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METHODS OF OBSTACLES COMPENSATION RESEARCH IN ANTENNA ARRAY BASED ON HILBERT TRANSFORM

Nowadays the functioning of radio systems of information transfer is carried out in a complex electromagnetic environment. A forward trend in the obstacle compensation realization for the above indicated conditions is to use of their spatial selection with the help of adaptive arrays (AA) that forma zero in the obstacles directed antenna pattern. It is necessary to use the radio direction finder assessing the obstacles directions together with AA in the protected information transfer system. The basic requirement for modern radio direction finding facilities is to ensure their high interference immunity and accuracy. Therefore, the development and improvement of the correlative spectral and spatial methods of direction finding, the investigation of their accuracy and interference immunity are urgent tasks.

The upgrading of the correlative spectral and spatial bearing assessment method using the Hilbert's transformation is executed.

To implement spatial selection the Z-channel parallel spatial and selective reception by means of digital synthesis of the discrete system (DS) is applied:

$$U_z(j\Omega_p)=\sum_{z=0}^{Z-1}\mathrm{Re}\left[U_z(j\omega_{S.k_l})\right]\cdot\exp(-j\Omega_p\cdot z)\cdot W(z)\,, \qquad (1)$$

where $\Omega_p=2\pi\cdot p/d\cdot Z$ – the value of the spatial frequency that determines the p -lobe direction of multilobed DS; d – the distance between AA elements; $\omega_{S.k_l}$ – the frequency of k_l spectral component in the operating frequency band of l signal frequency, $k_l=0,..N_S-1$; N_S – the number of readings of the accepted compound implementation; $W(z)$ – the weighting function of "window".

Then the spectral components subarray $\{U_z(j\Omega_p)\}_{p=p1,p2}$, which contains a component with an extrem frequency Ω_p^* is distinguished. This extrem frequency Ω_p^* component is divided into valid $U(\Omega_p,z)$ and imaginary $\widehat{U}(\Omega_p,z)$ components of an analytical signal $S_A(j\Omega_p,z)$ using the Hilbert's transformation:

$$S_A(j\Omega_p,z)=U(\Omega_p,z)+j\widehat{U}(\Omega_p,z)\,. \qquad (2)$$

The difference of arguments $\Delta\psi_B(\Omega_p,z)$ and modules $S_A(\Omega_p,z)$ of analytical signal complex counting is calculated. It corresponds to the spatial arrangement of the two selected antenna elements with numbers z_1 and z_2 within the linear AA. As a result of this upgrading the algorithm that uses numbers z_1 and z_2 so that $(z_2-z_1)\cdot d>\lambda_{S.k_l}/2$, where $\lambda_{S.k_l}$ - the spectral component wavelength with a frequency $\omega_{S.k_l}$, was found. The total difference of arguments $\Delta\psi_{П}(\Omega_p,z)$ of complex analytical signals $S_A(j\Omega_p,z)$ that exceeds π radian and is equal to the amount of the whole $\Delta\psi_{Ц}(\Omega_p,z)$ and the residual $\Delta\psi_{З}(\Omega_p,z)$ parts is estimated that raises the bearing accuracy.

The modeling of the advanced bearing method using MathCad11b is executed. The accuracy scoring is 20 %. The research of dependence of bearing accuracy on a signal-to-noise ratio, the angular direction of signal pass and the window type of spectrum analysis is also conducted.