

# 电力电容器与无功补偿

POWER CAPACITOR & REACTIVE POWER COMPENSATION

DIANLI DIANRONGQI YU WUGONGBUCHANG



ISSN 1674-1757



9 771674 175226



## 《电力电容器与无功补偿》 第4届编委会名单

主任委员：元复兴

副主任委员：周会高

委员：(以姓氏笔画为序)

王耀 王崇祜 刘水平 同向前  
汲胜昌 张万荣 张丹丹 张建平  
张建军 张春朋 李化 李电  
李志远 杨一民 陈才明 张勇军  
肖遥 张怿宁 卓放 段晓波  
祝令瑜 倪学锋 徐政 党智敏  
袁铁江 梁璇 贾华 黄莹  
葛磊蛟 葛锦萍 储松潮 翁利民  
薛畔

中国期刊全文数据库全文收录期刊  
万方数据库数字化期刊群入网期刊  
中国期刊订阅指南信息库收录期刊  
第四届陕西省科技期刊优秀期刊奖  
首届“西牛奖”十佳优秀中文科技期刊奖  
主管、主办：中国西电集团有限公司  
编辑、出版：《电力电容器与无功补偿》

编辑部

总 编：周会高

主 编：杨佩侠

责任编辑：杨文荣

编 辑：于淑霞

地 址：西安市西二环北段18号

邮 政 编 码：710077

电 话：(029)84221423

传 真：(029)84221423

在线投稿：[www.dldrq.com](http://www.dldrq.com)

电子邮箱：dldrqb@163.com

dldrq@126.com

出版日期：2022年2月25日

印 刷：西安新华印务有限公司

国内发行：陕西省邮政报刊发行局

订 购 处：全国各地邮局

中国标准连续：ISSN 1674-1757  
出 版 物 号：CN 61-1468/TM

邮发代号：52-13

每期定价：¥15.00元/本

广告经营许可证号：6101004001036

## 目 次

### ● 无功补偿与滤波 ●

含小水电的配电网电压无功优化控制综述

..... 闫群民，王佳，沈延峰，李杰义，周密(1)

交直流混联受端电网动态无功规划研究

..... 金楚，李作红，葛景，吴伟杰，杨燕，徐蔚(12)

基于迁移多搜索器 Q 学习算法的碳能复合流无功优化

..... 唐建林，余涛，肖勇，钱斌，王浩林(18)

混合无功补偿系统模型预测直接功率控制策略

..... 杨国，陈洁，朱亮亮，郑凯凯，陈文魁，徐康亮(30)

基于 SVG 成套设计的工频电磁场屏蔽措施研究

..... 郑毅，郭黎黎，张科乾，陶佳(37)

基于相位补偿谐振控制器的 STATCOM 电流控制策略

..... 王鹏飞，吴小丹，王辉，徐起阳(43)

基于 BP 神经网络建模的并联型有源电力滤波器谐波综合治理控制算法

..... 左宏基，陈宏军，徐峰亮，刘煜，张云鹏，邹峰恩，程萌萌(50)

基于 StatRF 基波正序提取方法的三相四开关 HAPF

..... 柴杰彤，刘洪臣(57)

一起油浸式并联电抗器总烃异常问题分析

..... 徐鹏，薛帅，杨斌，陈萧霖，赵文翰，陈昊(63)

### ● 电容器 ●

晶闸管控制串联电容器基波阻抗控制方法研究

.... 俞永军，徐伟丰，蔡重凯，翁军美，张占龙，端木子昂，葛昆明(68)

宽频域纹波环境下电解电容寿命模型建立及老化速率分析

..... 姚知洋，金庆忍，郭敏(75)

### ● 电容式电压互感器 ●

谐振机理在 CVT 故障中的影响分析及防护措施

..... 李应宏，王贵山，何学敏(82)

## ● 系统应用研究 ●

基于深度学习的配电网故障风险及状态检修

..... 马伟哲, 陈洪云(87)

源荷友好接口的负荷侧电压质量控制策略

..... 池小兵, 邹宇, 常亚飞, 同向前, 宋殷冠, 车辙(95)

基于改进人工鱼群算法的有源配电网的故障区间定位

..... 管恩齐, 何晋, 骆通, 周石金, 杨凡, 曹鲁成(102)

配电混合线路单相接地故障区段定位技术

..... 汪士杰, 孙晓茜, 杨延钧, 张建华(111)

一种新型铁磁谐振检测技术及防治设备研制

..... 李俊峰, 许晓玥, 廖益发, 杨金东(120)

一种基于马尔可夫链与两点估计法的电网调度操作风险评估方法

..... 黄健, 陈一丰, 马翔, 董树锋, 唐坤杰(127)

