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Ternary Pulse Compression Sequences Generation By Chaotic Tent Map Approach

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Abstract

In this paper, it is feasible to achieve superior performance in detection range and range resolution using the proposed Tent mapping based ternary codes. The performance parameter of tent mapping ternary code which is the discrimination factor has been estimated with and without windowing function.

Keywords: range, resolution, discrimination factor, tent map, windowing functions.

1. Introduction

The choice of a radar signal directly affects the performance of a range .ideally; a radar signal should be designed to yield high resolution, low probability of intercept and interference, optimum use of frequency spectrum, high power, low design cost and simplicity of generation. The performance of range resolution radar depends on the autocorrelation pattern of the coded waveform which is nothing but the matched filter output. Pulse compression which is a standard signal processing technique used to minimize the peak transmission power, maximize SNR, and to get better resolution can be achieved using matched filter. In this paper, the range and resolution of the radar signal is been improved by the windowing technique. The tent mapping approach is considered for the generation of good sequences in ternary code. In this work, good ternary phase codes are generated using Tent–map equation to achieve a low PSL.

II. The Tent-Map

The tent mapping is as follows

Xn+1=f(xn) ……………1.1

Tent chaotic mapping

Xn+1 = A - (B (xn)) A>1 .....1.2

The chaotic regime:

Xn belongs to [A (1-B), A] 0<B<2 ……1.3

III.Generation of code

The Tent map based ternary phase code (TMTC) devices directly from the Tent equation. A raw sequence x (n) is first obtained by setting r=4 in equation of the tent mapping, ensuring the tent map in chaotic region., thus by changing initial values and bifurcation factors we can generate a new different sequence for the analysis.

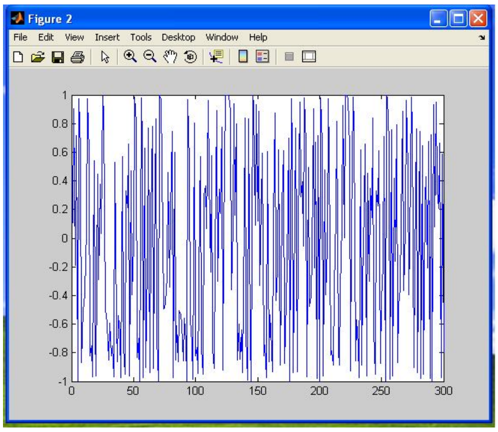

Fig 1.1(a) xo = 0.1 Variation of raw sequence

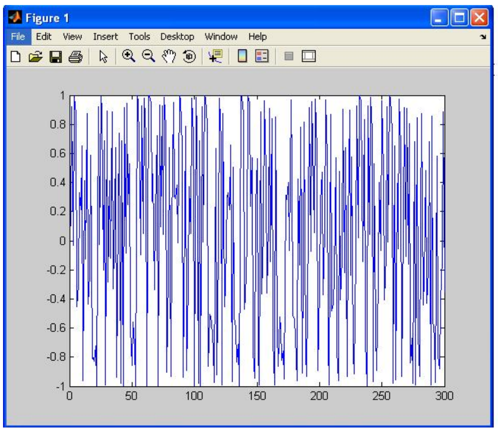

Fig 1.1 (b) x_0 = 0.1 1 Variation of raw sequence

The sequence is then quantized into three levels as per equation below.

$Y(n) = -1$ if $x(n) < 0.3$ ………………..1.4

0 if $0.3 < x(n) < 0.7$ …………..1.5

1 if $x(n) > 0.7$ …………...1.6

The Tent map equation is extremely sensitive to the initial condition, by varying the initial condition xo; a totally uncorrelated ternary code sequence can be obtained.

A sequence could be termed as good if it has biggest discrimination factor (D), from the codes y (n) of length n obtained,

$$D = \frac{R(0)}{MAX|R(K)|} \quad \text{Where } k \neq 0$$ ……….1.7

$R(k) = \sum yi * yi+k$ k= 0, 1, 2, 3….N-1 ……1.8

For all lengths

The performance parameter of tent mapping is the discriminator factor and it is estimated with and without windowing functions and the results are tabulated.

Results for the ternary codes without window function and its response to a matched filter.

Si.No	Length	Discrimination value
1	20	9.012
2	50	10.02
3	100	12.43
4	500	14.34
5	1000	16.09
6	1500	18.21
7	2000	20.54
8	2500	21.23
9	3000	22.34
10	3500	23.02

Results for the ternary codes with window function and its response to a matched filter.

Si.No	Length	Dr value	Dn value	Dm value	Dt value
1	500	16.039	17.120	16.121	17.079
2	1000	18.214	18.251	17.251	18.781
3	1500	20.062	20.624	19.121	20.272
4	2000	22.123	21.012	20.121	21.213
5	2500	22.421	21.123	21.019	22.561
6	3000	23.192	22.412	22.323	24.132
7	3500	24.324	23.513	22.412	25.614
8	4000	24.891	23.924	23.212	26.516

IV Result and conclusion

At different lengths, good sequences were obtained and it was found that the discrimination factor is increasing with the length of the sequence and it's found that the triangular widow showed better performance than the other window functions. Better sequences are found using the ternary codes.

At higher lengths, the rectangular and hanning window performed same performance when compared with the triangular window function.

