

# A Novel Technique for Extracting Radar Signal

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## **Abstract:**

In order to safe guard the country electronic war fare circuits and algorithms are installed in different platforms. Many signal processing techniques are used along with analog and digital systems. This paper involves a novel algorithm for extracting the radar signal. Different modulation techniques, inter and intra pulse modulation techniques are used for extracting the radar signal. The Linear frequency modulation concept utilizes up- down chirp. These are the characteristics of the inter pulse, intra pulse and baker codes include stagger and jitter PRI. No of modern techniques are used to extract the radar parameters, these techniques developed in the MATLAB tool.

**Keywords:**Inter pulse, Intra pulse, Barker code, LFM, Staggered PRI, Jitter PRI, up-down chirp.

## **1. INTRODUCTION:**

The current trends in radar electronic war fare, the electronic warfare devices are designed with high end algorithms which also include complex hardware. The modern electronic warfare systems are designed with high end capability of detecting, classifying, and measuring the enemy radars. These systems use different techniques like low pulse repetition interception, direction arrival, time of arrival, barker code to locate and analyze the enemy radars with accurate calculations. variety of operational characteristics are consist by these modern radar like, transmitter and receiver antennas, signal processing techniques, and modulation and demodulation techniques. The practical scenario consist more than one emitters with low pulse repetition frequency and with different frequency band. So the situation may consist more no of emitters with high density and the signals has to be interleaved with different frequencies. The EW system in ESM are super band frequency system. The final motto of the electronic war fare system is to detect, locate and measure the range of the enemy radars with different pulse compression techniques and barker codes.the main functional aspect of the

ew system is to find out the characteristics of the various signals received from the various emitters and make need full measurement to identify the location of the enemy radar.

## **2.CONVENTIONAL BLOCK DIAGRAM OF ESM RECEIVER:**

The basic construction of the receiver depends on the environment complexity i.e what is frequency of operation of each emitter and at which frequency they are operating. The block diagram consist of band pass filter, mixers, receiver antennas and local oscillator to generate the carrier frequency. Initially the signal received process through the BPF.; and then it fed to the linear analysis circuit to normalize the frequency component of the signal; and then it is fed to the mixer to shift the signal frequency of operation. Meanwhile amplifiers also used to amplify the signal amplitude to protect it from noise. the signal after shifting frequency is fed to the converter for conversion from analog to digital if we want to interface it with digital devices . The signal from the receiving wire is separated correctly in any occasion to disregard the picture recurrence and more. A community oscillator inside the recipient

creates a sine wave, which blends in with that sign, shifting it to a specific halfway recurrence (IF), commonly a decrease recurrence. The IF signal is itself separated and intensified and possibly handled in greater manners. The demodulator makes use of the IF sign up desire to the number one radio recurrence to reproduce a duplicate of the primary facts. The accompanying essential components are regular: collector; a tuned degree, for intensification cause (RF speaker); a neighborhood oscillator; a recurrence blender; a BPF and center of the street recurrence (IF) intensifier; and a demodulator further to greater hardware to (or different transmitted facts). This beneficiary circuit utilizes the automated recipient. The down changed over IF (750 to 1250 MHz) is examined with 1.299 Giga assessments/sec

## 2.1 INTRODUCTION TO INTER AND INTRA PULSE:

Any radar designed with some built in characteristics like pulse repetition interval, different scan types, different modulation types and so on. Pulse repetition interval defines the time which elapses between two pulses which emitted by the radar. it indicate the maximum range where radar can make unambiguous range measurements. Constant PRI, Staggered PRI, Dwell-and-Switch PRI and Jittered PRIs are different types of PRI . there exist different types of modulation techniques based on the radar design complexity. Among them two modulation methods are intra and inter pulse modulation. pulse repetition frequency, frequency and angle of arrival can be referred by inter pulse modulation. The inter pulse modulation can able to distinguish between two constant PRIs. The range ambiguity problem can be minimized by the Inter pulse modulation. Because the inter pulse modulation the radar receives echo signal before it transmits the second pulse. The another type of modulation technique is intra pulse modulation or intentional modulation. There exist two distinct methods in intra pulse modulation intentional and unintentional modulators. The intentional modulators used for the purpose of radar pulse

compression. it apply intentional changes in amplitude frequency, or angle .the intra pulse modulation technique in turn increase the possibility of target detecting, range resolution and velocity of the radar can also be .

