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Encoded Hybrid PSK/FSK Waveform for LPI Radar

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Abstract-Since the advantage of pulse compression radar, the pseudo random codes and poly time codes and non linear frequency modulation has been mostly widely used low probability intercept (LPI) radar waveforms. By changing frequencies time to time in frequency modulation known as non-linear frequency modulation (frequency hopping (FH)), peak to side lobe ratio (PSLR) can be achieved to make less severe the covering effect of nearby targets and to improve the useful dynamic range. Adding an appropriate binary encoded ternary phase shift signal (PSK) as form as Binary encoded Hybrid-PSK/FSK (BEH PSK/FSK), the peak side lobe ratios are obtained very low values (e.g., PSLR<-70dB), similar to the antenna side lobes. In advanced microwave power amplifier technology, now a day's using low peak to average power modules requires them to be amalgamated at the radio frequency (RF) stage in that way to obtain the required emitted radiated power. The deterministic waveforms are represents Noise waveform radar technology is a valid alternative. The pseudo-random waveform-realization of a noise process, the higher its bandwidth-time (or BT) product, the lower the (numerical) peak side lobe ratio. With practical Bandwidth-time values, the achievable peak side lobe using pure random is not sufficient the generated pseudorandom waveforms undergoes optimized genetic algorithm Hamming Scan (HS) to achieve optimized pseudo random (OBC), in order to achieve the desired side lobe level. This manuscript proposes a general analysis of the two modes of radar waveforms, i.e., Ternary and Binary alphabetic waveforms of coincidence detection.

Keywords: Hybrid PSK/FSK waveform, LPI Radar, Hamming scan, Hamming Back Track, Degree of Freedom, Coincidence Detection, DF, PSLR.

I. INTRODUCTION

In low probability of intercept (LPI) radar, the characteristics such as low power, larger bandwidth, other frequency hopping design parameters makes difficult to be searched by radar warning receiver (RWR). These special features are desirable due to detecting and tracking of an enemy target without alerting them to the radar's presence. More added characteristics keep the LPI radar find out by novel intercept receivers.

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Intercept receivers use variety of techniques to discover radars using angle of arrival, scan rate, bandwidth, carrier frequency, modulation period, and polarization etc., and LPI radar features pose a provocation to non-cooperative intercept receiver. In this paper we address the interception and analysis of radar signals, which includes the detection and estimation of LPI radar waveform parameters . Randomly changing one or many of these attributes can provide Uncertainty of the intercept receiver [1-2].

The correlated linear frequency waveform set design problems by optimizing these parameters for variant beam patterns. The existing beam pattern matching design methods have a principal problem that the resulted waveform is inconstant waveform and produced from a many alphabets, and thus the waveform cannot be cropped easily. LPI Radar uses continuous wave (CW), wide bandwidth low power signals of the order of few watts making its detection difficult [3]. The correlated LFM signal has few good attribute such as constant envelope, easy formation and fine Doppler tolerance [4-7]. A large pulse compression ratio that provides a wide band and low peak power used in LPI transmission in order to avoid interception by EW intercept receiver [8-10].

A desire sequence is the one with sharp sample-like autocorrelation. In mostly there are two major merits to calculate the resemblance of a sequence with sample: integrated side lobe level (ISL) and peak side lobes ratio (PSLR) [11-15]. To obtain long sequence with peaky autocorrelation is an optimization problem in the field of LPI radar signal design. Earlier research based on ternary sequence for conventional pulse compression radar results into improved performance in terms of achieving high PSL/merit factor (MF) [16-17]. The ternary sequence faces two problems [18]. First problem ternary sequence has low energy efficiency; The Second problem is difficult to have on-off switches at high power in comparison to phase shifting. To overcome these problems, the authors proposed a ternary sequence that can be coded into a binary sequence for transmission purpose [18]. In author [11] proposed a Non-linear frequency modulation (NLFM), better performance in terms of PSLR can be achieved by not masking a nearby target and to increase dynamic range. If an adding an approximate amplitude modulation, as occurs in Hybrid-NLFM (HNLFM), the corresponding PSLR values of HNLFM waveform as shown in Table III. In this paper A New Hybrid-PSK/FH waveform can be chosen for LPI transmission and thus binary encoded Hybrid PSK/FH (BEH PSK/FSK) waveform pulse compression with good discrimination factor (DF) and low PSLR and merit factor. This concept can be applied to the construction of new family of LPI radar signals. The Hybrid PSK/FSK waveform PSLR values are shown in Table IV and corresponding comparison of HNLFM and Hybrid PSK/FSK waveform graph as shown in figure 1.

