Time-And-Space Filtration By Polarization Of Free Electromagnetic Waves

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Abstract- The paper proposes to use the linear angle polarization for implementing time-and-space filtration. The signals in the form of waves with horizontal polarization are independent from signals, which consist of waves with vertical polarization. The two signals are orthogonal in relation to the real space where the wave propagation takes place. The polarity changes in time under the influence of pseudo-random sequence. Thus the specter is widened and the protection against interferences and non-allowed access is provided.

Key words- polarized wave, noise-like sequences, widened spectrum, switching-able polarization.

The polarization of electromagnetic waves propagating in free space has been used for a long time to divide signals or to filtrate them from interferences caused by other sources. These interferences are often signals from other radio stations. They occupy the same frequency band or a part of it. The division of signals according to frequency or time has been done in order to use one and the same line (medium). The division by linear polarization has been applied in the radio relay lines. The frequency bands are with horizontal or vertical polarization.

The paper proposes to use the linear polarization for time-and-space filtration. The signal in the form of a wave with horizontal polarization is undependable from the signal emitted through a wave with vertical polarization. The two signals are orthogonal in relation to the real space where the waves propagation takes place. Throughout the time polarization is changed under the impact of the pseudorandom sequence. Thus the spectrum is widened and the protection against interferences and unapproved access is provided.

The structural diagram of a radio communication system using the electromagnetic waves polarization for a time-and-space filtration is shown in Fig. 1. The modulation of an appropriate type takes place in the radio transmitter.

The modulated oscillations obtained have been switched in relation to the polarization. In that case switching from horizontal to vertical polarization and vice versa is provided. As a result, the radio waves of relevant polarization have been emitted into the space. The commutation is controlled by a generator of a pseudo-random sequence NLS (Noise-like Signal). The choice of the code sequence is made as it is made with the systems of FH (Frequency Hopping). Its length is of substantial significance. The rapid action of the generator is subjected to transient processes with switching of the modulated high-frequency oscillations. That is determined by the time of transition of displacing register from one condition to another and by the time of signal propagation in the feedback circuit. The time of switching related to the polarization is also in connection with the

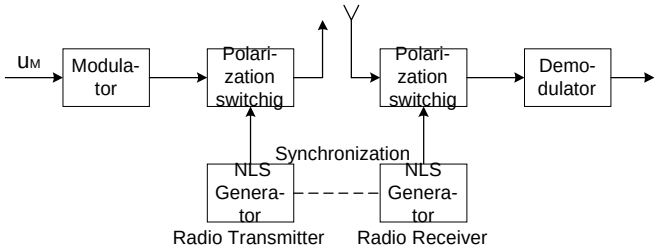

Fig.1

transient process. Both problems are solvable with the means of modern equipment within the microwave band.

The transmitting and receiving aerial are with markedly directed action. That limits the usage of the filtration proposed from the condition of preserving polarization with radio waves propagation. The examination on the process in a more general aspect will probably impose the generalization about a multiple access on the base of polarization and coding, i.e. as a variety of CDMA (Code Division Multiple Access). On its side, it gives a base to consider the radio communication system shown in Fig. 1 as a Spread-Spectrum-System with spreading by polarization switching (PS).

The opposite process takes place in the radio receiving set. First, the spectrum shrinks, then demodulation is carried out. To shrink the spectrum, it is necessary to have available NLS generator for a sequence that is the same as the one used in the radio transmitter. The synchronization of the two sequences is a necessary condition. Various concrete solutions of the problem are possible.

The usage of the linear polarization provides rapid division of the signals, which are emitted into the space in the form of radio waves and correspond to the random code sequence symbols. That is valid for a normal medium of wave propagation. For a complicated situation, it is necessary to develop a precise problem solution supported by a theoretical analysis and experimental confirmation.

The proposed time-and-space filtration is characterized with the following more important peculiarities:

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1. It widens the possibilities of using the frequency resource whose saving is extremely necessary due to the intensive increase of users.

2. The spectrum expansion is a prerequisite to protect it against interferences and some disadvantages with multi-ray radio wave propagation.

3. The usage of random sequences does not admit non-approved access.

4. The effect of filtration depends to a great extent on the conditions of radio wave propagation, as far as they could change the plane of polarization.

The proposed method of time-and-space filtration with switching to linear polarization by a random code sequence can find application in creating radio communication systems with widened spectrum.

REFERENCES:

[1] Hristov, H.D., E.S. Altimirski. Radio Engineering Electrodynamics and Electromagnetic Waves Propagation, Tehnika, Sofia, 1990 (in Bulgarian).

[2] Wideband CDMA Special Issue.IEEE Communications Magazine, vol.36, No 9, September, 1998.

[3] Blake R. Electronic Communication SystemsDelmar-Thomson Learning,2002.