ISSN 0735-2727, Radioelectronics and Communications Systems, 2008, Vol. 51, No. 10, pp. 524–530. © Allerton Press, Inc., 2008.
Original Russian Text © A.V. Shishkin, 2008, published in Izv. Vyssh. Uchebn. Zaved., Radioelektron., 2008, Vol. 51, No. 10, pp. 10–21.

Adaptive Algorithms Application in Sound Steganographic Systems with Signal Spectrum Broadening

A. V. Shishkin
Odessa National Maritime Academy, Odessa, Ukraine
Received in final form February 15, 2008

Abstract—In this paper sound steganographic system receiver structure with signal spectrum broadening is proposed and researched. This receiver consists of rehabilitate filter with adaptive coefficients and correlation receiver. Steganographic system algorithms with blind coder and decoder procedure are researched. It is shown that the rehabilitate filter with adaptive coefficients application provides essential increase in probability of correct binary detection of off-stage information or allows adding 30 times more bits of built-in data.

DOI: 10.3103/S0735272708100026

Today as steganography is considered as inconspicuous information transmission by means of built-in signal carrier of different physical structure (sound, image, and video). At that built-in signal does not interfere on information. Inconspicuous transmission is provided by insignificant interfering of signal-carrier that is lower than natural noise level and human visual sense of object-carrier level.

Digital steganography methods are researched in monographs [1–3] and many other papers, such as [4–7].

Information transmission steganographic systems (ITSS) are characterized by following parameters: velocity (data rate) of built-in data for inconspicuous transmission, level of a signal – carrier insertion interference, built-in data stability to influences on the signal-carrier by transmission channel. These stated parameters, i.e. velocity, interference and stability, are interrelated and for ITSS of different destinations their values have to be chosen taking into account their interconsistency. For example, ITSS with great inconspicuous information transmission velocity (about 1 bit per sample) is unstable to external influences. Inconspicuous information in such system can be easily damaged by external influences. On the other hand, if system has low value of average velocity values (less than 0.1 bit per sample), it is possible to obtain very stable to external influences built-in information. Such stable or robust systems are used in digital watermark (DW) systems. DW is prominent method in copyright technology.

DW systems have some advantages compared to cryptographic protection methods. Broken once crypto key does not protect the following data. As DW is information product mark, it can not be extracted without obvious DW carriers damage and so it can be used for all period of information carrier product existence.

The main approach to digital steganography and DW theory and methods development is ITSS consideration as classic communication system that provides application of theoretical approaches, which are developed for such communication systems research.

One method of build-in information resistance to different attacks improving is method of DW spectrum broadening. As well as in CDMA systems, pseudorandom sequence (PRS) with a sample length N is used in ITSS with spectrum broadening for one data bit transmission. PRS clock frequency value is selected to provide modulated PRS spectrum fitting into sound signal transmission spectrum. Inconspicuous signal in form of modulated PRS is added to sound signal-carrier as a noise with very low level intensity which can not be heard by human. DW signal detection and decoding are provided by means of correlation processing in the receiver. Correlator or matched filter output signal to noise ratio is calculated considering chosen length N of widening sequence.

ITSS signal to noise ratio is less than traditional communication system one. In ITSS it is considered that noise is carrier signal itself, which is useful signal in general transmission channels, and otherwise DW signal, built-in signal distortion i.e. in steganography systems is considered as useful one. In the papers [4] and [7] digital information about carrier is used to reduce an influence of signal-carriers on DW signal shaping (in case of informed coder). However, in many cases ITSS does not have any information about