Power System Planning and Implementation

Long-Term Load Forecasting for Fast-Developing Utility Using a Knowledge-Based Expert System

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Abstract: The application of the classical forecasting methods, when applied to a fast-developing utility with a period characterized by fast and dynamic changes, are insufficient and may provide an invaluable dimension to the decision-making process. In this paper, a knowledge-based expert system (ES) is implemented to support the choice of the most suitable load forecasting model for medium/long-term power system planning. In the proposed ES, the detailed problem statement including forecasting algorithms and the key variables (electrical and non-electrical variables) that affect the demand forecasts are first identified. A set of decision rules relating these variables are then obtained and stored in the knowledge base. Afterwards, the best model that will reflect accurately the typical system behavior over other models is suggested to produce the annual load forecast. A practical application is given to demonstrate the usefulness of the developed prototype system.

Keywords: Long-term load forecast, fast/normal developing utility, forecasting methods, artificial neural network, expert systems.

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Use of Load Control to Regulate Voltage on Distribution Networks with Embedded Generation

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Abstract: Since 1994 Econnect has, in conjunction with Northern Electric PLC, investigated the use of consumer load control as a new and innovative method to actively regulate distribution system voltage when affected by the operation of embedded generators [1],[2]. There are a number of issues that can limit the installed capacity of embedded generators; these are often voltage related, and the most common is steady state voltage rise. A number of techniques can be applied to limit steady state voltage rise, some of which are static in time (e.g., network reinforcement) and some dynamic (e.g., power factor control). This paper discusses the issue of excess steady state voltage rise and the methods of limitation that can be applied with specific reference to wind generation. The new and innovative approach using consumer load control is discussed and compared with the existing methods using a simulation case study.

Keywords: Load management, power distribution, wind energy, wind power generation, voltage control.

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Estimating Unit Cost in a Cogeneration Plant Using Least Squares

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Abstract: A method for establishing unit costs of delivered steam and electrical energy is presented. This method employs the use of least squares, based on a linear model of electrical energy generation and delivered steam as functions of generated boiler steam. The model is based on a plant design that allows steam to be extracted from between stages of the generating turbines at a reduced pressure to be used to serve heating loads. Alternatively, the steam can be run through lower pressure stages in the turbine to generate additional electrical power, and be exhausted at a vacuum, as dictated by external steam and electrical demand. A discussion of the accuracy of the method is presented as well as an example of the use of the method using two years of actual plant production.

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Power System Relaying

Experimental Results of a Supplementary Technique for Auto-Reclosing EHV/UHV Transmission Lines

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Abstract: A technique to discriminate between the line charging inrush current and the current resulting on closing or auto-reclosing a faulted EHV/UHV transmission line has been implemented on a 32-bit digital signal processor (DSP) board. The technique is based on the voltage signals before switching and the current signals. This technique is proposed to be a supplement to the main protection schemes for both single-circuit and double-circuit lines. The scheme is tested on a physical model of a transmission system with a source at each end. Laboratory tests show that the proposed technique is effective for three-pole and single-pole reclosing on a faulted or healthy line.

Keywords: Computer relaying, auto-reclosing, parallel and single lines, real-time implementation.

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Surge Protective Devices

A Composite Exponential and Linear MOA Model for Switching Transient Simulation

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Abstract: The multi-exponential MOA model currently used to simulate switching transients (current model) approximates the V-I characteristic of a MOA with several exponential segments. A test case illustrates a numerical oscillation caused by this model. The source of the oscillation is identified as the value jump of the derivative of the approximating function at the boundary point of adjacent exponential segments. The problem can be solved by using the Quasi-Newton method, but at the expense of computing time. A modified model is presented in this paper. This new model (proposed model) features a composite exponential and linear approximation to the V-I characteristic, and a monotonic derivative of the approximating function. The combination of the Newton method of iteration and the proposed model not only avoids numerical oscillation, but also has a better performance on computing time than the combination of the Quasi-Newton method and the current model.

Keywords: Electromagnetic transient, EMTP, iterative method, MOA, modeling.

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