II. SYSTEM MODEL

A. Binary Phase Shift (PSK) Signal

Increasing the number of elements or phase changes in the sequence allows the design of longer sequences, to result in a pulse compressed radar waveform with low time side lobes and higher range resolution waveform with greater processing gain in the receiver [9].

The Binary phase shift signal with phase code, l= {-1, +1), the code (+1) indicate 0 phase and (-1) indicate π radians. Consider a CW radar waveform of Period T which is a train of 'V' equal length pulses with each pulse width t_b. In order to generate binary phase shift signal (PSK) consider a carrier frequency f_c, the sampling frequency f_s, the W number of code periods to generate, W samples of phases 0, π/2, π, 3π/2, 2π, and 5π/2 are the cycles per subcode. In this process, the sequence S (n) generated a randomly as a {11-1111 -11-11-1-1 11-11-11}. The resultant PSK signal is given by

$$B(t) = \sum_{n=1}^{v} S(n) * fc \quad (1)$$

B. Frequency Hop (FH) Spread Spectrum Signal

FSK radar using frequency hopping (FH) techniques hops or varies the transmitting frequency in time over wide bandwidth in order to prevent an un-wanted receiver from intercepting the waveform. The radar frequency slots are chosen from an FH sequence {f1, f_2 …f_{Nf}} of the available frequencies for transmission at a set of consecutive time intervals {t_1, t_2 … t_V}. This improves the radar processing gain. Each frequency is used random method based on good DF or PSL values of the sequence. Since the frequency sequence appears random to the intercept receiver, the possibility of following the varying in frequency is impossible. This prevents a jammer from reactively jamming the transmitted frequency. To generate FH spread signal, consider M carrier frequencies with W samples within the carrier cycle 2π, where M is integer. For the generation of carrier signal we consider the multiplicative group consisting of five phasors $\{w_5^n; n = 0,1,2,3,4,5; w_5 = \exp(\frac{j2\pi}{4})\}$; 0, π/2, π, 3π/2, 2π and 5π/2. The resultant FH signal is phase as ternary. The expression for frequency hop (FH) spread signal is done on random selection basis corresponding to the binary time-frequency matrix. The FH Spread signal is given by

$$\mathbf{P(t)} = Ae^{j2\pi f j t} \quad (2)$$

The FH waveform has N_f random frequencies within a band B, with each frequency lasting time t_b s in duration. In FH spread signal, frequencies allocated has phase as ternary fj Є (+1, 0,-1) and P (t) of length N_t.

C. Hybrid Phase Coded Frequency Hop Spread Signal (Hybrid-PSK/FH)

In Hybrid-PSK/FH spread spectrum signal design the PSK signal B(t) of phases is multiplied with frequency hop Spread signal P(t) of phases. In this procedure the FH spread signal is modulated with BPSK signal i.e. each carrier frequency for allotment of FH spread signal which is relieved during a specific period of time is combined with BPSK. For this procedure with multiplicative group consisting of five phasors$\{w_5^k; k = 0,1,2,3,4,5; w_5 = \exp(\frac{j2\pi}{4})\}$; 0, π/2, π, 3π/2, 2π, 5π/2 considered for generation of carrier frequencies for FH signal such that the resultant signal phase as ternary. That ternary representation is modulated with BPSK to obtain mixed ternary representation. The ternary representation length is N_t. At receiver cross correlation is the process with a phase mismatched reference waveform to receive the echo wave of the target an alternative of an exactly phase matched reference. This allows radar to generate waveforms that can match targets spectral response in both magnitude and phase. The Combined Hybrid signal (BPSK coded FH spread spectrum signal) is given by

$$Q(t) = B(t)*P(t) \quad (3)$$

The ternary phases Q(t) is further encoded into binary phase sequence by using binary bigrams for the purpose of transmission, viz:+1→+1+1, -1→-1-1, 0→+1-1 or -1+1. The length of the binary bigram sequence Q (b) will be double the length of ternary representation ($2N_t$) when coded into binary bigrams i.e. is N_b. Hence the pulse compression ratio will increase. This gives confuse when electronic warning (EW) receiver attempts to characterize, classify and detect LPI radar transmitted waveform [1-2]. The transmitted Hybrid-PSK/FH signal is given by

$$S(t) = Ae^{j2\pi f jt + \Phi k} \quad (4)$$

Where Φ_k is one of N_b PSK code and f_j is the one of the N_f FH frequencies.

