ISSN 0735-2727, Radioelectronics and Communications Systems, 2020, Vol. 63, No. 8, pp. 398–404. © Allerton Press, Inc., 2020.
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Identification of Energy-Hidden Chirp Signals of Telecommunication Systems in Conditions of Parametric Uncertainty

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Received January 24, 2020
Revised July 3, 2020
Accepted July 14, 2020

Abstract—The ambiguity diagram of rectangular chirp RF pulse has been analyzed. The characteristic point of ambiguity diagram was identified. It was proposed to identify the signal on the basis of correlation level at the characteristic point of ellipsoidal ambiguity diagram built in a special coordinate system. The quasi-optimal autocorrelation algorithm with quadrature processing is proposed. This algorithm is resistant to a priori uncertainty of parameters of input energy-hidden signals with unknown waveform and unknown initial phase against the background of Gaussian stationary noise. The tuning parameters of identification scheme and the decision-making rule regarding the availability of chirp signal in the input mixture were determined. The simulation modeling of identification procedure was conducted using the software package Matlab R2016a. The simulation results confirmed the ability of the proposed algorithm to identify the chirp signal in the input mixture at small values of the signal-to-noise ratio.

DOI: 10.3103/S0735272720080026

1. INTRODUCTION

In recent times, there is a tendency to the rise of the number of telecommunication systems (TCS) that use signals with spread spectrum of radiations: code PSK (phase-shift keyed) signals and chirp signals. At the expense of this feature, the noise immunity of TCS is increased and the hidden mode of operation of these signals is provided that is important for military systems.

Hence, there is a need to develop the radio monitoring (RM) systems. The use of broadband signals in TCS significantly reduces the power spectral density of radiofrequency (RF) radiation and their energy availability. To detect such radiofrequency radiations and classify the applied signals, measure their parameters, and perform further processing in the situation without any a priori information about TCS liable to monitoring is a complex scientific and technological task.

2. PROBLEM STATEMENT

One of the most important scientific and technological tasks in radio monitoring of TCS using chirp signals [1], [2] is the identification of chirp modulation.

The problem of detecting an energy-hidden chirp signal and determining its parameters on the basis of a discrete model of autocorrelation receiver with quadrature processing was solved in [3], [4]. Therefore, it is expedient to identify the chirp modulation in these signals using the results obtained in these papers.

There are few publications in research literature dealing with the issue of identifying the chirp modulation in TCS signals under conditions of a priori uncertainty regarding the waveform and parameters of signal and energy hiding [1], [2]. The research studies focused on solving this issue are topical.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

ADDITIONAL INFORMATION

The initial version of this paper in Russian is published in the journal "Izvestiya Vysshikh Uchebnykh Zavedenii. Radioelektronika," ISSN 2307-6011 (Online), ISSN 0021-3470 (Print) on the link http://radio.kpi.ua/article/view/S0021347020080026 with DOI: 10.20535/S0021347020080026.

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