Intra pulses can be grouped as follows:

### 2.2 Amplitude modulation on pulse modulations

In this modulation technique the amplitude of the pulse signal is changed but frequency and phase are kept constant. there exist two types of modulation shapes linear and non linear amplitude on pulse. The modulation shapes like parabola, ramp are treated as nonlinear AMOP.,

### 2.4 Frequency modulation on pulse :

This modulation technique keep changes in frequency of the signal and other parameters are constant. This frequency modulation techniques are divided in to two groups they are linear FMOP and non linear FMOP. Chirp signal are considered as linear frequency modulation type and ramp, square, parabola signal are considered as nonlinear frequency modulation type.

### 2.5 Phase modulation on pulse

In phase modulation technique phase of the signal is modulated depending on the binary code.and amplitude kept constant.

**2.7 Barker Code:** A Barker code is a sequence of N values of +1 and -1,  $a_j$  for  $j=1, 2, \dots, N$  such that

$$\left| \sum_{j=1}^{N-v} a_j a_{j+v} \right| \leq 1$$

The barker code most essentially used in radar applications. The barker code have different length sequences and with correlation side lobes can be generated. The amplitude of the barker code is constant.13 is the maximum length which used in barker code. The binary code sequence consist only two values +1,-1. Which can be applicable only for  $N=3,4,5,7,11,13$ .

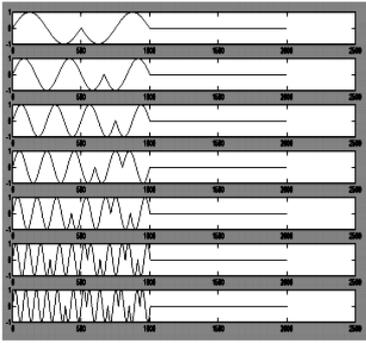


Figure-2.5 Barker Code Graphical Representation.

### III INTER MODULATION

By making use of PRI tweak acknowledgment in ESM frameworks, the manner towards perceiving the radars may be created. Regular sorts of PRI law are constant, jittered, bowled over, sliding, wobulated and DS (Dwell and Switch). In traditional techniques, consistent and amazed PRI tweaks are perceived in beat de-interleaving manner. The cutting facet ELINT frameworks may additionally quantify regulations of PRI and RF with an exceedingly excessive exactness. In the occasion that the sorts appear on beat or from heartbeat to conquer or from beat collecting to beat accumulating, they're viewed as quick. On the off risk that they appear from output to filter out or over longer durations, they are viewed as moderate. PRI is the meantime from starting of one heartbeat to the beginning of the subsequent heartbeat. These are radars with: PRI stable, PRI sliding, PRI live and switch, PRI amaze, PRI jitter.

#### 3.1 STAGGER PRI

PRI amaze is the utilization of at least PRIs chose in a set arrangement. The succession may also contain extra than one of the few interims earlier than it rehashes. The grouping is portrayed with the aid of the quantity of "positions" or interims utilized in making up the association and the quantity of numerous interims applied. A standard amaze association comprises of modifying lengthy and quick PRIs. This has interims and positions. [3] three.2 JITTER PRI A parameter PRI is viewed as a jittered if the varieties from the imply PRI show up in an irregular or pseudorandom fashion. PRI jitter

types can manifest among least and maximum intense PRI restrains or may be types from an average worth utilising discrete traits. [2]

