Adaptive antenna array efficiency in the presence of mutual coupling*

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At present, the question of the effect of the antenna system on the quality of spatial interference suppression has not been sufficiently investigated. Also, the question of the geometry and mutual arrangement of the elements at the adaptive antenna array has not been analyzed. Moreover, the level of interference suppression depends on the identity of radiation patterns of the antenna elements. The nonidentity of the phase and amplitude characteristics of the antenna elements has an effect on the suppression coefficient in the adaptive antenna array. The nonidentity of the characteristics is based on the mutual coupling of the elements at the array. Depending on the environment of the antenna elements by various objects (in the case under consideration, these are adjacent elements in the array), the shape of radiation pattern will be changed compare with case without adjacent elements. For each subsequent element in the array with respect to the previous element the condition of electrodynamic environment is not the same. That is the nonidentity of radiation patterns is significant factor for the same angles θ, φ.

Evaluation of an interference suppression performance will produce with antenna array mathematical model. This model allows taking into account amplitude and phase patterns of array elements obtained by using of electrodynamic modeling. To describe the interference suppression efficiency in adaptive antenna array, we will use the suppression coefficient. Define the suppression coefficient as the ratio of the signal power received by one antenna to the output signal power in the adaptive mode. In Fig. 1 (a) shows the dependence of the suppression coefficient on the interference direction of arrival, and we assume that elements are isotropic. Angles limits variation θ = [-90°; 90°], φ = [0°; 180°] in steps of 5°. The suppression coefficient, taking into account the radiation patterns of elements, is shown in Fig. 1(b). From Fig. 1 (b) it can be seen that at angles θ more than 60° (less than -60°) there is a significant reduction in the suppression coefficient caused by the mutual coupling of the elements.

With the mathematical model of the antenna array shown that the non identity of the amplitude and phase diagrams of the elements significantly influence the suppression coefficient. Using the example of isotropic antenna array, the influence of the geometry on the suppression coefficient is shown. Thus, to effective interference suppression in adaptive antenna arrays, it is necessary to use elements that in the antenna array will have the smallest possible spread of amplitude and phase diagrams.

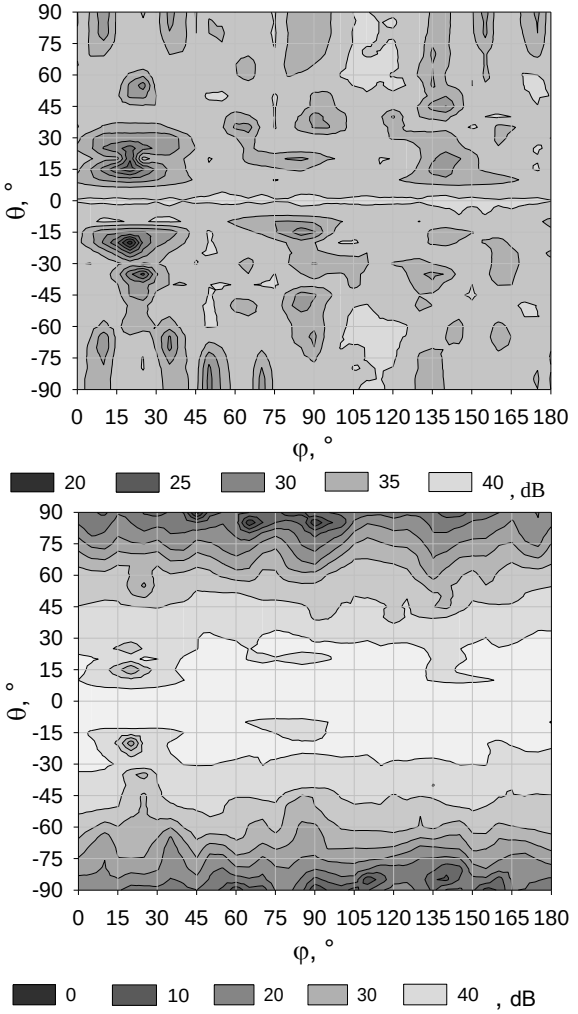

Fig. 1 Suppression coefficient. (a) Isotropic elements. (b) Microstrip elements.

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