ISSN 0735-2727, Radioelectronics and Communications Systems, 2013, Vol. 56, No. 4, pp. 201–206. © Allerton Press, Inc., 2013.
Original Russian Text © V.K. Marigodov, E.F. Baburov, 2013, published in Izv. Vyssh. Uchebn. Zaved., Radioelektron., 2013, Vol. 56, No. 4, pp. 56–61.

Game-Theory Estimation of the Throughput of Multi-Channel Communication System with Optimal Predistortion and Filtering

V. K. Marigodov and E. F. Baburov

Sevastopol National Technical University (SevNTU), Sevastopol, Ukraine

Received in final form March 22, 2013

Abstract—It is determined the throughput of multi-channel communication systems, where at each channel optimal linear predistortion and signals filtering are applied. It is compared the efficiency of such systems in case of different correlation degree in transmitted signal.

DOI: 10.3103/S0735272713040055

INTRODUCTION

For increase of efficiency and noise-immunity of multi-channel communication systems with information repetition at each of parallel channel, where optimal signals linear predistortion and filtering [1–3] are applied. Throughput of single-channel system with mentioned methods of processing of transmitted and received signals is researched in papers [4, 5]. It is of interest to estimate the efficiency of multi-channel communication systems with optimal linear predistortion and correction (OLPC) and optimal linear filtering (OLF) using game-theory methods, taking into account statistical relations in signals, transmitting via parallel channels of the system.

Game-theory approach allows to obtain optimal (minimax) strategies of gamers (operators of communication system and noise system), and also gain function or the value of the game.

The purpose of the paper is to define the relative efficiency of OLPC and OLF in multi-channel communication system in case of uncertainty and conflict between gamers.

THROUGHPUT OF THE SYSTEM WITH OLPC

In Fig. 1 it is shown structural chart of communication system with parallel OLPC. Here SS is the signal source, PF_i are optimal linear predistortion filters, CCh_i are communication channels, CF_i are optimal linear correction filters, SA_i are analyzers of instantaneous spectrum of the signal and additive noise, CC_i control channels, $N_i(\omega)$ are spectral power densities of interference in communication systems.

Useful signal from the output of the source are parallelizable and it is applied to predistortion channel filters inputs. Optimally predistorted signals are applied to communication channels inputs, and additive noise appears at their outputs. A mixture of the signal and the noise appears at each channel and information input of correcting filter, and also at the input of the analyzer of instantaneous spectrum of the signal and the noise. Last can operate in a mode where it is defined the communication channel state or the noise behavior [6, 7]. At the analyzer output control signal of adaptive tuning for correcting and predistortion filters is shaped through the control channel, which is a feedback channel. Receiver resolving circuit allows to select the channel with the greatest noise-immunity, using one of known criteria [3].

Information rate in a communication system with parallel channels and OLPC is defined as

$$R = \frac{1}{2\pi}\int_{\omega} \ln\left[1 + \frac{G(\omega)\left|K_{1i}(\mathrm{j}\omega)\right|^2}{N_i(\omega)}\right] \mathrm{d}\omega,$$