III. DESIGN ALGORITHM OF SYSTEM MODEL

The notation for design algorithm of bi-alphabetic representations of ternary representations obtained from BPSK signal combined with FH spread signal is

$$\mathbf{Q(n) = [Q_0, Q_1, Q_2, \ldots, Q_{r-2}, Q_{r-1}]} \quad (5)$$

N_t is the length of the combined ternary representation is taken as r, where the element Q_j is one of the alphabet [+1, 0, -1].

$$\boldsymbol{\rho(r) = \sum_{i=0}^{m-1-r} Q_i * Q_{i+r}} \quad (6)$$

ρ (r) is called the aperiodic autocorrelation function of the ternary phases representation.

$$\mathbf{D} = \frac{\rho(0)}{\text{Max}|p(k)|k=0} \quad (7)$$

Where D is the DF

$$\text{PSLR} = 20\log(\frac{1}{DF})\ \text{dB} \quad (8)$$

Where PSLR is peak to side lobe ratio

$$\text{ISL} = 10\log(\frac{1}{M})\ \text{dB} \quad (9)$$

$$M = \frac{\rho 2(0)}{\sum_{k=-r+1}^{r-1} \rho 2(k)} \quad (10)$$

Where ISL is integrated side lobe level and M is the merit factor. The matched filter output ρ (k), k = -r+1, -r+2 ….r-2, r-1, is the aperiodic autocorrelation can be represented mathematically as

$$\boldsymbol{\rho(k) = \frac{1}{M} \sum_{i=1}^{M-K} Qi\, Qi + k \quad k=-r+1, r+2, \ldots r-2, r-1} \quad (11)$$

The binary phase represented Hybrid-PSK/FH waveform obtained by binary bigrams method applies to ternary phase representations of Hybrid-PSK/FH spectrum signal which is a good DF and low PSLR. The generation of Hybrid PSK/FSK waveform as shown in figure1. Here DF D=db+dt is taken as objective function, db is values of binary phase sequences and dt is values of ternary phase sequences. When such a binary bigram is transmitted they can be subjected to bi-alphabetic representations at the receiver.

The proposed Hamming Scan (HS), Hamming Back Track (HBT) and Degree Of Freedom (DOF) algorithms are used to design an optimized ternary-binary alphabetic representation of hybrid BPSK/FH signal. In [19] authors proposed Hybrid-Nonlinear Frequency Modulation (HNLFM), the PSLR and DF can reach very low values (e.g., PSLR< -60dB) with increasing length. The proposed Hybrid-PSK/FH waveform would be performing well in increasing length and more noise environment. The PSLR and DF values of Hybrid-Nonlinear frequency modulation (HNLFM) and Hybrid PSK/FSK waveform, as shown in Table I, II, III &IV and also comparisons of Hybrid PSK/FSK spread spectrum signal waveform and HNLF waveform, as shown in Figure 2.

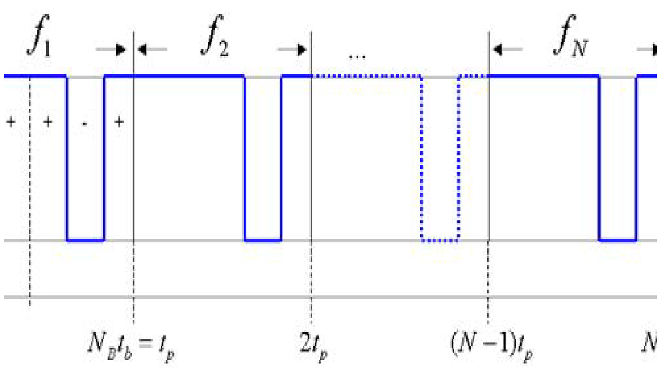

Figure 1. Generation of hybrid phase coded frequency hopping (Hybrid PSK/FSK) signal containing NF frequency sub codes (hops) each with duration tp . Each frequency sub code is subdivided into NB phase slots, each with duration tb.

