

ous potential differences within the manhole and on the surrounding ground surface during ground faults in the substation. Possible protective measures are discussed.

Keywords Manholes, substation grounding, safety conditions, protective measures.

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Minimum Losses Reconfiguration of MV Distribution Networks Through Local Control of Tie Switches

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Abstract: This paper deals with the problem of optimal reconfiguration of radial distribution networks for minimum loss operation. The proposed control strategy of the open-closed status of the tie switches is distributed, since every MV/LV node is provided with local controllers having some measured entities as input. It also does not prevent the system from the future implementation of centralized control; instead, it may represent the first step towards a complete automation of the distribution system. The proposed strategy is organized in hierarchic levels, the highest of which may be in the future a central control. After introducing the general problem of network reconfiguration, a review of the state of art on the subject is reported, even though the solution methodologies are usually related to the centralized formulation of the reconfiguration problem. The proposed local control strategy is outlined, and a detailed description of its different parts is reported with special attention to all the measures for a better performance of the system. Results of a number of simulation runs are reported in order to test the behavior of the proposed local control system in different possible operating conditions.

Keywords Reconfiguration, optimal control, distributed control, power distribution control.

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Switchgear

A Novel Hybrid Current-Limiting Circuit Breaker for Medium Voltage: Principle and Test Results

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Abstract: Although many attempts have been made to design a fault current-limiting circuit breaker (FCLCB) for medium voltage electric power systems, no economically attractive solution has been achieved so far. A novel concept for an FCLCB is introduced based on a hybrid arrangement of semiconductors, temperature-dependent resistors, and a newly developed fast-opening mechanical switch. The latter utilizes one part of an electrodynamic repulsion drive, which is concurrent with the moving double contact system. Laboratory tests as well as computer simulations of the complete FCLCB verify as an example the feasibility for the goal ratings 12 kV and 2/20 kA (single phase). A cost analysis shows the FCLCB to be more expensive than a conventional generator circuit breaker but to be in the price range of the Is-limiter and below the costs of superconducting FCL principles. It is concluded that the method provides the basis for further commercial product development.

Keywords: Circuit breaker, controlled switching, costs, fault-current limiting, GTO, high-speed switching.

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Transformers

Study of Abnormal Electrical Phenomena Effects on GSU Transformers

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Abstract: Three generator step-up (GSU) transformers successively failed in recent years in a large pumped storage plant, resulting in a considerable economic loss for the utility. A comprehensive investigation was done to find out the possible failure causes. Several aspects are considered in this study, including switching transients resulting from routine switching operations, lightning overvoltages, and harmonics and spikes due to static frequency converter (SFC) operation. The study showed that circuit breaker and disconnecter restriking may affect transformer insulation due to their frequent occurrence, gas insulated switching gear (GIS) side surge arresters provide inadequate lightning protection to GSU transformers, and SFC operation has little effect on transformer insulation. This paper presents the simulation results. Methods to lower the lightning transients at the transformer terminals were provided and implemented.

Keywords Pumped storage plant, GSU transformer, switching transients, very fast transients (VFT), restriking, lightning, static frequency converter, harmonics.

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A New Data Mining Approach to Dissolved Gas Analysis of Oil-Insulated Power Apparatus

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Abstract: This paper proposes a genetic algorithm for tuned wavelet networks (GAWN) for data mining of dissolved-gas-analysis (DGA) records and incipient fault detection of oil-insulated power transformers. The genetic-algorithm-based (GA) optimization process automatically tunes the parameters of wavelet networks, translation and dilation of the wavelet nodes and the weighting values of the weighting nodes. GAWNs can identify the complex relations between the dissolved gas content of transformer oil and corresponding fault types. The proposed GAWNs have been tested on the Taipower Company's diagnostic records, using four diagnosis criteria, and compared with artificial neural networks (ANNs) and conventional methods. Experimental results demonstrate that GAWNs have remarkable diagnosis accuracy and require far less learning time than ANNs for different diagnosis criteria.

Keywords Data mining, dissolved gas analysis, power transformers.

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Transmission and Distribution

Calculation of Electric Field and Potential Distributions into Soil and Air Media for a Ground Electrode of an HVDC System

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Abstract: The present article describes a methodology that allows suitable calculations of the electric field as well as the potentials and