分布感知集中决策的主动配电网能量管理调控技术研究

..... 刘洋, 李波, 赵瑞锋, 卢建刚, 王可, 戴月(134)

基于经济等效时间考虑电压暂降的供电可靠性评估方法研究

..... 秦川, 姜燕(144)

基于混合编码多种群遗传算法的动态电压恢复器优化配置求解方法研究

..... 周凯, 许中, 马智远, 栾乐, 郭倩雯(151)

基于球形解码的三电平 PWM 整流器多步长模型预测控制

..... 李枝亮, 周艳磊, 张晓(158)

## ● 清洁能源领域应用技术 ●

考虑风-氢-电的混合能源系统容量规划与运行优化

..... 陈传彬, 杨首晖, 王良缘, 王雪晶, 李庆伟, 邓智宏, 江岳文(165)

能量-调频市场风储多模式竞价策略

..... 王智伟, 徐海超, 刘鑫, 李征(173)

超级电容储能的双馈风机低电压穿越能力研究

..... 李娟, 王鹏, 李方媛, 胡阳, 董光睿(180)

面向可靠性提升的配电网分布式储能规划

..... 杨帆, 张章, 徐晶, 徐政, 吴志, 孙琦润(188)

自适应电压补偿的微电网功率均分控制策略

..... 刘靖宇, 于惠钧, 李秉晨, 龚星宇(197)

计及光伏电源群相关性的低压配电网电压风险评估

..... 潘锦源, 邓国豪, 刘剑, 郝金宝(204)

基于电压-光伏有功灵敏度的不平衡配电网均压控制策略

..... 杨亮, 袁帅, 吕志鹏, 杨鹏(212)

## ● 广告单位 ●

(81)

2022

1  
Feb.

CONTENTS  
(Founded 1980, Public Publication, Bimonthly)

Vol.43 No.1  
(Serial No.199)  
Feb. 2022

## CONTENTS

### ● Reactive Power Compensation and Filter ●

- Review of Voltage and Reactive Power Optimization Control of Distribution Network with Small Hydropower ..... YAN Qunmin, WANG Jia, SHEN Yanfeng, LI Jieyi, ZHOU Mi (1)
- Research on Dynamic Reactive Power Planning of Hybrid AC/DC Receiving-end Power Grid ..... JIN Chu, LI Zuohong, GE Jing, WU Weijie, YANG Yan, XU Wei (12)
- Reactive Power Optimization of Carbon-energy Composite Flow Based on Transfer Multi-searcher *Q*-learning ..... TANG Jianlin, YU Tao, XIAO Yong, QIAN Bin, WANG Haolin (18)
- Control Strategy of Direct Power Prediction for Hybrid Reactive Power Compensation System ..... YANG Guo, CHEN Jie, ZHU Liangliang, ZHENG Kaikai, CHEN Wenkui, XU Kangliang (30)
- Study on Shield Measures of Power Frequency Electromagnetic Shield Based on SVG Complete Design ..... ZHENG Yi, GUO Lili, ZHANG Keqian, TAO Jia (37)
- Current Control Strategy of STATCOM Based on Phase Compensated Resonant Controller ..... WANG Pengfei, WU Xiaodan, WANG Hui, XU Qiyang (43)
- Integrated Control Algorithm on Harmonics of Shunt Active Power Filter Based on BP Neural Network Modeling ..... ZUO Hongji, CHEN Hongjun, XU Fengliang, LIU Yu, ZHANG Yunpeng, ZOU Feng'en, CHENG Mengmeng (50)
- Three-phase Four-switch HAPF Based on StatRF Fundamental Wave Positive Sequence Extraction Method ..... CHAI Jietong, LIU Hongchen (57)
- Analysis of Abnormal Total Hydrocarbon in Oil Immersed Shunt Reactor ..... XU Peng, XUE Shuai, YANG Bin, CHEN Xiaolin, ZHAO Wenhan, CHEN Hao (63)

### ● Capacitor ●

- Research on Fundamental Wave Impedance Control Method of Thyristor Controlled Series Capacitor ..... YU Yongjun, XU Weifeng, CAI Chongkai, WENG Junmei, ZHANG Zhanlong, DUANMU Ziang, GE Kunming (68)
- Establishment of Life Model and Aging Rate Analysis of Electrolytic Capacitors in a Broad Frequency Range Ripple Environment ..... YAO Zhiyang, JIN Qingren, GUO Min (75)

### ● Capacitor Voltage Transformer ●

- Influence Analysis of Resonance Mechanism in Capacitor Voltage Transformer Fault and Protective Measures ..... LI Yinghong, WANG Guishan, HE Xuemin (82)