IV. OPTIMIZATION MODEL

A. Hamming Scan Algorithm

The Hamming scan is an algorithm which is more efficient though it is sub-optimal. The Hamming scan looks at all the Hamming neighbors and picks up the one with largest discrimination factor. If it is better than the original sequence, the algorithm is recursively continued from there as long as improvement is possible. The Hamming scan was expedited and made applicable at larger lengths by not calculating the periodic autocorrelation of the Hamming neighbors abinitio, recognizing the fact that as only one element is mutated, only its difference contribution needed to be taken into account. Each of the elements in the binary phase sequence [+1, -1] can be mutated in two possible ways:+1→-1 or -1→+1 resulting is combined to FH spread signal to obtain optimized ternary representation of binary phase coded frequency hop spread spectrum signal. These are two strands of Hamming neighbors. The better neighbor of these two strands could be selected by recursive local search among the Hamming neighbors of resulting binary phase sequence. The process of Hamming scan is shown in figure 2.The same technique is employed to substitute binary bigrams of ternary representation to obtain good combined discrimination factor. This idea is based on earlier work done for Bi-parental product algorithm for coded waveform design in radar [16] that employed Hamming scan and back-track algorithm for obtaining the ternary sequences with high merit factor. These results are used in the bi-alphabetic pulse compression radar signal design [18]. This idea is employed for the proposed work. The Hamming scan as optimization technique to improve discrimination factor values and further improve implementing a back tracking algorithm for bi-alphabetic representations. The discriminator factor values of Binary encoded Hybrid PSK/FSK spread signal using Hamming scan algorithm values are shown in Table I at different length of compression ratio. The DF value (db+dt) at ternary phase length 720 and binary phase length 1440 is 23.64 and PSLR value as low as -63.25dB, further improvement of DF and decrease of PSLR values applied Hamming Back track and degree of freedom algorithm. The results are tabulated in Table I and II.

B. Hamming Back track Algorithm

When bi-alphabetic Hamming scan contains no representation with discrimination factor superior to starting representation, the Hamming back-track still looks at the prescribed number n (called span) of the best Hamming neighbor [18]. The algorithm then obtains the best sequence obtainable from them by a prescribed number (called the height) of recursive Hamming scan and selects it, if it is superior to the starting sequence. The ternary representation obtained from Binary phase coded frequency hop Spread Spectrum signals are two strands of Hamming neighbor corresponding to two alphabet value obtained by mutation and n of best neighbor are picked up on each strand. A span of n=6 is used in this proposed work. If the Hamming back-track succeeds improving discrimination factor, the search can resume by further application of bi-alphabetic Hamming scan. Each time the binary bigram representation corresponding to the improved optimization of combined ternary representation is obtainable from binary phase coded frequency hop spread spectrum signal. The improvement in discrimination factor values of ternary phases and binary phases of Hybrid PSK/FSK signal in HBT algorithm. These is due to the algorithm obtains the best sequences obtainable from them by a prescribed number (called height) of recursive hamming scan and selects it. The values are listed in Table I. The DF values are good improvement in a Hamming back-track Algorithm compare to Hamming scan Algorithm. By applying a back- track algorithm for bi-alphabetic representation has further improve in the discrimination factor by using degree of freedom algorithm for the ternary representation is explained in section 5.3 and its values are shown in Table II.

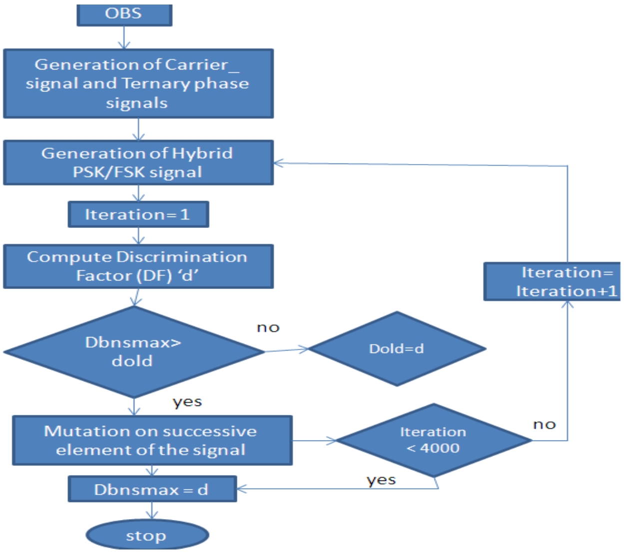

Figure 2. Flow chart of optimization Hamming scan and Hamming back track Algorithm

Table I. Comparison of Sum of DF values of bi-alphabetic phasesmodulted with FHSS using HS and HBT algorithm.

