Cyclostationary Based Frequency Offset Estimation For Transmitting Different Data Inputs

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Abstract: Although the many technologies are evolved during the past few decades, the spectrum utilization is not yet utilized efficiently. Therefore, it is necessary to focus on technologies which will be helpful for using spectrum efficiently such as called as spectrum sensing technologies. In the literature, different spectrum sensing methods are proposed in which the most efficient method, Cyclostationary method is focused more in this paper. When a signal is transmitted over a wireless channel, the signal will be disturbed due to the channel noise. This channel noise may lead to phase, amplitude and frequency offset. However in this paper, the frequency offset estimation of Cyclostationary detection in Cognitive radio network for number of CR users is analyzed and remaining offsets are assumed as null.

Index Terms: Cognitive radio, Cyclostationary method, Frequency offset, Spectrum sensing.

1. INTRODUCTION

Among the range detecting calculations proposed in the writing [1]–[4], we consider in this paper highlight based indicators. Highlight indicators adventure sign's cyclostationarity by identifying spectrum correlation crests in the SCF, which is scanty in both cyclic and precise recurrence areas. They are additionally exceptionally vigorous to commotion vulnerability which makes other finders, for example, vitality indicators come up short. Likewise, include finders can separate among sign of intrigue (SOIs), meddling sign, and commotion by utilizing the SOI's cyclostationary unearthly connection highlights [5]. Range detecting is the undertaking of acquiring mindfulness about the range use and presence of essential clients in a geological territory. This mindfulness can be acquired by utilizing geolocation and database, by utilizing signals, or by neighborhood range detecting at subjective radios [6]–[9]. It likewise includes figuring out what kinds of sign are involving the range including the tweak, waveform, transmission capacity, bearer recurrence, and so on.. Be that as it may, this requires all the more dominant sign examination methods with extra computational unpredictability. There is a reduction in the likelihood of identification at whatever point the divert is in a profound blur. This can be eased by abusing spatial decent variety either using helpful range detecting [10] or, if accessible, the utilization of numerous receiving wires. Thus, range detecting calculations misusing different radio wires have gotten significant intrigue [11] - [13]. The radio space with the presented measurements can be characterized as "a hypothetical hyperspace involved by radio sign, which has measurements of area, point of entry, recurrence, time, and potentially others" [14], [15]. This hyperspace is called electrospace, transmission hyperspace, radio range space, or basically range space by different creators, and it tends to be utilized to portray how the radio condition can be shared among numerous (essential as well as optional) frameworks [14]–[17]. Orthogonal frequency division multiplexing (OFDM) transmission is getting expanding consideration as of late due to its power to frequency-selective fading and its subcarrierwise versatility. Then again, multiple input multiple output (MIMO) frameworks pull in impressive enthusiasm due to the higher limit and spectral productivity that they can give in examination single-input single-output (SISO) frameworks. As needs be, MIMO-OFDM has developed as a solid possibility for beyond third generation (B3G) versatile wideband communication [18]. It is notable that SISO-OFDM is profoundly touchy to carrier frequency offset (CFO), and precise estimation and compensation of CFO is significant [19]. Various methodologies have managed CFO estimation in a SISO-OFDM arrangement [20]–[25]. As per whether the CFO estimators use preparing groupings or not, they can be named daze ones [20] [21] and preparing based ones [19], [23]–[25]. Like SISO-OFDM, MIMO-OFDM is additionally touchy to CFO. In addition, for MIMO-OFDM, there exists multi-antenna interference (MAI) between the got sign from various transmit reception apparatuses.

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2 SPECTRUM SENSING TECHNIQUES

Cognitive radio devices have the ability to acquire knowledge of the environment through their context awareness, such that, they obtain information by sensing variables related to the channel characteristics, interference, power, and spectrum accessibility among others. Signal processing techniques are proposed in the literature [26] - [29] that use the advantage of man-made signals which present periodicity in their statistics. First of all we need primary user waveform on which we can apply different spectrum sensing techniques.

2.1 Matched filter

Matched filter improves the signal to noise (SNR) of received signals which is a major advantage to detect signals [30]. However, this method requires an efficient demodulation method of a primary user. This method requires prior information (may be modulation type, coding, packet format etc) about the primary user signal at both MAC and PHY layers. Matched filter method uses coherent detector to demodulate the signals by mitigating synchronization errors such as timing and frequency offsets. Various receiver algorithms are to be employed to achieve perfect demodulation and it may consume pore power which is a major disadvantage of matched filter method.

