173 |
| <i>Hongyuan Wu, Weijie Lin, Yong Chen, Huan Guo, Mingyu Zhou, Ruixiong Yang</i>   |     |

|  |     |
|--|-----|
| Research on the Principle and Effectiveness Analysis of Online Monitoring of Transformer Windings Based on Multi-point Injection ..... | 179 |
| <i>Changbin Luo, Min Zhang, Lilong Liu, Weizhao Yang, Gengli He, Dong Li</i>   |     |

|   |     |
|---|-----|
| A Novel Differential Method for Power Loss Measurement of White Light Emitting Diodes ..... | 184 |
| <i>Ahmed Zurfi, Ali Ibrahim</i>   |     |

|  |     |
|--|-----|
| Research and Development of the Conductivity Testing System for Generator Circuit Breakers with Ultra-High Rated Currents.....                           | 190 |
| <i>Haifan Li, Guohong Fu, Jia Cheng, Ruiyu Zeng, Huan Guo</i>  |     |
| Power System Harmonics Analysis and Mitigation Using Single-Tuned Filter Based on ETAP .....   | 195 |
| <i>Muntasir Elhaj, Omer Salim, Faisal B. Alanazi, Mohammed O. Bahabri</i>  |     |
| Common-mode Electromagnetic Interference Suppression Method for Full-Bridge LLC Resonant Converter .....   | 200 |
| <i>Wei Shen, Sen Huang, Sen Wang, Weibin Si, Wei Li, Chuang Bi</i>   |     |
| Establishment and Verification of Detailed Analytical Models for Shaft Voltage and Bearing Current of Flat-Wire Motor.....                               | 205 |
| <i>Zhen Mao, Tanci Chen, Feng Chai, Yulong Pei</i>   |     |
| Control Strategy of Grid-Forming VSG Based on Adaptive Inertia and Damping .....   | 212 |
| <i>Xu Wang, Li Ma, Mingyang Guo, Qiang Guo, Kaile Xi, Yan Jia</i>  |     |
| LightGBM-TabTransformer-Based Hybrid Data-Driven Parameter Estimation Method for Under-Water WPT Systems .....   | 217 |
| <i>Xiaotian Zhang, Weiye Wang, Xuemei Zeng, Di Heng, Hao Chen, Bo Luo, Chao Gong, Jose Rodriguez</i>   |     |
| <b>❖ New Power System Collaborative Operation and Control Based on Clean Energy</b>  |     |
| Evaluation for Grid-Forming Capability of Battery Energy Storage Systems .....   | 222 |
| <i>Yongxiang Cai, Yang Wang, Song Zhang, Shaoxin Shi, Qiao Peng</i>  |     |
| Research on partition reserve optimization method for multi-zonal interconnected power system .....  | 227 |
| <i>Tingxiang Liu, Libin Yang, Zhengxi Li, Kai Wang, Ziming Wang, Feng Xiao</i>   |     |
| Research on Energy System Management and Circuit Optimization Strategies for Unmanned Underwater Vehicles .....  | 232 |
| <i>Dihua Lu, Guofei Lyu, Te Yu, Xuerui Sheng, Chang Zhang, Zhaojun Wang</i>  |     |
| Rolling Dispatch for Geo-distributed Data Centers Considering the Uncertainties of Tasks and Renewables Based on Boundary Correction .....               | 238 |
| <i>Tianyu Jin, Xinyu Chen, Linquan Bai</i>   |     |
| Optimized Design of a Stand-Alone Hybrid PV/Wind/Diesel Energy System for Sustainable Development in Sudan: Minimizing Costs and Carbon E missions ..... | 244 |
| <i>Muntasir Elhaj, Omer Salim, Tarteel H Abobaker, Amna M. Nasr, Mosaab Abdalla</i>  |     |
| A research on building energy consumption prediction method based on GBRT-LSTM.....  | 251 |
| <i>Tao Wang, Wenmeng Zhao, Zhe Cheng, Sliang Wang</i>  |     |
| <b>❖ New Integrated Energy Systems and Power Generation Technologies</b>   |     |
| Short-term Photovoltaic Power Prediction Based on Similar-day Method Using LSTM-TCN Model.....   | 258 |
| <i>Guanghui Zhu, Jingjing Lyu, Chuan He</i>  |     |