Discrimination Factor DF Values						
S. No	Length of Binary Sequence S	Length of Ternary phases Hybrid PSK/FSK	HS(d_b+d_t)	PSLR in dB(HS)	HBT(db+dt)	PSLR in dB(HBT)
1.	30	180	20.05	-59.96	20.119	-60.03
2.	40	240	19.40	-59.30	20.40	-60.31
3.	50	300	21.00	-60.89	21.56	-61.41
4.	60	360	21.53	-61.38	21.90	-61.72
5.	70	420	21.51	-61.37	21.86	-61.69
6.	80	480	22.11	-61.92	22.844	-62.57
7.	90	540	22.36	-62.14	23.02	-62.72
8.	100	600	22.87	-62.59	23.49	-63.13
9.	110	660	22.78	-62.51	23.71	-63.31
10	120	720	23.64	-63.25	24.03	-63.58

C. Degree of freedom (DOF) Algorithm

The recursive local search among hamming neighbors of a binary phase sequence is combined with FH spread signal to obtain optimized ternary representation. To build substituted binary bigram representation S_b of length 2N$_t$ from ternary representation of binary phase coded frequency hop spread spectrum signal. During this correspondence the ternary representation '0' can be coded in two different ways: +1 -1 or -1 +1. Thus the binary bigram sequence can be taken from 2^{mz} alternatives, where mz is the number of zero representation in the ternary representation of binary phases coded frequency hop spread spectrum signal. This extra degree of liberty can be explored to take a binary bigram representation among 2^{mz} alternatives which has the more discrimination factor. This problem can itself be organized as a selective hamming scan which permits bigram mutation to -1 +1→+1 -1 in the binary bigram representation only where these bigrams have an origin due to 0 element in the mixed ternary representation of binary phase coded frequency hop spread signal. In case of HBT algorithm the discrimination factor values at length 120 of binary encoded Hybrid PSK/FSK signal is 24.03 and PSLR value is -63.58dB, for the same length after applying DOF algorithm the discrimination factor value is 42.57 and corresponding PSLR value is -75.02dB. In HNLFM waveform at length 128 by millet, sub optimum and optimum method they got -30, -65 and -75dB. The different cases of values of HNLFM waveform and binary encoded Hybrid PSK/FSK waveform as shown in Table III and IV and these two waveform comparisons are shown in figure 3. Compare to HNLFM waveform binary encoded Hybrid PSK/FSK waveform got less PSLR values. This will help to low side lobe ratio to LPI radar waveform so that the low power signal of detection process has become easy and also help to improve resolution of LPI radar.

Table II. Sum of DF and PSLR values of bi-alphabetic phases modulted with FHSS using HBT with DOF algorithm.

Discrimination Factor DF Values						
Length of binary phase sequence	**Length of LPI transmitted Hybrid PSK/FSK**	**Length of sub pulses of Ternary phases (N_t)**	**DF values of Ternary phases modulated FHSS (dt)**	**DF Values of Binary bigrams modulated FHSS (db)**	**Sum of DF values D=dt+db**	**PSLR in dB**
30	360	180	11.6059	10.20	21.8	-61.7
40	480	240	13.20	10.0120	23.2	-62.9
50	600	300	14.075	10.02	24.0	-63.6
60	720	360	18.508	13.2412	31.5	-69.0
70	840	420	18.512	13.363	31.8	-69.1
80	960	480	20.818	13.8727	34.08	-70.5
90	1080	540	19.846	14.6403	34.48	-70.8
100	1200	600	20.689	15.7143	36.39	-71.8
110	1320	660	22.602	18.3462	40.94	-74.2
120	1440	720	23.04	19.6596	42.577	-75.0

Table III.The pulse compression ratio effect on the peak-to-side lobes ratio (PSLR), HNLFM (optimum and sub-optimum) and Millet signals.

