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THE IMPACT OF THE SUPPORTING STRUCTURE ON THE ANTENNA ARRAY PARAMETERS

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The paper describes results of study of the effect of the surface impedance parameters of an antenna frame (a circular metal cylinder with radio-absorbing coating) on the parameters of an antenna array made as a set of longitudinal electric dipoles: radiation pattern, level of side and rear lobes, and input impedance.

The radar characteristics of various military objects can be changed with the aid of radio-absorbing materials and coatings applied to the supporting structures of the objects, particularly those used for fitting antenna systems [1]. From the viewpoint of electrodynamics, application of radio-absorbing coatings modifies distribution of surface currents due to control of surface waves' amplitudes in slowing-down structures formed on the body surface. However, such field distribution on the object surface not only modifies the object scattering characteristics but also changes the radiation and matching parameters of the antenna nearby. Low fabrication cost of the slowing-down structures (magnetodielectric coatings, corrugated structures, controlled impedance coatings etc.) [2–7] and the lack of a need to create sophisticated amplitude-phase distribution in the radiating aperture promote application of such structures as multifunctional control systems [2–4].

One of the obstacles to wide application of such multifunctional control systems is complexity of realization of the slowing-down structure parameters, which have to be determined from simulation of the electromagnetic field of the antenna located near the body. This process can be facilitated substantially if for description of the slowing-down structure we use a generalized parameter — the surface impedance tensor [5–7]. The latter is known to characterize the interrelation, at the body's outer surface, between tangential components of the electromagnetic field of the wave falling at an arbitrary angle. Moreover, when dealing with boundary problems, with boundary conditions of various orders introduced on the outer surface of the coating [3–9], this tensor permits us to simulate slowing-down structures, including multilayer ones, with accuracy sufficient for practical applications. In addition, the surface impedance concept can be used for the field description not only in the remote but also in the near zone [4].

The purpose of this paper is to investigate the effect of the surface impedance parameters of a circular cylinder on characteristics of radiation and matching of a nearby antenna array composed of longitudinal electric vibrators.

Selection of this structure as an object of inquiry has a sound motivation: a circular cylinder with nonzero impedance often serves as a good approximation at modeling the geometry of actual objects, and thin longitudinal electric dipoles make it possible to describe behavior of many types of wire antennas. The relation between slowing-down system parameters and the respective surface impedance value is described in a large number of papers, for instance, in [5, 7, 9], and is beyond the scope of this work. In the investigations described below, a scientific method is used, which has been suggested in earlier works of the author [10–13]: application of spectral representation of the Green function and isolation of the domain, where this function is singular. We first analyze the impact of the surface impedance parameters on the

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