

ISSN 0258 - 8013
CODEN ZDGXER

中国电机工程学报

半月刊

第 42 卷 第 14 期

Proceedings of the CSEE

SEMIMONTHLY

Vol.42 No.14

中国电机工程学报

第四十二卷

第十四期

二〇二二年七月

Proceedings of the CSEE

Vol.42

No.14 July 2022



7月
2022
2022-07-20 出版

ISSN 0258-8013



中国电机工程学会主办
THE CHINESE SOCIETY FOR ELECTRICAL ENGINEERING



中国电机工程学报

ZHONGGUO DIANJI GONGCHENG XUEBAO

第 42 卷

第 14 期 (总第 697 期)

2022 年 7 月 20 日

目 次

(论文电子版 <http://www.pcsee.org/CN/volumn/home.shtml>)

“数字电网技术”专题特约主编寄语.....李鹏, 李鹏, 黄凯, 郭焯 (5001)

· 数字电网技术 ·

数字电网的理念、架构与关键技术.....李鹏, 习伟, 蔡田田, 于浩, 李鹏, 王成山 (5002)

电力定制化芯片应用场景及关键技术展望.....董旭柱, 谌立坤, 王波, 尚磊, 陈军健 (5017)

多时间尺度的配电网深度强化学习无功优化策略.....胡丹尔, 彭勇刚, 韦巍, 肖婷婷, 蔡田田, 习伟 (5034)

面向需求响应的多边缘网关协同信息缓存与分发策略.....孙毅, 陈恺, 陆旭 (5045)

电网调控决策知识模型建模及实现方法.....周二专, 张思远, 严剑峰, 吴倩红 (5057)

· 大电网规划与运行 ·

大电网可靠性评估的最优 f 散度重要抽样法.....赵渊, 刘祎, 任和, 程学渊, 谢开贵 (5067)

风电基地经特高压直流送出系统换相失败故障(三): 送端风电机组暂态过电压抑制措施
.....李光辉, 王伟胜, 何国庆, 刘纯 (5079)

直驱风电场并入弱交流电网的次同步分量通路及阻尼特性分析
.....高本锋, 王义, 曾四鸣, 李铁成, 刘毅, 邵冰冰, 向玲, 赵书强 (5089)

简化单机水电系统负阻时频率振荡的类 Hopf 非光滑分岔分析.....薛安成, 王嘉伟, 刘晓博, 庄文彬, 郭鹏程 (5103)

· 智能电网 ·

能源区块链共识算法性能的评估方法与实证分析: 以分布式能源交易为例
.....沈翔宇, 罗博航, 陈思捷, 严正, 平健, 何光宇, 嵇士杰, 常新, 李达 (5113)

新能源电力系统并网设备小扰动稳定分析(二): 导出机理与稳定性分类探讨
.....宫泽旭, 艾力西尔·亚尔买买提, 辛焕海, 张欣, 鞠平, 袁小明, 屠竞哲, 傅闯 (5126)

多微电网系统的合作博弈模型及其优化调度策略.....李得民, 吴在军, 赵波 (5140)

融入重构级别快速识别的配电网两阶段优化运行.....马望, 高红均, 杨艳红, 王程, 潘虹锦, 刘友波, 刘俊勇 (5154)

海上风电场集电网的高频谐振分析.....秦垚, 王晗, 庄圣伦, 蔡旭, 吕敬, 霍乾涛 (5169)

· 发电 ·

基于数据驱动的燃煤锅炉 NO_x 排放浓度动态修正预测模型.....唐振浩, 朱得宇, 李扬 (5182)

基于 SDAE 预测模型和改进 SSA 的 NO_x 排放优化.....马良玉, 孙佳明 (5194)

基于信息物理融合和 XGBoost-MPGA 算法的燃煤电厂脱硫系统运行优化
.....肖祥武, 李志金, 舒畅, 周宏贵, 王鹏浩 (5202)

基于吉布斯自由能变的非共沸混合工质有机朗肯循环热力性能分析
.....卜淑娟, 杨新乐, 李惟慷, 苏畅, 戴文智, 王新 (5212)

· 电力电子与电力传动 ·

多电平变换器简化虚拟矢量 PWM 及应用.....李永东, Qamar Attique M, 房展超, 王奎, 周培毅 (5221)

混合式直流断路器合成开断试验方法及等效研究.....周万迪, 郭亮, 魏晓光, 高冲, 贺之渊, 张升 (5233)

混合导通模式并网逆变器的直接电荷量控制方法.....赵普, 张宇, 关清心 (5242)

基于四管双向变换器的退役电池组有源快速均衡方法.....王鹿军, 柯锦洋, 詹敏, 吴铁洲, 姜久春 (5254)

· 电机与电器 ·

级联 H 桥逆变器驱动永磁同步电机的鲁棒预测电流控制策略.....姚欢, 史婷娜, 王志强, 张国政, 陈炜 (5266)