### ● Research on System Application ●

- Fault Risk and Condition Maintenance of Distribution Network Based on Deep Learning ..... MA Weizhe, CHEN Hongyun (87)
- Load-side Voltage Quality Control Strategy of Source-load Friendly Interface ..... CHI Xiaobing, ZOU Yu, CHANG Yafei, TONG Xiangqian, SONG Yinguan, CHE Zhe (95)
- Fault Section Location of Active Distribution Network Based on Improved Artificial Fish Swarm Algorithm ..... GUAN Enqi, HE Jin, LUO Tong, ZHOU Shijin, YANG Fan, CAO Lucheng (102)

- Location Technology for Single Phase Earth Fault Section of Distribution Hybrid Line ..... WANG Shijie, SUN Xiaoqian, YANG Yanjun, ZHANG Jianhua (111)
- New Ferrromagnetic Resonance Detection Technology and Development of Its Prevention Device ..... LI Junfeng, XU Xiaoyue, LIAO Yifa, YANG Jindong (120)
- Risk Assessment Method for Power Grid Dispatching Operation Based on Markov Chain and Two-point Estimation Method ..... HUANG Jian, CHEN Yifeng, MA Xiang, DONG Shufeng, TANG Kunjie (127)
- Research on Energy Management and Regulation Technology of Active Distribution Network Based on Distributed Sensing and Centralized Decision ..... LIU Yang, LI Bo, ZHAO Ruifeng, LU Jiangang, WANG Ke, DAI Yue (134)
- Research on Reliability Evaluation Method of Power Supply Considering Voltage Sag Based on Economic Equivalent Time ..... QIN Chuan, JIANG Yan (144)
- Research on Optimal Configuration Solution Method of Dynamic Voltage Restorer Based on Hybrid Encoding Multiple Population Genetic Algorithm ..... ZHOU Kai, XU Zhong, MA Zhiyuan, LUAN Le, GUO Qianwen (151)
- Multi-step Model Predictive Control of Three-level PWM Rectifier Based on Spherical Decoding ..... LI Zhiliang, ZHOU Yanlei, ZHANG Xiao (158)

### ●Application Technology in the Field of Clean Energy●

- Capacity Planning and Operation Optimization of Wind-hydrogen-battery Hybrid Energy System ..... CHEN Chuanbin, YANG Shouhui, WANG Liangyuan, WANG Xuejing, LI Qingwei, DENG Zhihong, JIANG Yuewen (165)
- Bidding Strategy of Wind and Energy Storage with Multi-mode in the Energy and Frequency Modulation Market ..... WANG Zhiwei, XU Haichao, LIU Xin, LI Zheng (173)
- Research on Low Voltage Ride-through Capability of Double-fed Fan Based on Super Capacitor Energy Storage ..... LI Juan, WANG Peng, LI Fangyuan, HU Yang, Dong Guangrui (180)
- Distributed Energy Storage Planning of Distribution Network for Reliability Improvement ..... YANG Fan, ZHANG Zhang, XU Jing, XU Zheng, WU Zhi, SUN Qirun (188)
- Power Sharing Control Strategy of Microgrid Based on Adaptive Voltage Compensation ..... LIU Jingyu, YU Huijun, LI Bingchen, GONG Xingyu (197)
- Voltage Risk Assessment of Low Voltage Distribution Network Taking into Account Correlation of Photovoltaic Power ..... PAN Jinyuan, DENG Guohao, LIU Jian, HAO Jinbao (204)
- Grading Control Strategy of Imbalance Distribution Network Based on Voltage-photovoltaic Active Power Sensitivity ..... YANG Liang, YUAN Shuai, LYU Zhipeng, YANG Peng (212)

---

**Sponsored by:**China XD Group Co., Ltd.

**Edited by:**Editorial Office of POWER CAPACITOR & REACTIVE POWER COMPENSATION

**General Editor:**ZHOU Huigao

**Chief Editor:**YANG Peixia

**Add:**No.18, the North of the No.2 West Ring Road, Xi'an, Shaanxi 710077, P.R.China

**Tel:**+86-29-84221423

**Fax:**+86-29-84221423

**Website:**www.dldrq.com

**Email:**dldrqxb@163.com dldrq@126.com

**Distributed by:**Shaanxi Office of Postal Service

版权声明

1.本刊对发表的文章拥有出版电子版、网络版版权，并拥有与其他网站交换信息的权利。本刊支付的稿酬已包含以上费用。

2.本刊文章版权所有，未经书面许可，不得以任何形式转载。