Fault Section Estimation in Power Systems Using a Novel Decision Support System

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Abstract: This paper presents a novel decision support system (DSS) using circuit breaker information for online fault section estimation in power systems. The new representation of knowledge and approach to resolving fault diagnosis problems are included in the proposed system. The DSS automatically creates rules for knowledge representation and develops an efficient diagnosis procedure. After the fault section is estimated, the logical reasoning approach uses the relay information to further validate the candidate fault section and circuit breaker status. Test results verify that the DSS can obtain rapid and accurate diagnosis results with flexibility and portability for fault diagnosis of diverse power systems. Those results further demonstrate the feasibility of applying the proposed DSS to actual power system fault section estimation.
Keywords: Power systems, fault section estimation, decision support system.

Assessment of Available Transfer Capability and Margins

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Abstract: Available transfer capability (ATC) calculation is a complicated task that involves the determination of total transfer capability (TTC) and two margins: transmission reliability margin (TRM) and capacity benefit margin (CBM). Three currently used methods of TTC determination are presented and compared in this paper. Besides these methods, the transfer-based security constrained OPF (TSCOPF) method is proposed in this paper as a replacement of the conventional SCOPF method for use in the deregulation environment. Both TRM and CBM, which account for reliability of the system, are seldom mentioned in papers associated with ATC. This paper presents a probabilistic method to assess TRM and proposes rules and a procedure to allocate CBM and two methods of incorporating CBM into ATC. A modified IEEE RTS is utilized to demonstrate the proposed methods, and the results show that the values of ATC are quite different when margins are taken into account and the methods of incorporating ATC affect the ATC value significantly.
Keywords: Available transfer capability, total transfer capability, transmission reliability margin, capability benefit margin.

Power System Relaying

An Adaptive Distance Relay and Its Performance Comparison with a Fixed Data Window Distance Relay

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Abstract: This paper describes the design, implementation, and testing of an adaptive distance relay. The relay uses a fault detector to determine the inception of a fault and then, uses data windows of appropriate length for estimating phasors and seen impedances. Hardware and software of the proposed adaptive relay are described in the paper. The relay was tested using a model power system and a real-time playback simulator. Performance of the relay was compared with a fixed data window distance relay. Some results are reported in the paper. The results indicate that the adaptive distance relay provides faster tripping in comparison to the fixed data window distance relay.
Keywords: Distance relays, adaptive relaying, line protection, microprocessor-based relays.

An Accurate Fault Classification Technique for Power System Monitoring Devices

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Abstract: This paper presents a novel method of classifying transmission line shunt faults. Most algorithms that are employed for analyzing fault data require that the fault type be classified. The older fault type classification algorithms are inefficient because they are not effective under certain operating conditions of the power system and may not be able to accurately select the faulted transmission line if the same fault recorder monitors multiple lines. The technique described in this paper has been proven to accurately identify all ten types of shunt faults that may occur in an electric power transmission system. The other advantage of this technique is that it can be used where multiple transmission lines are present. It is able to identify the faulted line even if secondary effects are recorded in the unfaulted lines.
Keywords: Fault classification, fault analysis, fault type, secondary effects, positive, negative and zero sequence components, algorithm, fault recorder, shunt fault.

Transformers

Unit Commitment of Main Transformers for Electrified Mass Rapid Transit Systems

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Abstract: This paper proposes the transformer planning for an electrified mass rapid transit system so that the overall cost of main transformers is minimized over the life cycle. The unit commitment is applied to derive the optimal transformer capacity to meet the annual peak demand and provide reserve for service reliability. The motion equation of train sets is used to derive the dynamic power consumption and travel distance as each time snapshot. The Simulink package is applied to solve the power demand of each train set by the simulation of VVVF inverters and induction motors. The dc/ac load flow analysis is performed to find the annual power loading of traction substations and whole Taipei MRT network. The transformer loss, investment and service reliability are used to define the equivalent cost of all feasible states for each dynamic programming stage. According to the computer simulation, very significant cost saving is obtained by the proposed methodology for transformer capacity planning of an MRT network.
Keywords: Mass rapid transit, unit commitment, dynamic programming, motion equation, dc/ac load flow analysis.

Structure of Transfer Function of Transformers with Special Reference to Interleaved Windings

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Abstract: Transfer function (TF) is computed during impulse tests on transformers. The structure and shape of TF depends on the type of winding, viz., disc, layer-type, or interleaved winding. There are certain features specific to TF of an interleaved winding, which have, over