### RESULTS:

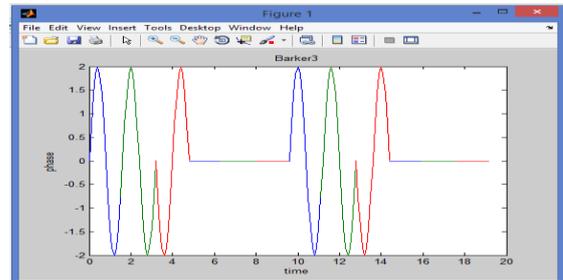


Figure - 4.1 MATLAB Implementation of Barker code 3

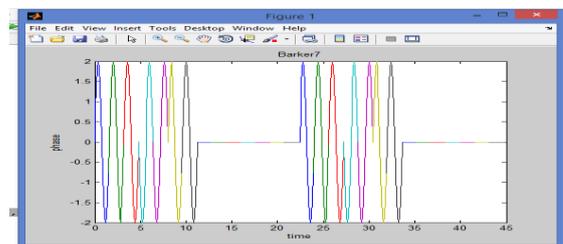


Figure-4.2 MATLAB Implementation of Barker code 7

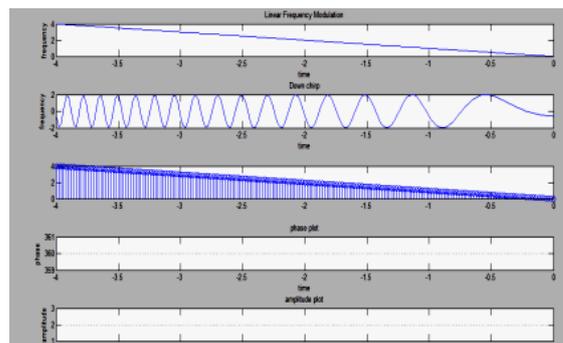


Figure-4.3 MATLAB Implementation of LFM-Down Chirp

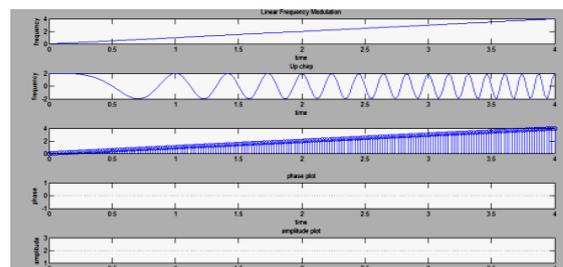


Figure-4.4 MATLAB Implementation of LFM-Up Chirp

## VI CONCLUSION

In this paper, the finger printing of regulated signs and symptoms and symptoms of numerous sorts have been tested and affordable calculations had been created to separate the ones radar signal parameters. To verify those characteristics, at the begin MATLAB CODE is created and dissected via the reenactments, which can be exhibited in the paper. Likewise, the reenactment is completed for extraction of attributes of the examples using DSP calculations is completed and brought within the paper. As a consequence, the reenactment of Inter and intra beat capabilities and extraction of the equivalent has been finished and displayed inside the paper. A similar artwork can be moreover achieved by using using quite a few complex signs and symptoms like Huff-guy code, and so forth.

## REFERENCES

1. [http://www.Ijetae.Com/files/Volume4Issue4/IJETAE\\_0414\\_18.Pdf](http://www.Ijetae.Com/files/Volume4Issue4/IJETAE_0414_18.Pdf)
2. Richard G. Wiley "The examination of radar alerts" bankruptcy 8 internet web page no 100 and fifty
3. Richard G. Wiley "The studies of radar indicators" bankruptcy eight page no 154
4. [http://en.Wikipedia.Org/wiki/Barker\\_code](http://en.Wikipedia.Org/wiki/Barker_code)  
J.C.Toomay,Paul J.Hannen "Radar ideas for the Non-professional" 0.33 release
5. Simulation and Extraction of Radar sign Parameters making use of virtual signal Processor via D Priyanka<sup>1</sup>, Ch Viswanadham<sup>2</sup>, Afroz.
6. August Golden Jr., Radar electronic conflict AIAA education association 1987.
7. Fred E. Nathanson, Radar design precept, second edition.
8. Dr. V okay Atre, electronic conflict-A perspective, IETE Technical audit Vol 17, No6, Nov-Dec-2000.
9. G Nagendra Rao, CVS Sastry, N Diwakar, traits in Digital battle, IETE Technical audit Vol20, N02, and March-April 2003.
10. T.D. Bhatt, E.G. Rajan, P.V.D. Somasekhar Rao, "shape of recurrence coded waveforms for goal discovery", IET Radar, Sonar and Navigation,