Preprint Order Number: PE-041PRD (05-2002)
Discussion Deadline: October 2002

The Optimization of Spectrum Analysis for Digital Signals

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Abstract: This paper provides a complete method to solve the defects of spectrum analysis for discrete signals. Much research has been issued to deal with the defects of the fast Fourier transform (FFT). Those methods may cause the characteristics of the original signal to be altered or may solve this problem in part only. The defects of spectrum analysis cannot be solved efficiently and completely by those methods. These defects result because frequency scales cannot match with signal characteristics. This paper is based on a concept to establish a complete solution divided into three steps. First, this paper analyzes the signal characteristics to be the basis of spectrum adjustment. A simple and accurate algorithm is used to find the frequency and amplitude of each component. Next, this paper finds optimum spectrum parameters to make the new spectrum match with signal characteristics. Finally, this paper takes the parameters to reanalyze the original signal. The method will make spectrum analysis reach optimization. Every procedure in this paper compares with traditional ones to prove its benefits. Moreover, we verify the theory feasible by analyzing actual signals.

Keywords: FFT, spectrum analysis, signal characteristic, spectrum parameter, optimization.
Preprint Order Number: PE-050PRD (05-2002)
Discussion Deadline: October 2002

Flicker Produced by Harmonics Modulation

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Abstract: Flicker effect caused by voltage harmonics modulation is discussed. Simple functions are used to show that harmonic components, despite satisfying the specific harmonic limits, may produce flicker due to combined amplitude modulation. Computer simulations, based on the International Electrotechnical Commission (IEC) methodology, are numerically validated and then applied to calculate the instantaneous flicker sensation resulting from different combinations of harmonics modulation. The results are also confirmed in laboratory tests using a flicker meter to measure the flicker levels obtained by synthesizing the same type of signals on a programmable function generator.

Keywords: Voltage harmonics, harmonic modulation, harmonic limits, interharmonics, flicker effect, flicker limits.
Preprint Order Number: PE-056PRD (05-2002)
Discusison Deadline: October 2002

Theorem and Application of Adjustable Spectrum

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Abstract: This paper affords the theorem, procedures, and evaluation of the ability of adjustable spectrum for signals. By means of adjusting frequency resolution and frequency shift, we can adjust frequency scale. The paper evaluates every process of computation to verify accurate computation and fast response of adjustable spectrum. Because frequency scale of this spectrum is adjustable, it makes the spectrum analysis of signal reach optimization. The method eliminates the picket-fence effect and the leakage effect by FFT. The procedures remain the characteristic of fast computation, which makes spectrum analysis have the ability of real-time response.

Keywords: Adjustable spectrum, optimization, fast fourier transform, picket-fence effect, leakage effect.
Preprint Order Number: PE-136PRD (05-2002)
Discussion Deadline: October 2002

A Hybrid Least-Squares GA Based Algorithm for Harmonic Estimation

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Abstract: Harmonic estimation in a distorted signal along with additive noise has been an area of interest for researchers in many disciplines of science and engineering. This paper presents a new algorithm to estimate the harmonics in power systems using genetic algorithms (GA). The harmonic estimation problem is linear in amplitude and nonlinear in phase. The proposed hybrid algorithm takes advantage of this structure and iterates between linear least-squares amplitude estimation and the nonlinear GA-based phase estimation. Improvement in both convergence for solution as well as processing time is demonstrated from this algorithm.

Keywords: Genetic algorithms, least squares, hybrid algorithm, harmonic estimation, performance index.
Preprint Order Number: PE-170PRD (05-2002)
Discussion Deadline: October 2002

Power System Operations

A Study on Determination of Interface Flow Limits in the KEPCO System Using Modified Continuation Power Flow (MCPF)

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Abstract: This paper reports a study on determining the steady-state voltage stability limit of interface flow on a set of interface lines between the metropolitan region and the neighboring regions in the Korea Electric Power Corporation (KEPCO). The interface flow limit considering severe contingencies is determined with a concept of interface flow margin, which is the active power flow margin of the key transmission lines between one region and others under a fixed load demand condition. The paper proposes a procedure to determine secure limit of active power flow on a set of specified interface lines. The procedure uses the modified continuation power flow (MCPF) tracing a path of power flow solutions with respect to generation shift to vary interface flow. In simulation, voltage stability limits of the metropolitan interface flow of the 1998 KEPCO system are determined.

Keywords: Interface flow limit, KEPCO system, modified continuation power flow, steady-state voltage stability.
Preprint Order Number: PE-754PRS (03-2002)
Discussion Deadline: August 2002
Note that this abstract was included in the June 2002 issue of IEEE Power Engineering Review, but author information was missing. It appears in this issue in its corrected form.

Simulation Study of Internet-Based Inter-Control-Center Data Exchange for Complete Network Modeling

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Abstract: The model used for real-time network security and transmission capability analyses requires the use of a large area network and has to be brought up to real-time conditions. To build a complete network model, SCADA data must be made available to many external bodies. An Internet interface to SCADA systems is proposed for inter-control-center data exchange. A discrete even technique is utilized to simulate the interarea data exchange. The performance modeling of data exchange on the Internet is established, and a quantitative analysis