ANALYSIS OF THE CAPACITY CHANNELS RADIO ENGINEERING SYSTEMS USING THE POWER DISTRIBUTION ALGORITHM

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At present, the main feature telecommunication systems in the modern world is the continuous growth of the number of subscribers, as well as their needs and requests. In this difficult competitive environment, such a parameter of a radio communication system as its channel capacity comes to the fore [1, 2].

From this side, the technology multi-antenna transmission has a huge number of advantages in radio engineering systems. For example, with the help of several antennas at the input, it is possible to transmit independent signals from each of them to several subscribers [3, 4].

One of the most important advantages MIMO in radio transmission systems is the effective combating of such systems with fast fading caused by the multipath effect [1].

The multipath effect is an unpleasant situation when the receiver antenna can receive not only the useful signal, but also a number of its copies reflected from different surfaces. The signals at the reception are added up and, since they have traveled different distances, each such copy has its own delay time, as well as a different phase. In the worst case, rapid fading occurs in the communication system.

The appearance such fading occurs unexpectedly, in this case the signal is greatly weakened in a very short time, on average to a depth 30 - 40 dB, and assessing the quality of communication at such moments is impossible.

This article is devoted to the analysis of the capacity of channels of radio engineering systems using the algorithm power distribution between antennas during multi-antenna transmission information.

The capacity of a radio communication system, according to C. Shannon, is the maximum possible number of bits that can be transmitted per unit of time in a single frequency band without errors. It is also called channel capacity, frequency efficiency.

For a SISO (Single Input Single Output) system, the throughput will be determined by the Shannon-Hartley theorem as follows [1, 4]:

$$C_{SISO} = (F_2 - F_1) \cdot \ell og_2[1 + (P_S / \sigma_0^2)] \ , \tag{1}$$

where $\Delta F -$ the bandwidth of the communication channel and is equal to $\Delta F = F_2 - F_1$; $P_S -$ is the signal power and $\sigma_0^2 -$ is the spectral power of noise in radio engineering systems.

As can be seen, all variables in formula (1) are limited resources, in these circumstances the scientists came up with the idea using multi-antenna technologies, with the help of which high throughput of channels of radio engineering systems is achieved.

The formula for the throughput of a multi-antenna system -MIMO will look different. It should be noted that in real conditions, the CSI (Channel State Information) between different users always differs, as does the noise level in each of the subchannels [3].

Assuming that in a communication system the receiver does not process the channel matrix and has no connection with the transmitter, the formula looks like this [1]:

$$C_{MIMO} = \sum_{i=1}^{K} \ell og_2[1 + (\lambda_i \cdot P_0 / N\sigma_0^2)], \tag{2}$$

where N – number of transmitting antennas; λ_i – eigenvalues of the channel matrix **H**; K – rank of the channel matrix **H**, where the number limits the number of transmitting antennas.

As can be seen from (2), the maximum value of the channel capacity in a radio engineering system is achieved by distributing power using the water filling method [1, 4].

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