S.No.	Length of the compression ratio	HNLFM optimum PSLR (dB)	HNLFM sub-optimum PSLR (dB)	Millett waveform PSLR (dB)
1.	32	-30	-30	-25
2.	64	-50	-50	-28
3.	128	-75	-65	-30
4.	256	-80	-63	-32
5.	512	-82	-62	-33
6.	1024	-85	-60	-34

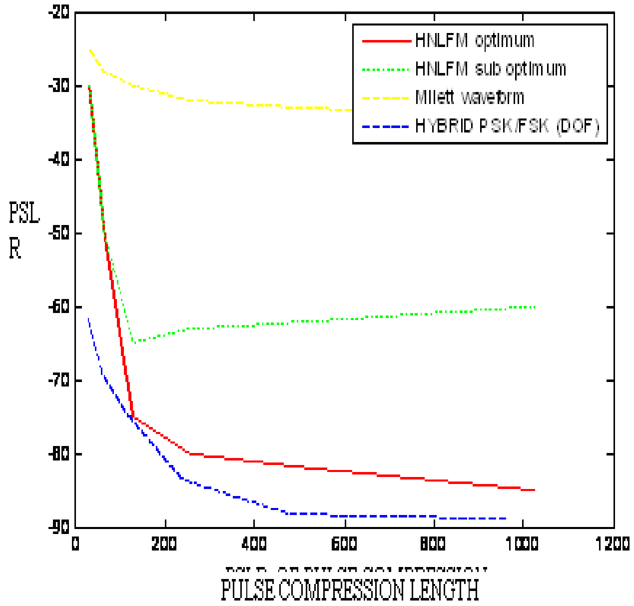

Figure 3. Consequence of the compression ratio on the peak-to-side lobes ratio (PSLR), HNLFM (optimum and sub-optimum) , Millet signals and Hybrid PSK/FSK(optimum).

Table IV. Effect of the compression ratio on the peak-to-side lobes ratio (PSLR), Hybrid PSK/FSK waveform (DOF Algorithm) Signal.

S.No.	Length of Binary sequence S	Length of LPI transmitted Hybrid PSK/FSK	Length of Ternary decoded Hybrid PSK/FSK	Discrimination Factor DF	PSLR(dB)
1	30	360	180	21.8	-61.64
2	60	720	360	31.59	-69.059
3	120	1440	720	42.57	-75.02
4	240	2880	1440	65.5	-83.64
5	480	5760	2880	82.56	-88.27
6	960	11520	5760	85.22	-88.9

V. SYSTEM TRANSMITTER AND RECEIVER

To set up notation and to set up the designs for bi-alphabetic explanation of the ternary representations, let $S_t = \{s_1, s_2, s_3, s_4 \ldots, s_{N-1}, s_{Nt}\}$ Be sequence representations of length N_t, here the components of S_t are selected from alphabet {+1, 0, -1}. The ternary representation sequence can be coded into binary representation sequence of length $2N_t$ with the alphabet from {+1, -1} using the encode rule as shown in Table V. At receiver, the binary phase sequence is decoded into ternary phase sequence using conversion rule shown in Table VI. The corresponding transmitter and receiver block diagram is shown in figure 4.

In HybridPSK/FSK waveform has as low PSLR values for increasing compression ratio. Because, we applied HS and selective HBT algorithm to PSK and FH spread signal to generated good ternary phased waveform. Further these ternary phases are converted to binary phases with the help of binary bigram method and its length become double. This intra pulse modulated code with doubling of length and has achieved low PSLR and good DF values are selected based on DOF algorithm. The optimized ternary-binary alphabetic representations are good DF in an additive white Gaussian noise (AWGN) environment, SNR and high resolution with Doppler environment of LPI Radar. The ternary-binary alphabetic sequence attains good DF values at increasing length, various SNR and noise standard deviation (N_{sd}). The DF values in various SNR and Noise standard deviation (Nsd) is shown in Figure 5 & 6. Due to AWGN channel PSK coded FH spread spectrum waveform converted to ternary phase coded FH spread spectrum waveform. In poly-gram reading, this also gives as binary ternary phase representation. These two sequences are notation ally received and transmitted. They have been decoded separately at the receiver to find through coincidence detection.

Table V. Ternary phases to binary conversion at Transmitter

Ternary	1	-1	0	0
Binary	2	-2	0	0

Table VI. Binary phases to Ternary conversion at Reciver

Binary	+1 +1	-1 -1	+1 -1	-1 +1
Tenary	+1	-1	0	0

In case of multiple targets or noise when two or more echo pulses are received within the sub-pulse range, the resultant decoded phase representation sequence may become a ternary phase representations with alphabets form {+1, 0, -1}. The given sequence has a ternary representation phases S_t is received it can be subjected to bi-alphabetic Hybrid PSK/FSK LPI waveform with the conversion rule shown in Table VI.