At lower lengths, the hanning window function performed better when compared with the other window functions

V Graphical Results

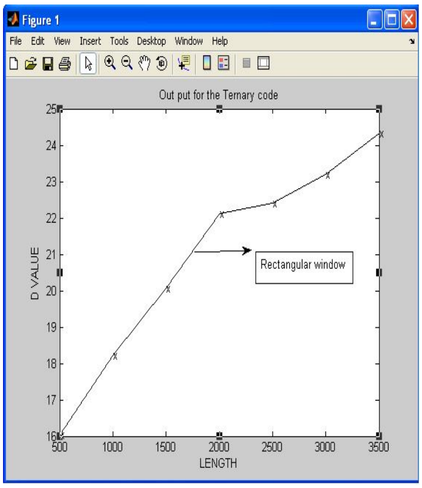

Fig 1.2 discrimination curve for rectangular

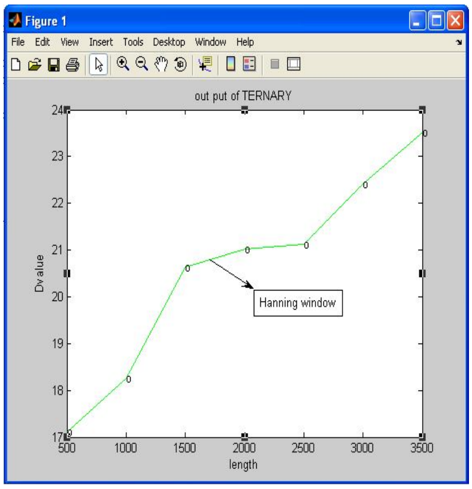

Fig 1.3 discrimination curve for hanning

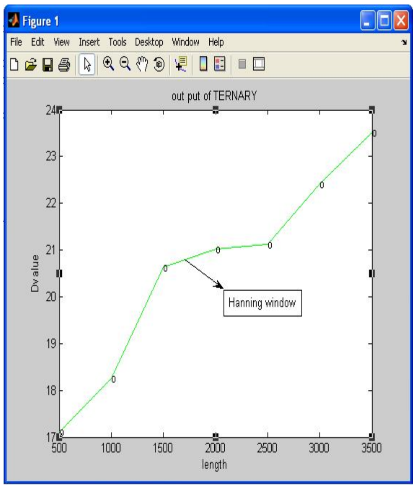

Fig 1.4 discrimination curve for hamming

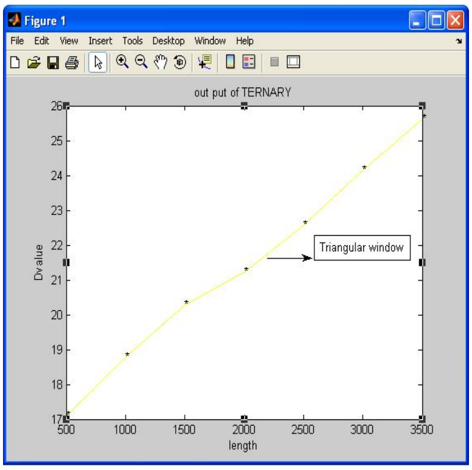

Fig 1.5 discrimination curve for triangular

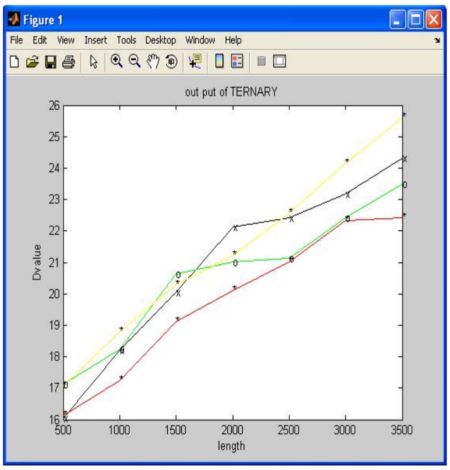

Fig 1.6 output of ternary code

VI. References

[1] International Journal of Bifurcation and Chaos," vol. 9, No.1, pp. 155-213, 1999

[2] Radar signal design using chaotic signals vol.18, pp 424- 521, 2007

[3] A. Bauer. "Utilisation of chaotic signals for radar and sonar purposes". Norsig 96 pp. 33-36

[4] "A Chaotic Direct-Sequence Spread-Spectrum" IEEE Transactions on Communications. vol. 45(2/3/5), pp. 1156-1159, 1996.MAKOTO,

[5] *Proc. IEEE Power Electron. Spec'*s. Lin and D. Y. Chen, "Reduction of power supply EMI emission by switching frequency modulation," in *Conf.*, 1993, pp. 127–133.

[6] D. Middleton, *An Introduction to Statistical Communication Theory*. New York: McGraw-Hill, 1988.

[7] "Chaotic pulse code for radar pulse compression "IEEE Radar Conference, 2001, LEIZHAO andJEFFREY, PP 279-283.

[8] "Radar signal processing" LEWIS, B.L, BAUEL, INC, 1996, PP325-329.

[9] "Base band model for distance and bearing estimation", A.bauel, proc.IEEE, ISCAS-3, MONTERY, California, pp. 275-278, 1998.

[10] "Ternary Pulse Compression Sequence", INST, MOHORIR, P.S.RAJA RAJESWARI and VENKATA RAO.K, PP.146-149, 1998.

[11] "A Chaotic Sequence Spread-Spectrum" IEEE Transactions on Communications. vol. 25(2/3/9), pp. 1126-1129, 1996.MAKOTO ITOH,

[12] "Ternary Pulse Compression Sequence by logistic map" ", IEEE, MOHORIR, PP.2512-2515, 1998

[13] "Direct Sequence –Radar Communication System" vol.19, pp 529- 531, 2008

[14] "International Journal on Chaotic Signals ", vol.12, no.23, pp.236-239, 1997