2.2 Cyclostationary based detection (CBD)

Figure 1 shows the implementation of a spectrum correlation function for cyclostationary feature detection, which is designed as augmentation of the energy detector with a single correlator block [31]. The major advantages CBD method are it provides constant false alarm rate (CFAR) even with inaccurate information of noise variance and provides improved performance even at very low SNRs [32], [33].

III. RESULTS AND DISCUSSION

Figure 2 shows the obtained results for Cyclostationary based frequency offset estimation while transmitting a single character ‘R’ when the frequency is set to (a) 100 Hz (b) 200 Hz (c) 500 Hz and the peaks are observed at +200 & -200, +400 & -400 and +1000 & -1000, respectively.Figure 3 shows the obtained results for Cyclostationary based frequency offset estimation while transmitting a single word ‘RESEARCH’ when the frequency is set to (a) 100 Hz (b) 200 Hz (c) 500 Hz and the peaks are observed at +200 & -200, +400 & -400 and +1000 & -1000, respectively.Figure 4 shows the obtained results for Cyclostationary based frequency offset estimation while transmitting a statement

‘RESEARCH IS CREATING A NEW KNOWLEDGE’ when the frequency is set to (a) 100 Hz (b) 200 Hz (c) 500 Hz and the peaks are observed at +200 & -200, +400 & -400 and +1000 & -1000, respectively.

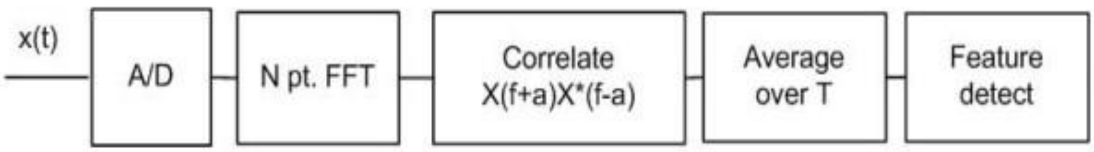

Fig. 1: *Implementation of Cyclostationary based detection (CBD) spectrum sensing [30].*

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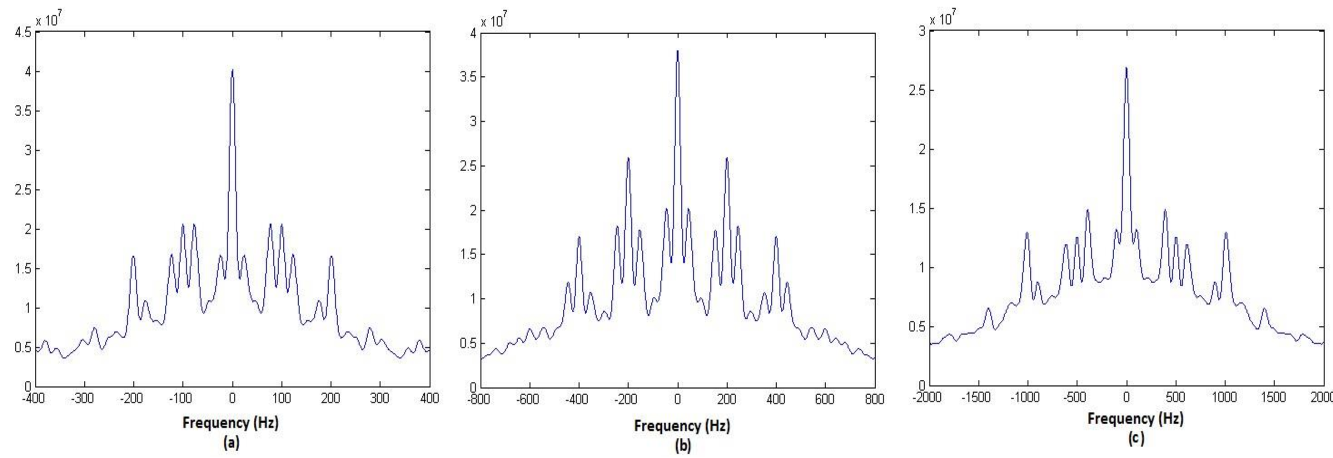

Fig. 2: Obtained results for Cyclostationary based frequency offset estimation while transmitting a single character ‘R’ when the frequency is set to (a) 100 Hz (b) 200 Hz (c) 500 Hz.

