Analysis of Frequency Estimation of Unbalanced Conditions by using Filtering Techniques

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ABSTRACT

In this proposed system, the critical problematic situation of frequency assessment is to be analyzed and estimated by using some novel technique. The technique is mainly dealt with the estimation is improved based a novel mean square technique. It also demonstrates a very simple and easy approach for the estimation of frequency in an unbalanced condition. An advanced version of ACLMS is the main impact of the proposed system. Thus, it also increasing and augmenting both merging level and accuracy of the normalized time variant system. The proposed algorithm is real adaptive filter with real constraint which can be proficiently employed by the processor. The performance and analysis of the proposed method along with simulation results relating with the existing techniques are provided in precarious cases such as several unstable conditions and existence of harmonic distortions. Simulation results show that the proposed technique accomplishes a better performance in the effect of convergence rate and frequency estimation precision as related with CLMS and ACLMS techniques.

Keywords: augmented complex normalized least mean squares (ACNLMS), frequency estimation, adaptive filter, unbalanced condition.

I. INTRODUCTION

An auspicious tool for the future generation of power systems are digital Signal processing. Frequency is an essential consideration of a power system in observing, regulate and safety applications. Moreover, correct and online frequency estimation in a power system is a requirement for the future cleversystem where the generation, load and topology will be vigorously simplified. In addition, unpredicted frequency variation from nominal value specifies an emergency situation where quick reaction should be taken into consideration. Hence reckless and precisefrequency estimation is essential in such circumstances. Numerous algorithms have been suggested for frequency estimation in power systems. Conventionally, zero crossing statistics have been demonstrated for frequency estimation. As a consequence of the humiliation of zero crossings by noise and other harmonic distortions, other practices have been recommended. Meanwhile, frequency designates balance or imbalance between load and generation, it has vital role in a power system. Moreover, the information that the quantity of active power created would be continuously equal to the active power expended damages is one of the main problems in power systems. If the spent power is more than the shaped power, then the frequency would reduce and vice versa. Subsequently, differences from minimal frequency value designate lack of balance, such as surprising abnormal system conditions, between active power consumed plus losses and active power produced. Even small deviations from this value would damage synchronous machines and other applicants. Therefore, making sure of the frequency being constant is of great importance to power system networks. Control and protection of power system require fast and accurate frequency estimation and thus it is a challenging problem that has attracted a lot of attention.

Maximum works take up standing parameter and do not deliberate the deviation of the compensation caused by the Doppler shift. Hence these types of procedures mostly lose when frequency offset changes from time to time. In an adaptive LMS-based filter has been offered to estimate the frequency, which can trail the difference between offset caused by the Doppler shift. The recommended algorithm in works well under the guess of the Gaussian distributed noise.
Nevertheless, in many wireless channels, it has been perceived that the noise frequently monitors non-Gaussian distribution. Hence, the predictable estimators could hurt from performance degradation in the non-Gaussian noise situations. To report this concern, our intention is to improve a robust and adaptive algorithm to evaluate the CFO which is forceful in existence of impetuous noise. To this end we must to go outside mean squared error to achieve higher order minutes of the error. Information speculative capacities have also been projected as cost functions in adaptive filters. The use of Correlation entropy as a cost function in order to train the filter weights has been proposed. The given algorithm which uses maximum correlation entropy as the cost function has lower computational complexity than MEE, while its robustness is similar to the MEE based algorithm. Thus, we improve a MCC based adaptive algorithm for CFO estimation. To develop the proposed algorithm, we originally articulate the CFO estimation permitting to the MCC, and then we consume the gradient-ascent method with suitable instantaneous approximations to solve it. We compare the performance of the proposed algorithm with the LMS-based algorithm in different conditions including the Gaussian noise, impulsive noise, and time varying CFO, where the results show the superior performance of the proposed algorithm.