|  |     |
|--|-----|
| Active Power Coordinated Control of Grid-Forming Renewable Generations and DC Transmission System .....                        | 265 |
| <i>Zhi Jing, Shao Chong, Xu Honglei, Zhou Dengyu, Liu Zhidong, Wang Caixiu</i>   |     |
| Hierarchical Reserve Power Dispatching of Multi-terminal DC System-Integrated Wind Power Systems for Frequency Control.....    | 271 |
| <i>Ruanming Huang, Linxin Miao, Chenhao Mo, Haoen Li, Yuchen Qi, Yuehai Chen, Qiao Peng</i>                                    |     |
| Hybrid Energy Storage System with DC-DC Boost Converter and MPPT P&O Control for Optimized Photovoltaic Power Management ..... | 277 |
| <i>Mostafa Wageh Lotfy, Aziza I. Hussein</i>   |     |
| Design of Distributed Photovoltaic Perception Control Flow Transmission Based on Internet of Things ...                        | 283 |
| <i>Zhu Qiao, Yu Yan, Jixin Hou, Chen Liu, Zhixing Zheng, Qing Liu, Wenbin Wang, Jie Meng</i>                                   |     |
| Experimental Investigation on Energy Consumption and Emissions of Automotive Air Conditioning for Heavy-Duty Vehicles .....    | 293 |
| <i>Jianfu Zhao, Xun SHANG, Tengting Li, Fengbin Wang</i>   |     |
| A Novel Constrained Load Flow Model and Algorithm for New-type Power System Based on the Levenberg-Marquardt Method.....       | 300 |
| <i>Jiaxuan Wang, Yinsheng Su, Guanghu Xu, Qin Gao, Tongpeng Mu, Haicheng Yao, Bao Li, Yujun Li</i>                             |     |
| Study of Energy-saving Effects of Predictive Cruise Control for Heavy-duty Vehicles Based on Real Road Tests .....             | 306 |
| <i>Jianfu Zhao, Fengbin Wang, Tengting Li</i>  |     |
| A Power Hardware-in-Loop Platform With PEM Electrolyzer Towards Electricity-Hydrogen Integrated System.....                    | 314 |
| <i>Zhiyao Zhong, Hao Li, Jiakun Fang, Shijie Cheng</i>   |     |
| Two Newton-based Improved Algorithms For AC/DC Hybrid Power Flow .....   | 319 |
| <i>Yinsheng Su, Nanyu Wang, Guanghu Xu, Qin Gao, Tongpeng Mu, Haicheng Yao, Bao Li, Yujun Li</i>                               |     |
| <b>❖ Control Strategies, Digital Operation and Energy Storage Configuration for Smart Grids</b>                                |     |
| Optimal Deployment Design of Smart Microgrid in Aquaculture System .....   | 327 |
| <i>Junchao Cheng, Yongyi Huang, Xunyu Liang</i>  |     |
| Primary FM Control Strategy for Energy Storage Considering Multiple Storage Links.....   | 333 |
| <i>Jun Yang, Changjun Tuo, Xuan Wang, Jiasheng Wang</i>  |     |
| Buoyancy Energy Storage: Innovative Solutions for Grid Energy Storage Challenges .....   | 338 |
| <i>Junchao Cheng, Yongyi Huang, Xunyu Liang</i>  |     |
| A Three-Dimensional Evaluation Method for the Comprehensive New Energy Carrying Capacity of Distribution Networks .....        | 343 |
| <i>Baoying Wu, Yanliang Li, Baorong Zhou, Wenmeng Zhao, Tian Mao, Dong Zhang</i>   |     |

|   |     |
|---|-----|
| A Distributed Load Restoration Method in Reconfigurable Distribution Networks Based on Multi-Agent Reinforcement Learning ..... | 350 |
|---|-----|

*Huayu Zhang, Tao Feng, Zihan Li, Guangze Shi*

|  |     |
|--|-----|
| Multi-Scenario Scheduling Optimization Strategies for Pumped Storage Power Stations Considering Hydropower in the Same River Basin ..... | 355 |
|--|-----|