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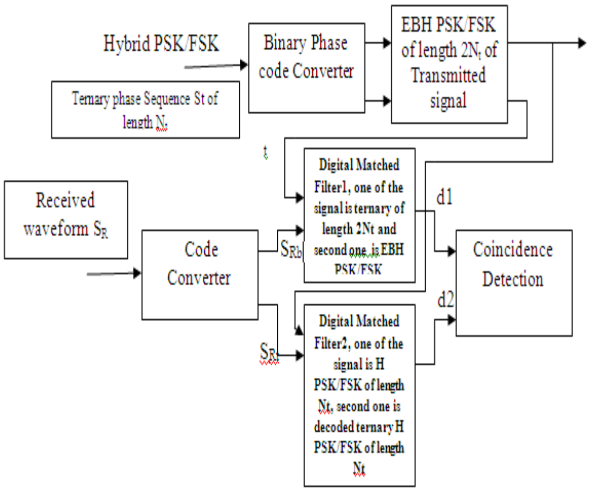


Figure 4. Block diagram of Transmitter and receiver

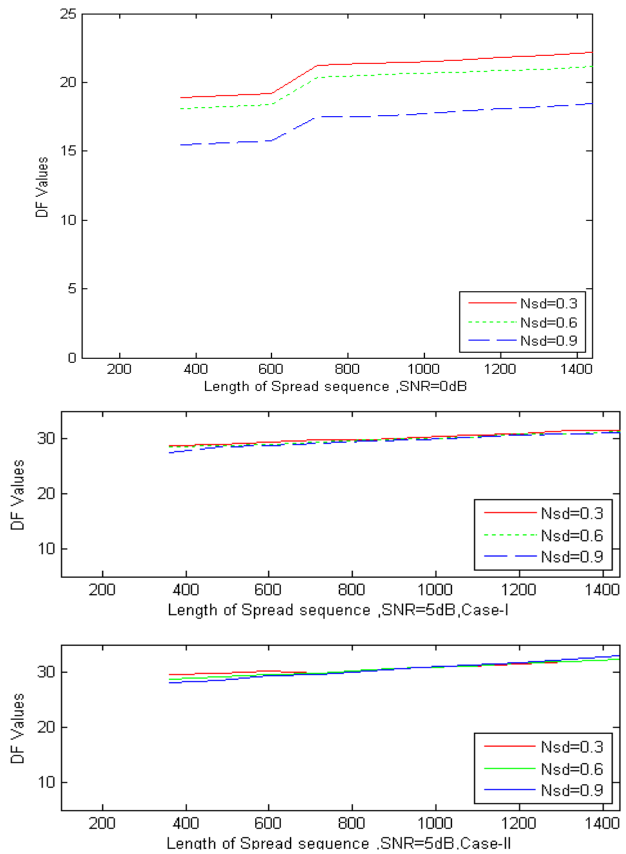
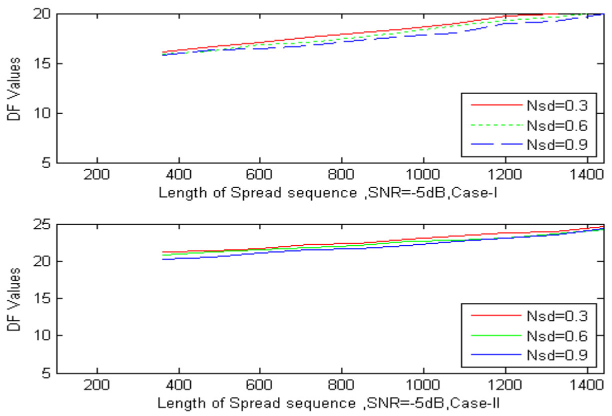


Figure 5. Performance of Hybrid PSK/FSK waveforms SNR at 0 and 5dB and Noise standard deviation Nsd at 0.3, 0.6 and 0.9