2. LITERATURE SURVEY

HlaingMinn et.al proposed A Robust Timing and Frequency Synchronization for OFDM Systems. In this work, he demonstrated robust symbol-timing and carrier-frequency synchronization scheme applicable to orthogonal frequency-division- multiplexing systems is presented. The proposed method is based on a training symbol specifically designed to have a steep roll off timing metric. The proposed timing metric also provides a robust sync detection capability. Both time domain training and frequency domain (FD) training are investigated. For FD training, maintaining a low peak-to-average power ratio of the training symbol was taken into consideration. The channel estimation scheme based on the designed training symbol was also incorporated in the system in order to give both fine-timing and frequency-offset estimates. For fine frequency estimation, two approaches are presented. The first one is based on the suppression of the interference introduced in the frequency estimation process by the training symbol pattern in the context of multipath dispersive channels. The second one is based on the maximum likelihood principle and does not suffer from any interference. A new performance measure is introduced for timing estimation, which is based on the plot of signal to timing-error-induced average interference power ratio against the timing estimate shift. A simple approach for finding the optimal setting of the timing estimator is presented. Finally, the sync detection, timing estimation, frequency estimation, and bit-error-rate performance of the proposed method are presented in a multipath Rayleigh fading channel.

G. Ren et.al proposed An efficient frequency offset estimation method with a large range for wireless OFDM systems. An efficient frequency offset estimation method is proposed for wireless orthogonal frequency-division multiplexing (OFDM) systems. In the proposed method, the received samples of the training symbol are processed by a novel envelop equalized processing method, and the estimation of the frequency offset in the OFDM systems turns out to be the frequency estimation of a complex tone. A novel frequency estimation method is employed to estimate the frequency offset. The estimation range of the proposed method is as large as the bandwidth of the OFDM signal, and the performance of the proposed method is independent of the structure of the training symbol.

M. Mojiri et.al proposed Robust adaptive frequency estimation of three-phase power systems. An algorithm based on the concept of an adaptive notch filter is proposed for the frequency estimation of three-phase power signals. The algorithm permits direct estimation of frequency and its rate of change for power system signals. The proposed method uses the information of all three-phase signals together. The structure, mathematical formulation, and theoretical stability analysis of the proposed technique are presented, and its performance is studied in a variety of scenarios where three-phase power signal attributes such as frequency and amplitude undergo variations over time. This study confirms the desirable transient and steady-state performances of the proposed algorithm. In contrast to the
A suitable and robust algorithm for frequency estimation of three-phase signals, and the second is for frequency estimation of single-phase systems. To demonstrate the performance of the developed algorithm, computer-simulated data records and calibrator-generated signals are processed. The proposed algorithm has been put to test with distorted three-phase voltage signals.

Y. Xia and D. P. Mandic were proposed **Augmented MVDR spectrum-based frequency estimation for unbalanced power systems**. A robust technique for online estimation of the fundamental frequency of both balanced and unbalanced three-phase systems is proposed. This is achieved by extending the recently introduced iterative frequency estimation method based on minimum variance distortion less response (MVDR) spectrum, in order to enhance its robustness in unbalanced system conditions. The approach is made optimal for the second-order noncircular nature of the unbalanced complex-valued system voltage, by combining the iterative MVDR (I-MVDR) frequency estimation and the complete available (augmented) second-order statistics. Such an approach makes it possible to eliminate the otherwise unavoidable estimation bias in unbalanced system conditions. It is also shown that the proposed method approaches the theoretical Cramer-Rao lower bound (CRLB), which we rigorously derive for the vector parameter in power systems. Simulations over a range of unbalanced conditions, including voltage sags, the presence of higher-order harmonics, and for real-world unbalanced power systems, support the analysis.

A. K. Pradhan et.al proposed **Power system frequency estimation using least mean square technique**. Frequency is an important parameter in power system monitoring, control, and protection. A least mean square (LMS) algorithm in complex form is presented in this paper to estimate power system frequency where the formulated structure is very simple. The three-phase voltages are converted to a complex form for processing by the proposed algorithm. To enhance the convergence characteristic of the complex form of the LMS algorithm, a variable adaptation step-size is incorporated. The performance of the new algorithm is studied through simulations at different situations of the power system.