配电变压器表贴式相变辅助散热温度计算方法.....石华林, 熊斌, 冯韵, 蔡木良, 顾国彪 (5278)

电动汽车新型转子内置式永磁同步电动机转矩脉动与电磁振动抑制研究
.....王道涵, 彭晨, 王柄东, 冯振康, 张方旭 (5289)

适用于全风速工作区间稳定性分析的双馈风机二元导纳模型.....杜程茂, 杜雄, 樊丽娟, 苏婧媛 (5300)

· 高电压技术 ·

高压功率模块封装绝缘的可靠性研究综述.....李文艺, 王亚林, 尹毅 (5312)

纳秒脉冲电压下油浸纸局部尖端缺陷击穿特性及损伤规律.....李斯盟, 杨帆, 秦锋, 汲胜昌, 陈伟 (5326)

复杂多径传播条件下变压器局部放电定位方法研究.....贾骏, 陶风波, 杨强, 付慧, 杨景刚, 陆云才, 赵恒阳 (5338)

· 电工理论与新技术 ·

基于阻抗自适应调整的输电线路取能装置稳定取能方法.....樊绍胜, 钟洪亮, 岳舟 (5348)

YBCO 超导带材堆叠导线中内封接头的电流分布仿真模型研究
.....钱刚, 刘斌, 张建文, 王龙彪, 李柱永, 金之俭 (5360)

考虑趋肤效应的铁磁材料宽频损耗分离模型.....赵志刚, 林琪铭, 姬俊安, 马习纹 (5374)

· 英文概述见论文电子版 ·

PROCEEDINGS OF THE CHINESE SOCIETY FOR
ELECTRICAL ENGINEERING
(PROCEEDINGS OF THE CSEE)

Vol.42 No.14 (Ser. 697)

Jul. 20, 2022

CONTENTS

(Electronic Journals <http://www.pcsee.org/EN/volumn/current.shtml>)

