Successive Interference Cancellation Methods in Tree Algorithms of Random Multiple Access

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Abstract - **In this paper are given the main idea of using Successive interference cancellation method in tree algorithms of random multiple access. Nowadays this method is one of the most promising methods of multistation access.**

Keywords – **Successive interference cancellation, tree algorithms, random multiple access, multistation access.**

I. INTRODUCTION

Among the various methods of multiple (multistation) access in wireless communications the greatest popularity acquire techniques of random multiple access (RMA). These algorithms are ALOHA, the Binary Exponential Backoff (BEB) [2], spanning tree algorithm. The most important characteristic of these methods is the time spent to resolve the conflict. The most promising is successive interference cancellation method simply called SIC.

II. FUNCTIONING OF TREE ALGORITHMS

For successful operation while using methods RMA as BEB and tree algorithms in wireless communication tight synchronization between subscribers stations (SS) and base station (BS) is required.

In traditional tree algorithms in the presence of a conflict situation at a BS side a conflict situation is identified. After a conflict is detected, BS gives the permission to one of the speakers to transmit its packet in the next slot. The other conflicting packages (or package) is passed in the third slot Figure(1).

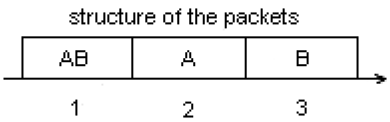

Fig.1 Structure of the packet A and B when there are conflicts in the first slot.

A feature of the algorithm SIC applying to the situation in Figure(1), is that the third slot should not be passed at all. This package can be obtained (calculated) of the signals in a conflicting packages, by subtracting A+B of the sum signal is related to a package A, adopted in the second slot. Structural differences of signals in adjacent slots take place due to the influence of randomness of the medium parameters and multipath propagation. Misalignment of the received signal $y(t)$ from a given structure can occur, for example, by distortion, the presence of additive or multiplicative noise in the communication line. Thus, in conditions of multipath propagation in the line of radio pulse shape information spreads, the amplitude and phase are distorted. Model of the distorted signal can generally be written as an integro-power Volterra polynomial of the first kind.

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$$y(t)=\sum_{m=1}^{N}\int_0^t\dots\int_0^t K_m(S_1,S_2,\dots,S_m)\prod_{i=1}^{m}x(t-S_i)dS_i,\quad t\in[0,T], \tag{1}$$

Where K_m - the kernel of Volterra, in the stationary case are symmetric with respect to all variables. Block diagram that implements the procedure eq(1) is shown in Figure 2.

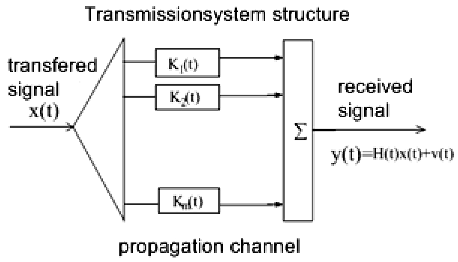

Fig.2 Modeling results

Fig. 2 - Equivalent structure of signal $x(t)$ transmission system through a multipath channel.

Multipath signal components are represented as:

$$y_i(t)=\int_0^t K_i(t,S_i)x(S_i)dS_i,\quad i=1,2,\dots,N, \tag{2}$$

For the correction of acquired in the communication channel distortion is necessary to perform the procedure inverse to transformation eq(2).

$$\Delta y(t)=y(t)-y_{\hat{Y}}(t) \tag{3}$$

We can solve the problem of managing the corresponding coefficients in order to minimize the difference eq(3). There is a problem of control observation [1] based on the discrepancy. For solving of this problem Kalman filtering method are used.

III. CONCLUSION

1)As a mathematical model of propagation channel are used model based on Volterra polynomial of the first kind.

2)A problem of amplitude and phase equalization are solved using Kalman Bucy optimal procedure.

REFERENCES

[1] Поповский, В.В. Математические основы управления и адаптации в телекоммуникационных системах.[Текст]/ Поповский В.В., Олейник В.Ф. // Х. СМИТ, 2011-362с.

[2]Yu, Y. High-throughput random access using successive interference cancellation in a tree algorithm [Текст]/ Yu. Y.,Giannakis G.B. // IEEE Transactions Inform. Theory.2007.V.53, № 12, p. 4628-4639.