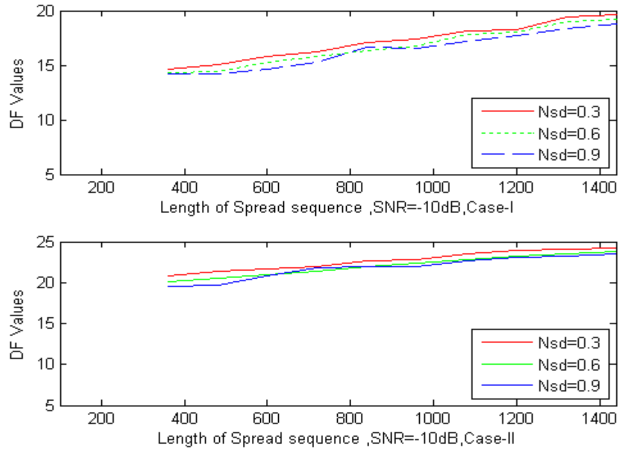


Figure 6. Performance of Hybrid PSK/FSK waveforms SNR at -5 and -10dB and Noise standard deviation Nsd at 0.3, 0.6 and 0.9

A. Coincidence detection of bi-alphabetic Hybrid PSK/FSK signal for LPI Radar

At the rceiver to detect the target from the coincidence peaks of cross correlation of binary phases i.e. HBT and DOF algorithm applied, binary phase modulated Hybrid FSK/PSK signal and decoded ternary phases modulated Hybrid FSK/PSK signal. The joint coincidence of cross correlations peaks simultaneously in different channels indicates the presence of target. It is also interesting to observe that the surronding side lobes will not align or synchronize in three channels. This eliminates the possibility of false target detection due to time side lobes. This is shown in figure 7 The results shows that the ternary phase sequence (intra pulse modulated phase sequence) obtained from BPSK signal is modulated with FHSS signal yield improvement in the DF values than the directly binary phases sequence modulated FHSS signal. This has happend because zero elements in the ternary phases, it contributes logged to zero elements products in the auto correlation function. Because of its less contribution, we need to balance together. The corresponding of zero elements possessed technical difficulty of off/on transmission at huge power. If cross correlation is analysed after decoding the received waveform into discrete phase representations, so that the ternary phase representations can be encoded into binary phases by using of bigram and DOF algorithm method at transmitter. So that the intra pulse modulated code will increases in length, that will make attempt to charcaterize the received wavefrom decoded into two significances: one a binary phases modulate FHSS signal, second a ternary phase modulated FHSS signal. The peaky auto correlation should then apply to both of them or as a compromise, it has to be done combinedly good without giving any significance being best individually. This proposed wavefrom design problem and has given two methods in this way.

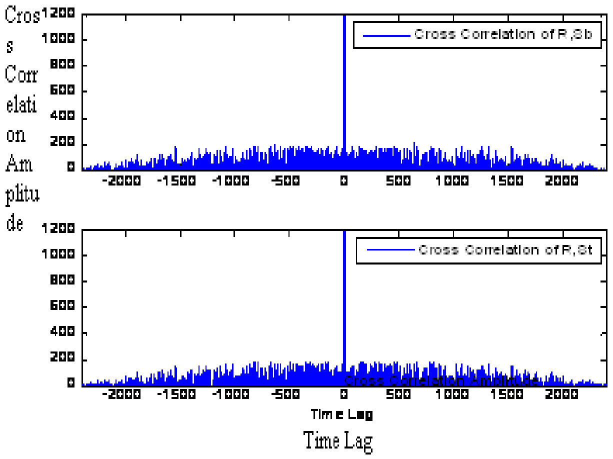


Figure 7. Coincidence detection of a target of bi-alphabetic phase modulated FHS signal.

VI. CONCLUSION

There are two things done: one is waveform design for LPI at the transmitter end and second case is waveform detection of the LPI at the receiver. At the transmitted end we generated ternary phase Hybrid-PSK/FH waveform with good PSLR values at length 960 is -88.9dB but the authors [19] HNLFM waveforms the PSLR values at length 1024 is -85dB. This will help to low side lobe ratio to LPI radar waveform so that the low power signal of detection process has become easy and also help to improve resolution of LPI radar. There are two advantages here: one is we are transmitting binary phase sequence with double length so that its energy efficiency is good, second one is widening the length so that suppressing the power this is basic requirement of LPI. At the receiver we receiving binary phase coded waveform and we are processing the binary phase coded waveform as we received and we are also extracting ternary phase coded waveform with good PSLR from binary phase coded waveform. The transmitted waveform design is growing significant criteria in the design of advanced radars. The applicability of reliable and meticulous waveform will be generate in real-time, large spontaneous range digital auto and cross correlations makes it possible to use as radar waveforms, a large waveforms with number of DOF of the order of tens of hundreds and more, giving pulse compression ratio with a large bandwidth-time, processing gain of the similar order of magnitude.

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