*Wenbao Hu, Xue Ma, Fang Li, Xiantao Li, Zhiping Ying, Jinjun Wang, Heng Chen*

|   |     |
|---|-----|
| Genetic Algorithm-Based Substation Access Road Optimization Method..... | 364 |
|---|-----|

*Chenxi TANG, Wei LI, Yue ZHUO, KeYang SUN, Yali WANG, Li LIU*

|  |     |
|--|-----|
| Research and Application of Lightweight GIS Components in Power Grid Dispatching System - Taking the Application of New Energy Panoramic Monitoring System as an Example ..... | 369 |
|--|-----|

*Yaowei Zhang, Caishen Fang, Yuan He, Yuan Zhang*

## ❖ **Power Demand Analysis and Market Transactions**

|  |     |
|--|-----|
| Dynamics of Market Equilibrium under Transition towards Higher Renewable Penetration Considering Joint Energy Markets Clearing ..... | 375 |
|--|-----|

*Yuliang He, Xinyu Chen, Yuxin Zhang*

|  |     |
|--|-----|
| Real-Time Operation Strategy for Energy Storage Considering Power Generation Rights Transfer ..... | 382 |
|--|-----|

*Fangzhao Deng, Jianan Si, Hujun Li, Xingwu Guo, Boning Yu, Man Jin*

|   |     |
|---|-----|
| Residents' electricity-saving behavior under demand-side management of electricity: A quasi-natural experiment of "E-Saving" Activity ..... | 388 |
|---|-----|

*Yacan Wang, Jianing Yu, Xu Wei, Jingjing Li, Xuesong Li, Chengjie Wang, Hongjian Bai*

|   |     |
|---|-----|
| Research on Demand Response Model Optimization for User-Adjustable Loads..... | 393 |
|---|-----|

*Boyuan Cao, Shuang Wang*

|  |     |
|--|-----|
| Effects of Time-of-Use Pricing on Peak and Off-Peak Electricity Use: an Empirical Study Based on Micro-level Data..... | 400 |
|--|-----|

*Yacan Wang, Shuchen Liu, Xu Wei, Chengjie Wang, Xuesong Li, Xiao Huang*

## ❖ **New Technologies for Power Supply and Power Station Energy Storage**

|  |     |
|--|-----|
| Research on Remote Dynamic Patrol Technology of Relay Protection based on Master-Substation Interaction..... | 405 |
|--|-----|

*Hongming Shen, Ying Liu, Houyuan Li, Zhihong Xiao, Peili Yan, Ziqi Wang*

|  |     |
|--|-----|
| Optimizing CCS Retrofit Configuration for Coal-fired Power Plants Considering Flexibility Enhancement Strategy ..... | 409 |
|--|-----|

*Yaxing Liu, Chang Liu, Xinyu Chen*

|  |     |
|--|-----|
| Modeling and Enhancement of Seismic Resilience for Ultra High Voltage Converter Station..... | 415 |
|--|-----|

*Zhihang Xue, Hongjun Wang, Fenglian Liu, Changhua Zhang*



|  |     |
|--|-----|
| Design and Implementation of Baseline Verification and Analysis System for Host Equipment in Power Monitoring System.....        | 421 |
| <i>YANG Qing, QU Gang, ZHANG Liang, JIN Haochun, WU Xin, ZHAI Haibao, XU Xin</i>   |     |
| Optimization of Electric Vehicle Smart Charging and Discharging Decisions Based on Policy Gradient Reinforcement Learning .....  | 426 |
| <i>Zhanlian Li, Mengxuan Yan, Chun Sing Lai, Loi Lei Lai</i>   |     |
| Exploring User Behavior Variations in Plug-in Hybrid Electric Passenger Vehicles Across Diverse Temperature Conditions .....     | 431 |
| <i>Run HE, Guangya ZHANG, Hongxia JIANG, Zhe WANG, Bingcai WU, Hanzhengnan Yu, Xiaopan AN</i>                                    |     |
| Operation Mode and Capacity Tariff Mechanism of a Pumped Storage Power Plant Considering Hydropower in the Same River Basin..... | 437 |
| <i>Xue Ma, Yun Chen, Fan Yang, Jin Gao, Yanpu MA, Hui Wang, Heng Chen</i>  |     |

## **Author Index**