A Novel Approach to Real-Time Economic Emission Power Dispatch

Huang, C.M.;Huang, Y.C.

Author Affiliations: Kun Shan University of Technology, Taiwan; Chen Shiu Institute of Technology, Taiwan.

Abstract: This paper describes a novel approach that combines abductive reasoning networks (ARN) and the technique for order preference by similarity to ideal solution (TOPSIS) decision approach to achieve real-time economic emission power dispatch and the best compromise solution. The objectives of fuel cost and environmental impact of emission are considered simultaneously. The proposed ARN handles complicated relationships between the load demands (input) and the generation power of each unit (output) using a hierarchical network with several layers of function nodes of simple low-order polynomials to make the computed outputs fit the historical data. Once the ARN is constructed, the desired outputs can be produced as soon as the inputs are given. According to the set of noninferior solutions for a specific load level, the TOPSIS approach is used to provide operators with the best compromise solution. The effectiveness of the proposed approach has been demonstrated by the IEEE 30-bus 6-generator and the practical Taipower 388-bus 27-generator test systems. The test results reveal that the proposed ARN outperforms the artificial neural network (ANN) method in both developing the model and estimating the outputs of the generating units according to the input load demands.

Keywords Real-time power dispatch, bi-objective optimization, abductive reasoning network.

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Power System Relaying

Transient Positional Protection of Transmission Lines Using Complex Wavelet Analysis

Zhang, D.J.; Wu, Q.H.; Bo, Z.Q.; Caunce, B.

Author Affiliations: University of Liverpool, U.K.; ALSTOM T&D Protection and Control Ltd., U.K.

Abstract: This paper presents a new high-speed protection scheme, transient positional protection (TPP) for power transmission lines. This scheme is developed using complex wavelet analysis, based on the concept of transient-based protection (TBP), in which the fault-generated high-frequency transient signals contained in the primary voltages are utilized to detect fault position according to their relative traveling time and polarities. Combined information (CI) is obtained from complex wavelet coefficients to extract and localize a band of specified high-frequency components propagating along the transmission line. A typical 400 kV EHV transmission system was simulated by PSCAD/EMTDC to evaluate the scheme. Simulation results show that this scheme is capable of providing correct responses under various system configurations and fault conditions.

Keywords Power transmission lines, positional protection, transient-based protection, complex wavelet analysis.

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A Novel Principle of Single-Ended Fault Location Technique for EHV

Heng Xu, H.; Bao Hui, Z.; Zhi Lai, L.

Author Affiliations: Xi'an Jiaotong University.

Abstract: A new fault location principle using one-terminal voltage and current data for EHV transmission lines is described, which is based on distributed parameter line model, breaking through the traditional single-ended fault location ideas. The voltage profile along the healthy line could be calculated using single-ended voltage and current data, however, the voltage profile behind the fault point is not true for a faulted line. The norm value of the derivative function of the "fictitious profile" to distance is minimum at the fault point based on which the fault location function is constructed. The numerical algorithm is also described. This principle is proved by EMTP simulations to be immune to fault resistance, fault types, and fault inception angle. Theoretically, the accuracy of the principle is proportional to the sampling rate of the locator.

Keywords Fault location, distributed parameter line model, transmission lines.

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Event-Orthogonal Error-Insensitive Multiple Fault Detection with Cascade Correlation Network

Lin, W.M.; Lin, C.H.; Sun, Z.C.

Author Affiliations: National Sun Yat-Sen University, Taiwan.

Abstract: This paper presents the design of a fault detection system with cascade correlation network (CCN) for a power system. Associate fault components with the states of protective devices would form symptomatic patterns to create training data. The proposed method makes use of information from both the primary and backup devices involving single fault, multiple faults, data communicate with errors, or fault with the failed operation of delays and circuit breakers. With a sample power system, computer simulations were conducted to show the effectiveness of the proposed system.

Keywords Fault detection system, cascade correlation network (CCN), symptomatic patterns.

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An Adaptive Scheme To Prevent Undesirable Distance Protection Operation During Voltage Instability

Jonsson, M.; Daalder, J.

Author Affiliations: Chalmers University of Technology, Sweden.

Abstract: An adaptive algorithm to prevent undesirable distance protection operations during voltage instability is proposed. The algorithm is based on mathematical logic blocks and uses the rate of change of voltage as an additional relay criteria to increase the relay security with respect to voltage instability. Studies are based on simulations using two different test systems: a 15-bus system developed by the authors and the Nordic32 system. The investigation shows that undesirable zone 3 distance relay operations can be the difference between a blackout and a recovering system during voltage instability. However, simulations have shown that the adaptive algorithm may save the system from a collapse. Although the algorithm prevents mal-trips due to voltage instability the reach of the distance relay will not be restricted.

Keywords Adaptive relaying, distance protection, remote backup, voltage stability.

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Substations

Safety Conditions in Manholes in the Vicinity of Substations

Nahman, J.M.; Paunovic, I.

Author Affiliations: University of Belgrade.

Abstract: In many cases, the manholes for maintaining various installations including power and telecommunication cables, water-, remote heating-, and gas-pipes are located in a close vicinity of power substations. The paper analyzes the risks of the occurrence of danger-