Research of the Discrete Frequency-Modulated Signals Properties

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Abstract - **The given results of design of compound signals are with the discrete change of frequency. It is analyzed influence of some parameter of p on cross-correlation and frequency properties of RF pulse signals with the different amount of frequency steps. The ambiguity function are got for the different parameters of discrete FM signals.**

Keywords - **compound signals, discrete FM signals; RF pulse signal with the different amount of frequency steps.**

I. INTRODUCTION

Discrete wideband radar signals can be formed not only by inwardly-impulsive phase manipulation but also by means of change of frequency through certain time domains T_e.

One of classes of such signals there are discrete signals, in which a difference of carrier frequencies on two nearby intervals is permanent by a size, even Δw.

II. RESEARCH OF DFM SIGNALS

The temporal model of such signals can be presented in a next kind

$$s(t)=\sum_{n=0}^{N-1} S(t-nT_e)\cos[(w_0+n\Delta w)(t-nT_e)], \quad (1)$$

where ***n*** – sequence number of RF pulse elementary (changes from ***0*** to ***N-1***); ***N*** – an amount of RF pulse elementary in a signal; $S(t-nT_e)$ – function which describes the law of waveform envelope change of ***n***-th RF pulse elementary; nT_e – delay time of ***n***-th RF pulse elementary in relation to the first; w_0 – radian frequency of first RF pulse elementary; $n\Delta w = n2p\Delta f$ – increase of frequency of ***n***-th RF pulse elementary (in relation to frequency of the first pulse).

For research the class of signals is chosen with the determined values of parameters, which meet a condition:

$$T_e\Delta f = p, \quad . \quad (2)$$

where ***p*** – any number.

In literary sources such signals name impulsive sequences with a frequency shift or signals with step frequency modulation.

Basic properties of composite waveform signals determine ambiguity function the basis of researches of their functions.

Putting these values in the formula of function of ambiguity function,

$$c(t,w_d)=\left|\int_{-\infty}^{\infty}\sum_{n=0}^{N-1} S_n(t-nT_e)\sum_{n=0}^{N-1} S_n^{*}(t-nT_e-t)e^{jw_d t}dt\right| \quad (3)$$

will define the ambiguity function of the probed signal. Choosing the parameters of signal,

$$S(t-nT_e)=\begin{cases}1, & nT_e \le t \le (n+1)T_e \\ 0, & \text{for other values } t\end{cases} \qquad n=0,1,2,\ldots,(N-1) \quad (4)$$

$w_0T_e = 2pp$, where p – any integer;

and conducting a row enough difficult transformations, will use expression of ambiguity function of this signal for the construction of figure.

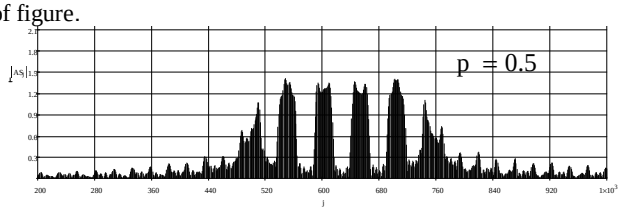

Fig.1. Image of spectrum of signal at p=0,5

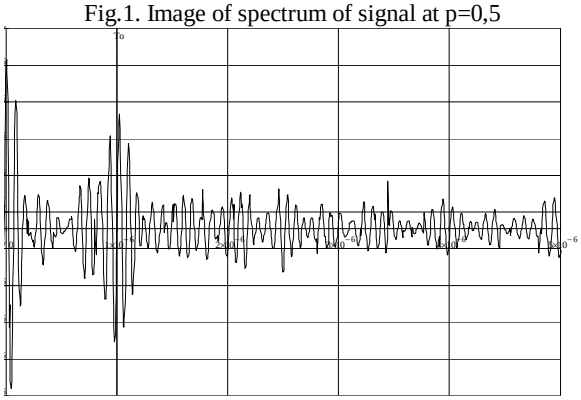

Fig.2. Image of cross-correlation function of signal at p=0,5

III. CONCLUSION

The ambiguity function of signal with step modulation of frequency substantially depends on work of size of frequency step ***Δf*** on duration of step T_e. This product $p = \Delta f T_e$ it is one of important parameters of signal which determines properties of his ambiguity function.

It should be noted that a possible compromise is between the size of peaks of ambiguousness and structure of spectrum of signal at different values ***p***. At the use of such signals in the systems with clutter elimination it can influence on the high-quality indexes of work of the system.

REFERENCES

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