cross-subsidies among generators and demands. The purpose of this comparison is to quantify the actual cost to market participants of using a simple, seemingly transparent procedure, such as an auction-based algorithm, versus an integrated but computationally intensive one, such as an optimal power flow.

**Keywords:** Pool-based electricity market, auctions, inefficiencies, cross-subsidies, optimal power flow.

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**Finding Improved Local Minima of Power System Optimization Problems by Interior-Point Methods**

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**Abstract:** This paper presents a simple heuristic technique to deal with multiple local minima in nonconvex, nonlinear, power system optimization problems by solving a sequence of interior point subproblems. Both the real-valued and the mixed-integer cases are discussed separately. The method is then applied to the unit commitment problem, and its performance on realistic cases is compared with that of a genetic algorithm.

**Keywords:** Nonconvex mixed-integer optimization, interior point algorithms, global optimization, genetic algorithms.

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**The Existence of Multiple Power Flow Solutions in Unbalanced Three-Phase Circuits**

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**Abstract:** This paper presents a new phenomenon found for unbalanced power flow solutions: the existence of two voltage solutions at the neutral points of unbalanced three-phase circuits. The phenomenon is different from that found in traditional single-phase balanced power flow solutions. It is dependent on the degree of system or load unbalance. If the unbalance is reduced to zero, the two solutions will merge into one. This paper presents our observations and analysis on the problem. A test system is used to illustrate the practical significance of the phenomenon. We hope this work will stimulate further research on this challenging and interesting problem.

**Keywords:** Unbalanced power flow, multiple solutions, power quality.

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**Energy Clearing Price Prediction and Confidence Interval Estimation with Cascaded Neural Networks**

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**Abstract:** The deregulated power market is an auction market, and energy market clearing prices (MCP) are volatile. Good MCP prediction and its confidence interval estimation will help utilities and independent power producers submit effective bids with low risks. MCP prediction, however, is difficult since bidding strategies used by participants are complicated and various uncertainties interact in an intricate way. Furthermore, MCP predictors usually have a cascaded structure, as several key input factors need to be estimated first. Cascaded structures are widely used, however, they have not been adequately investigated. This paper analyzes the uncertainties involved in a cascaded neural network structure for MCP prediction and develops the prediction distribution under the Bayesian framework. A fast algorithm to evaluate the confidence intervals by using the memoryless quasi-Newton method is also developed. Testing results on a classroom problem and on New England MCP prediction show that the method is computationally efficient and provides accurate prediction and confidence coverage. The scheme is generic, and can be applied to various networks, such as multilayer perceptrons and radial basis function networks.

**Keywords:** Power systems, market clearing price, Bayesian inference, neural networks, cascaded structure, prediction, confidence interval, risk management.

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**Purchase Allocation and Demand Bidding in Electric Power Markets**

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**Abstract:** The purchase allocation problem is one of the most important problems faced by an electric energy service provider under the new market environment. The optimal purchase allocation problem for dual electric power markets and demand bid generation are discussed in this paper. The price volatility is considered explicitly in purchase allocation problems, and the sequential nature is modeled by conditional stochastic characteristics. Analytical solution for the optimal allocation is derived with given demand and statistical characteristics of the market prices. The method for generating demand bids for a purchaser based on market allocation and price forecasting is developed. The numerical simulation for market allocation and bid generation are shown based on actual data of the U.S. California power market.

**Keywords:** Power system economics, optimization methods, uncertainty.

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**Lagrangian Heuristics Based on Disaggregated Bundle Methods for Hydrothermal Unit Commitment**

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**Abstract:** The paper presents a simple and effective Lagrangian relaxation approach for the solution of the optimal short-term unit commitment problem in hydrothermal power generation systems. The proposed approach, based on a disaggregated Bundle method for the solution of the dual problem, with a new warm-starting procedure, achieves accurate solutions in few iterations. The adoption of a disaggregated Bundle method not only improves the convergence of the proposed approach but also provides information that are suitably exploited for generating a feasible solution of the primal problem and for obtaining an optimal hydro scheduling. A comparison between the proposed Lagrangian approach and other ones, based on subgradient and Bundle methods, is presented for a simple yet reasonable formulation of the hydrothermal unit commitment problem.

**Keywords:** Hydroelectric-thermal power generation, power generation scheduling, power generation dispatch, optimization methods, mixed-integer programming.

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**A Novel ACS-Based Optimum Switch Relocation Method**

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**Abstract:** A cooperative agent algorithm, the ant colony system (ACS), for optimum switch relocation is proposed. Switch relocation is a useful tool for distribution automation, since it can reduce the interruption costs without additional capital investments. The formulation of switch relocation is a combinatorial optimization problem with nonlinear and nondifferential objective function. The authors choose the ACS to solve the problem since it has the characteristics of positive feedback, distributed computation, and the use of a constructive greedy