JJ Dai

Retired
Formal Physical Scientist & Technology Manager at
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WORKING HISTORY

Department of Energy (DOE), US ***2020 – 2021***
Physical Scientist & Technology Manager
Eaton Corporation US, US ***2018 – 2020***
Engineering Service Specialist & Global Account Manager, Oil, Gas and Chemical Group
Eaton Corporation APAC, China ***2013 – 2017***
Director, Renewable Energy Applications & Country Manager, Engineering Services
Operation Technology, Inc., (ETAP), US ***1992 – 2013***
Senior Vice President, Advanced Technology
General Manager, OTI Far-East
Southeastern University, China ***1984 – 1985***
Researcher
Wuhan University, China ***1982 – 1984***
Research & Lecturer
Nanjing Power Company, China ***1977 – 1978***
Engineer

HIGH EDUCATION HISTORY

PhD Electrical Engineering, The University of Toledo, Toledo, OH
MS Electrical Engineering, The Ohio State University, Columbus, OH
MEng Electrical Engineering, Wuhan University, Wuhan, China
BS Electrical Engineering, Wuhan University, Wuhan, China

PROFESSIONAL HISTORY

Senior Member, IEEE (since 2010)
Board member, IEEE Industrial Application Society (IAS) Executive Committee (2011, 2012)
Chairman, IEEE IAS I&CPS Power System Analysis Subcommittee (2000, 2001)
Secretary, IEEE PCIC Safety Subcommittee (2019, 2020)
Member, IEEE Standard Association Advisory Board (2010)
Co-chairman, IEEE Std. 3002.8-2018
Secretary, IEEE Std. P3002.9 Member, WECC Dynamic Model Validation Working Group (2010, 2011, 2012)
Registered Professional Engineer, State of California

TECHNICAL PUBLICATIONS

Published more than thirty technical papers in transactions and conference proceedings, in the domain of electromagnetic field numerical analysis, digital and adaptive control, power system modeling and simulation, power system design and analysis, engineering solutions and services, dynamic and transient stability, power quality and harmonics, optimization and estimation, microgrid and renewable energy applications, solar energy grid integration, industrial and commercial power system standard development.

Topics 1
Industrial and Commercial Power System Harmonic Studies and Mitigations

Abstract -- This tutorial discusses the latest IEEE Std. 3002.8 "Recommended Practice for Conducting Harmonic Analysis Studies of Industrial and Commercial Power Systems". The standard is based on IEEE Std. 399 (Brown Book) with many new enhancements and additions. The new standard systematically addresses requirements and recommendations for performing power system harmonic studies, including developing system models, modeling various harmonic sources and electrical equipment and devices, preparing required data for modeling and studies, validating model and data, selecting study cases, and analyzing results and outputs from the studies. Necessary features for computer tools that are used to perform harmonic-analysis are listed and discussed. The latest IEEE Std. 519-2014 "Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems" is referenced in the standard, as well as references related to interharmonics. One illustration example is provided at end of the tutorial to help readers further understand harmonic studies and expected results. The author of this tutorial is the co-chair of IEEE Std. 3002.8 working group.

Topic 2
Automatic Load Shedding Protection at Industrial Plants

Abstract -- This tutorial reports a dynamic modeling of a coal-chemical plant and studies for automatic load shedding protection. The plant had on-site generation to support partial plant loads. In the past, disconnecting from the grid had caused frequency and voltage decay in the plant electrical system to drop out some critical loads. A complete system computer model is constructed including generator dynamics and excitation and prime mover/governor control characteristics. Transient stability simulations to various loading and generation conditions were carried out to understand and study system frequency and voltage behaviors and patterns of change under a sudden islanding case by analyzing frequency vs. time and frequency change rate vs time curves. Further, through carefully evaluating plant load priorities as well as load dependencies, several feasible load shedding control strategies were proposed and simulated by computer modeling and study. Simulation results verified that proposed load shedding schemes can correctly predicate the frequency drop thus automatically shed non-critical and independent loads to prevent system frequency drop to exceed the allowable deviation. The solution is automatic and feasible which has been successfully implemented at the plant.

Topic 3
Approaches to Perform Transient Stability Studies and Design Protections in Industrial Power Systems

Abstract -- Many large Oil and Gas plants have installed cogeneration or gas and steam generators to increase efficiency, reduce electricity cost, and improve system reliability. Adding synchronous generators to a power system tremendously increases system complexity and brings in stability concerns. Power system stability requires all synchronous machines in an interconnected electrical system to remain in synchronism; otherwise the generators will become unstable or lose stability, which can quickly propagate across the entire network to cause system-wide shut down. Following IEEE recommended practice, and authors' extensive experience in modeling power system dynamics and conducting studies, this tutorial addresses approaches and procedures to perform transient stability study and helps engineers to understand required protections and operations to ensure stable operation of the system. Relevant IEEE standards and task force reports and important literatures in the area are referenced in the tutorial.

Topic 4

Switching Transients in Industrial Power Systems and Mitigations through Simulation Studies

Abstract – During circuit breaker switching operation, oscillatory transient voltage and traveling wave can be generated at terminals of the breaker. The transient voltage can cause restrikes inside the breaker so the current interruption is failed. The traveling wave with very high frequency can be propagated via cables or lines to interconnected inductive load such as transformers or rotating machines and excite internal resonance within inductive coils such that cause insulation breakdown due to resonant voltage magnitude. Breaker transient recovery voltage (TRV) must be studied based on fault current level and system configuration in order to specify adequate TRV rating for breakers. Traveling wave transients also need to be studied and analyzed to ensure internal resonance conditions are covered by proper protections. This tutorial introduces IEEE Std PC37.011-2017 Guide for the Application of Transient Recovery Voltage for AC High-Voltage Circuit Breakers with Rated Maximum Voltage above 1000 V and IEEE Std C58.142-2010 IEEE Guide to describe the Occurrence and mitigation of Switching Transients Induced by Transformers, Switching Device, and System Interaction, discusses modeling and studies to simulate the system configuration and operating conditions, and procedures to design and protect the system correctly.