

RECENT ADVANCES IN EMP SIMULATIONS

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The present-day problem of an effective use of high-powerful EMP simulators for experimental estimations of radioelectronics stability is a correct choice of the testing pulses parameters. This choice must provide the highest authenticity of simulation to operation conditions. It is realized for the complete adequacy level. In this paper the possibilities of realization of the complete adequacy have been studied for an aircraft object modeled by a finite perfectly conducting cylinder.

For the correct choice of the parameters of testing pulses it is necessary to take into consideration a number of peculiarities of the fast transition EMP (FT EMP) interaction with the object both during the operation and tests in the simulators. To these peculiarities one can refer the resonant character of FT EMP interaction with an object, the superposition of the natural frequencies, defining the diffusion inside the object through the screen walls, is negligibly small and the principal penetration occurs through the irregularities in the walls of screen-casing. Therefore, we shall consider further only the latter interaction mechanism. Let us also suppose that the dimensions of irregularities are small in comparison with the dimensions of an object. In this case when some assumptions are met, it is sufficient to determine the distribution of current induced on the homogeneous screen and then to determine fields inside the screen that are mainly stipulated by the action of irregularities. For example, the resonant scattering of outer noise-carrying field on the object occurs during the interaction of nanosecond fields with the screen-casings of aircraft having the characteristic dimensions. As a result, the spectral density of a current induced on the envelope and defining the field levels of the high-frequency components inside the screen-casing has an explicit resonant character.

The spectrum of natural frequencies of electrodynamic system "test object - FSS" can be represented in the first approximation as a superposition of frequencies spectrums of the object located in the free space and of the FSS of simulator. The conditions when the complete adequacy could be realized have been defined using the analysis of the spectrum s of induced currents in cases of both operation conditions and simulation.

To solve this problem the advanced electrodynamic apparatus has been used. The problem is reduced for calculations of the currents induced on cylinder. It includes formulation of the problem using tensor Green functions, Pocklington integral equation for induced currents and its asymptotic solution on the basis of the method of sequential approximations.

The recommendations for further modifications of high-powerful EMP simulators have been formulated on the basis of obtained result. In addition, let us note, that the way for choice of the testing pulses parameters proposed in this paper at all is not limited by thin cylinder model. It has a common methodological importance.