F. A. S. Neves et.al proposed **A space-vector discrete Fourier transform for unbalanced and distorted three-phase signals**. In this paper, a space-vector discrete-time Fourier transform is proposed for fast and precise detection of the fundamental-frequency and harmonic positive- and negative-sequence vector components of three-phase input signals. The discrete Fourier transform is applied to the three-phase signals represented by Clarke’s αβ vector. It is shown that the complex numbers output from the Fourier transform are the instantaneous values of the positive- and negative-sequence harmonic component vectors of the input three-phase signals. The method allows the computation of any desired positive- or negative-sequence fundamental-frequency or harmonic vector component of the input signal. A recursive algorithm for low-effort online implementation is also presented. The detection performance for variable-frequency and inter-harmonic input signals is discussed. The proposed and other usual method performances are compared through simulations and experiments.

**3. PROPOSED SYSTEM**

In Frequency estimation systems, the chief synchronization considerations to be assessed are a sync flag demonstrating the existence of the signal,
the beginning time of the FFT window, the frequency offset owing to the erroneousness of the transmitter and receiver oscillators, and the Doppler shift of the mobile channel, as well as the channel evaluates if articulate reception is accepted. The sync flag can be produced by automatic gain control (e.g., ramp-up indication via power measurement and threshold decision) or using a training symbol. For the concluding case, the similar metric used for scheduling synchronization may be used together with the threshold decision, so as to produce the sync flag. After identifying the presence of the signal, the other sync parameters are projected. In the resulting, the consequence of timing synchronization errors is concisely termed for the later use.

\[ \vartheta(k) = V(k) \cos(\omega k \Delta T + \varphi) \]  \hspace{1cm} (1)

\[ \vartheta(k) = V(k) \cos(\omega k \Delta T + \varphi - 2\pi/3) \]  \hspace{1cm} (2)

\[ \vartheta(k) = V(k) \cos(\omega k \Delta T + \varphi + 2\pi/3) \]  \hspace{1cm} (3)

where \( V_u(k), V_v(k), \) and \( V_x(k) \) are maximum (peak) value of every voltage signal at time instant \( k \), \( \Delta T \) is sampling interval, is the phase of fundamental component, and \( \omega = 2\pi f \) is the angular frequency of the voltage signal, with \( f \) being the system frequency. Therefore, the complex voltage signal \( V(k) \) of the system is given by

\[ \vartheta(k) = \nu(k) + j \nu(k) \]  \hspace{1cm} (4)

In practice, this complex signal was extensively used for frequency estimation in three phase power systems. Naturally, the harmonics that are mainly zero sequence \( \vartheta(k) \) are blocked by this transformation. Thus, the zero-sequence was discarded in all these references and we did the same. Motivating from the recursive relation for single phase voltage, a recursion can be resultant for the complex voltage is rewritten as the sum of two clockwise and counter clockwise voltages as:

\[ \vartheta(k) = \nu(k) + \nu(k) \]  \hspace{1cm} (5)

4. SIMULATION RESULTS

The innovative suggested LMS algorithm and its frequency estimator were applied to estimate the power system frequency from discrete time samples of three-phase voltage signals. Different experiments were conducted to evaluate the performance of the proposed algorithm in comparison to the counterpart algorithms i.e. CLMS and ACLMS. Simulations were performed in the Mat lab programming environment with a sampling frequency of 5kHz. The simulation results are be in the region of over 100 independent runs.

Fig.1: Frequency estimation under unbalanced conditions.

Fig.2: Variance of frequency estimation of three algorithms in various noisy conditions.

Fig.3: Frequency estimation under sudden frequency changes.
VI. CONCLUSIONS

The proposed system accomplishes a similar performance and a comprehensive estimation range in evaluation with the LMS-based algorithm. The proposed algorithm depends on a recursion which was demonstrated in this system. This recursion recommends understanding the next sample of the complex voltage based on two previous samples in the place of CLMS or established on previous sample and its conjugate in ACLMS. A general simulation result illustrates the benefits and problems of the proposed algorithm in contrast with the CLMS and ACLMS. Alternatively, ACLMS leave behind our proposed algorithm in noisy cases. Based on the results of the simulation, we determine that the proposed system offers strong performance regarding distortion of the input signal, e.g., harmonics and noise distortions; and also variations of its inside parameter. Furthermore, it has the ability to deliver fast and accurate frequency estimation under a number of unbalanced conditions.

REFERENCES


