# 2018 71st Annual Conference for Protective Relay Engineers (CPRE 2018)

College Station, Texas, USA 26-29 March 2018



IEEE Catalog Number: ISBN:

CFP18557-POD 978-1-5386-6128-4

### **Copyright © 2018 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:	
ISBN (Print-On-Demand):	
ISBN (Online):	
ISSN:	

CFP18557-POD 978-1-5386-6128-4 978-1-5386-6127-7 2474-9745

#### 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 Web: www.proceedings.com



# 2018 71st Annual Conference for Protective Relay Engineers

March 26 - 29, 2018 | Texas A&M University, College Station, TX

## **Table of Contents**

Accurate and Economical Traveling-Wave Fault Locating Without Communications Adaptive Protection - What Does It Mean And What Can It Do? Advantages of Comprehensive Monitoring for Critical Circuit Breakers An Innovative and Automated Solution for PRC-027 Compliance An Introduction to Completing a NERC PRC-019 Study Analyzing Faulted Transmission Lines: Phase Components as an Alternative to Symmetrical Components Application of Undervoltage Protection to Critical Motors Applying Intelligent Fast Load Shed Using IEC 61850 GOOSE Automated Approach to Generate Customized Reports Based on Relay Setting Files Stored in a Database Automatic Multi-Vendor IED Fault Data Collection and Analysis Solution Back to the Basics – Event Analysis Using Symmetrical Components Beyond the Knee Point: A Practical Guide to CT Saturation Case Studies in Facility Wide Time Synchronization CCVT Failures and Their Effects on Distance Relays Circuit Breaker Ratings – A Primer for Protection Engineers **Communications Assisted Islanding Detection** Comparing Protective Relaying Test Philosophies and Methods Adopted by Different Utilities Continuous Automated Analysis of Protection Scheme Communications Leads to Improved Reliability and Performance Correlating Protective Relay Reports for System-Wide, Post-Event Analysis Cost Benefit Analysis of Faster Transmission System Protection Systems Cyber Security – Securing the protection and control relay communication in Substation Deterministic Communications for Protection Applications Over Packet-Based Wide-Area Networks Directional Element Design for Protecting Circuits with Capacitive Fault and Load Currents Distance Protection: Why Have We Started With a Circle, Does It Matter, and What Else Is Out There? Electromagnetic Torque From Event Report Data – A Measure of Machine Performance Evaluation of 13kV Dry-Type Shunt Reactor Protection following Near-Miss Expanding Protection and Control Communications Networks With Wireless Radio Links Experience with a Digital Substation Pilot in North America Fast Fault Detection Challenge for Alienation Coefficient Based Bus Fault Discriminator Fault Location System for Radial MV Underground Distribution Cable Networks Generator Third-Harmonic Protection Explained GPS and GLONASS Constellations for Better Time Synchronizing Reliability High-Impedance Differential Applications With Mismatched CTs

Impact of Incipient Faults on Sensitive Protection

Integration of Electrical Data and Transformer Gas Analysis for Full Asset Monitoring Learn IEC 61850 Configuration in 30 Minutes

Life Cycle Experiences with Micro-processor Based Relays and Roadmap to Sustainability Line Current Differential Relay Response to a Direct Lightning Strike on a Phase Conuctor Locating Faults Before the Breaker Opens – Adaptive Autoreclosing Based on the Location of the Fault

Method of Capacitor Failure Detection and Location in Shunt Capacitor Banks

Motor Thermal Capacity Used – How Does Relay Know When 100% is Reached?

Multi-Range Signal Oscillation Detection – Concepts and Applications

New Design of Directional Ground Fault Protection 67N

New Methods for Monitoring Neutral Grounding Resistors

New Protection Scheme for Type 4 Wind Turbines

Optimizing HV Capacitor Bank Design, Protection, and Testing

Performance Analysis of Distance Protection Using Different Impedance Calculation Methods

Phase-Shifting Transformer Control and Protection Settings Verification

Protection Challenges for Transmission Lines with Long Taps

Protection for Sub Synchronous Torsional Interaction (SSTI) Conditions Using an Industrial Sub-harmonic Relay

Redundant Bus Protection Using High-Impedance Differential Relays

Relay Logic Programming Explained

Safety And Its Importance In Protective Relaying

Setting and Verification of Generation Protection to Meet NERC Reliability Standards

Sharing Direct Fiber Channels Between Protection and Enterprise Applications Using Wavelength Division Multiplexing

Simplicity in Relay Protection System design; is it still valid element?

Site Acceptance Testing of a Duke Energy Distribution Automation Project Utilizing a Simulation Based Test Approach

Solving Old Problems with New Technology - Monitor and Measure GIC and OPD Currents Standardizing Engineered Protection Systems with Flexible Naming Extensions

Substation Testing and Commissioning: Power Transformer Through Fault Test

Teleprotection with MPLS Ethernet Communications - Development and Testing of Practical Installations

The Return of the Dedicated DFR - How IEC 61850 Process Bus Simplified DFR Installation The Six Ways to Ensure Improper Operation of Microprocessor Relays

Time-Domain Elements Optimize the Security and Performance of Transformer Protection

Travelling Wave Fault Locator (TWFL) Technology Applied to HVDC Transmission Line

Tutorial on High Impedance Fault Detection

Using Protective Relays for Microgrid Controls

Using the Multi-Loop Fault Analysis Method for Setting and Evaluating Generator Protection Elements

Who Has the 32?