- Foreword From the Guest Editor in Chief of Special Columns for “Digital Power Grid Technology”
..... LI Peng, LI Peng, HUANG Kai, GUO Ye (5001)
- **Digital Power Grid Technology** •
Concept, Architecture and Key Technologies of Digital Power Grids
..... LI Peng, XI Wei, CAI Tiantian, YU Hao, LI Peng, WANG Chengshan (5002)
Application Scenario and Key Technology Prospect of Power Specific Integrated Circuit
..... DONG Xuzhu, CHEN Likun, WANG Bo, SHANG Lei, CHEN Junjian (5017)
Multi-timescale Deep Reinforcement Learning for Reactive Power Optimization of Distribution Network
..... HU Daner, PENG Yonggang, WEI Wei, XIAO Tingting, CAI Tiantian, XI Wei (5034)
An Information Caching and Distribution Strategy of Demand Response Service Considering Cooperation of Edge Gateways
..... SUN Yi, CHEN Kai, LU Xu (5045)
Decision Knowledge Modeling and Implementation for Power Grid Dispatching and Control
..... ZHOU Erzhan, ZHANG Siyuan, YAN Jianfeng, WU Qianhong (5057)
- **Large Power Grid Planning and Operation** •
Optimal f -divergence Based Importance Sampling for Composite Power System Reliability Evaluation
..... ZHAO Yuan, LIU Yi, REN He, CHENG Xueyuan, XIE Kaigui (5067)
Commutation Failure of UHVDC System for Wind Farm Integration (Part III): Transient Overvoltage Suppression Measures of
Wind Powers in Sending Terminal Grid..... LI Guanghui, WANG Weisheng, HE Guoqing, LIU Chun (5079)
Analysis of Sub-synchronous Component Path and Damping Characteristics of D-PMSG-based Wind Farm Incorporated Into Weak
AC Grid..... GAO Benfeng, WANG Yi, ZENG Siming, LI Tiecheng, LIU Yi, SHAO Bingbing, XIANG Ling, ZHAO Shuqiang (5089)
Hopf-like Non-smooth Bifurcation Analysis of Frequency Oscillation in Simplified Single Hydropower Generator System With
Negative Damping XUE Ancheng, WANG Jiawei, LIU Xiaobo, ZHUANG Wenbin, GUO Pengcheng (5103)
- **Smart Grid** •
An Evaluation Method and Empirical Analysis of Energy Blockchain Consensus Algorithms: A Case Study of Distributed Energy
Trading..... SHEN Xiangyu, LUO Bohang, CHEN Sijie, YAN Zheng, PING Jian, HE Guangyu, JI Shijie, CHANG Xin, LI Da (5113)
Small Signal Stability Analysis of Grid-connected Equipment in Power System (Part II): Discussion on Mechanism Derivation and
Classification of Stability GONG Zexu, YAERMAIMAITI Ailixier, XIN Huanhai,
..... ZHANG Xin, JU Ping, YUAN Xiaoming, TU Jingzhe, FU Chuang (5126)
Cooperative Game Model and Optimal Dispatch Strategy of Multi-microgrid System LI Demin, WU Zaijun, ZHAO Bo (5140)
Two-stage Optimal Operation for Distribution Network Based on Fast Identification of Reconfiguration Level
..... MA Wang, GAO Hongjun, YANG Yanhong, WANG Cheng, PAN Hongjin, LIU Youbo, LIU Junyong (5154)
Analysis on High Frequency Resonance of Collector Network in Offshore Wind Farm
..... QIN Yao, WANG Han, ZHUANG Shenglun, CAI Xu, LYU Jing, HUO Qiantao (5169)
- **Power Generation** •
Data Driven based Dynamic Correction Prediction Model for NO_x Emission of Coal Fired Boiler
..... TANG Zhenhao, ZHU Deyu, LI Yang (5182)
NO_x Emission Optimization Based on SDAE Prediction Model and Improved SSA..... MA Liangyu, SUN Jiaming (5194)
Operation Optimization of Flue Gas Desulfurization System in Coal-fired Power Plant Based on Cyber-physical Fusion and
XGBoost-MPGA Algorithm..... XIAO Xiangwu LI Zhijian, SHU Chang, ZHOU Honggui, WANG Penghao (5202)
Analysis of Thermal Performance of Organic Rankine Cycle With Zeotropic Mixture Working Fluids Based on
Gibbs Free Energy Change..... BU Shujuan, YANG Xinle, LI Weikang, SU Chang, DAI Wenzhi, WANG Xin (5212)
- **Power Electronics and Drives** •
Implementation of Simplified Virtual Vector PWM for Multilevel Converter
..... LI Yongdong, Qamar Attique Muhammad, FANG Zhanchao, WANG Kui, ZHOU Peiyi (5221)
Synthetic Breaking Test Method and Equivalence Analysis of Hybrid DC Circuit Breakers
..... ZHOU Wandu, GUO Liang, WEI Xiaoguang, GAO Chong, HE Zhiyuan, ZHANG Sheng (5233)
Direct Charge Control Method for Mixed Conduction Mode Grid-connected Inverters ZHAO Pu, ZHANG Yu, GUAN Qingxin (5242)
Active Fast Equalization Method for Retired Battery Pack Based on Four Switch Bidirectional Converter
..... WANG Lujun, KE Jinyang, ZHAN Min, WU Tiezhou, JIANG Jiuchun (5254)
- **Electric Machines and Apparatus** •
Robust Predictive Current Control for PMSM Fed by CHB Inverter
..... YAO Huan, SHI Tingna, WANG Zhiqiang, ZHANG Guozheng, CHEN Wei (5266)
Temperature Calculation Method of Surface Mounted Phase Change Auxiliary Cooling for Distribution Transformer
..... SHI Hualin, XIONG Bin, FENG Yun, CAI Muliang, GU Guobiao (5278)
Research on a Novel Interior Permanent Magnet Machine with Segmented Rotor to Mitigate Torque Ripple and
Electromagnetic Vibration..... WANG Daohan, PENG Chen, WANG Bingdong, FENG Zhenkang, ZHANG Fangxu (5289)
Two-variable Admittance Model for DFIG Stability Analysis Under the Entire Wind Speed Operation Range
..... DU Chengmao, DU Xiong, FAN Lijuan, SU Jingyuan (5300)
- **High Voltage Engineering** •
Review of Packaging Insulation Reliability for High Voltage Power Module..... LI Wenyi, WANG Yalin, YIN Yi (5312)
Breakdown Characteristics and Damage Law of Localized Tip Defect on Oil-immersed Paper Under Nanosecond Pulse Voltage
..... LI Simeng, YANG Fan, QIN Feng, JI Shengchang, CHEN Wei (5326)
Research on Partial Discharge Location Method of Transformer Under Complex Multipath Propagation
..... JIA Jun, TAO Fengbo, YANG Qiang, FU Hui, YANG jinggang, LU Yuncai, ZHAO Hengyang (5338)
Theory and New Technology of Electrical Engineering
A Stable Energy Acquisition Method for Transmission Line Energy Extraction Device Based on Adaptive Impedance Adjustment
..... FAN Shaosheng, ZHONG Hongliang, YUE Zhou (5348)
Study on Current Distribution Simulation Model of Inner Encapsulated Joints for the YBCO Soldered-stacked (SS) Wire
..... QIAN Gang, LIU Bin, ZHANG Jianwen, WANG Longbiao, LI Zhuyong, JIN Zhijian (5360)
Wideband Loss Separation Models of Ferromagnetic Materials Considering Skin Effect
..... ZHAO Zhigang, LIN Qiming, JI Jun'an, MA Xiwen (5374)
- **For Extended Summaries, Please See the Electronic Journals** •