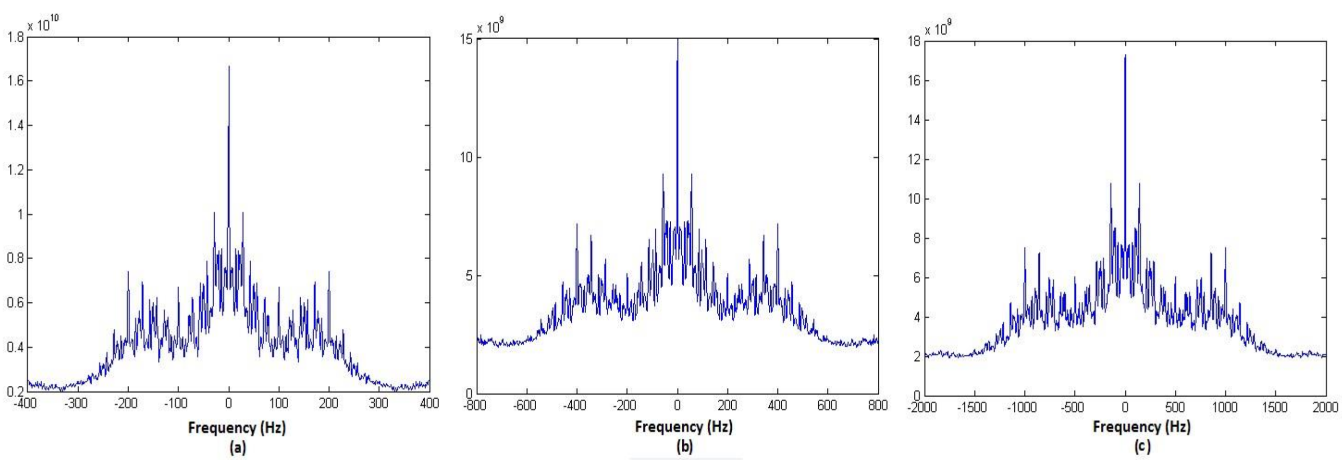

Fig. 3: *Obtained results for Cyclostationary based frequency offset estimation while transmitting a single word ‘RESEARCH’ when the frequency is set to (a) 100 Hz (b) 200 Hz (c) 500 Hz.*

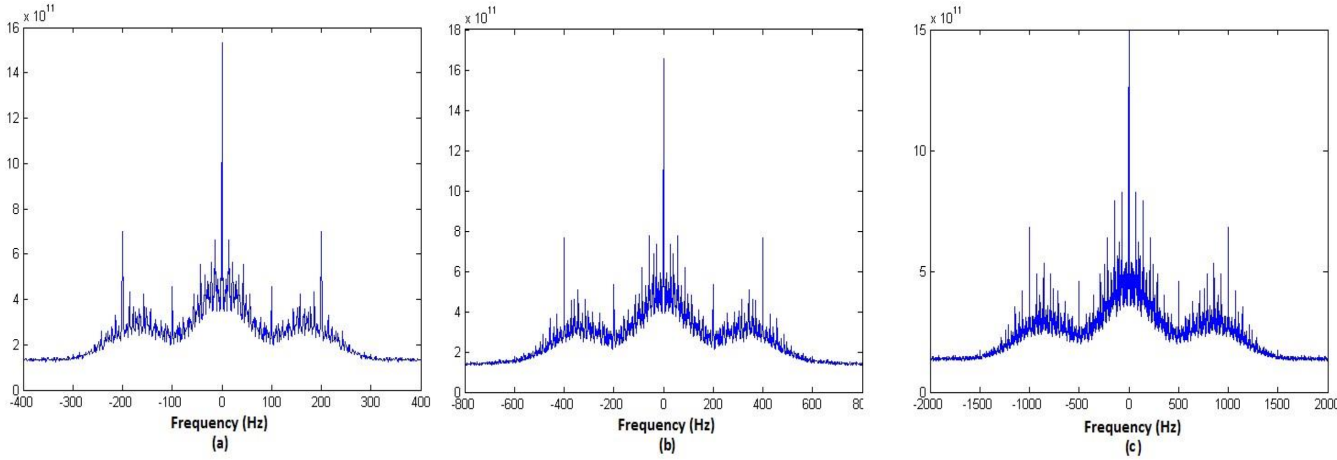

Fig. 4: *Obtained results for Cyclostationary based frequency offset estimation while transmitting a statement 'RESEARCH IS CREATING A NEW KNOWLEDGE' when the frequency is set to (a) 100 Hz (b) 200 Hz (c) 500 Hz.*

4 CONCLUSION

In this paper, the FRA data of a transformer is successfully transmitted and received over AWGN and Rayleigh channels. Two communication channels are implemented and performance is analyzed in terms of BER and SNR. The results obtained by using two different channels show that for DSSS system BER decreases as the number of users increase while for Rayleigh channel there is frequent change in the BER. With the help of spread spectrum sensing we have compared the strengths of signals in DSSS and FHSS. It is concluded that FHSS system has better performance than DSSS, since DSSS is less immune to the noise compared to DSSS transmission for both the channels.

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