Paper ID: 44450
oral

IAF MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Space Environmental Effects and Spacecraft Protection (6)

Author: Mr. Oleg Dotsenko
Yuzhnoye State Design Office, Ukraine

OPTIMIZATION OF SATELLITE PROTECTION FROM THE SPACE RADIATION EFFECTS

Abstract

Space radiation hardness assurance of satellites remains to be a complex scientific and technical problem that covers a wide range of issues related both to the understanding of the space environments and to the mechanisms of their impacts on satellites. The application of new technologies, combined with the use of commercial elements and materials often make ineffective the traditional practices for space environment hardness assurance of satellites. The careful radiation designing, within which one of the key places consists in optimizing shielding fields surrounding satellite critical elements is the essential part of modern satellite development. In the most general form, the problem of optimizing the space radiation shielding of a satellite is formulated as follows: "How the shielding field should be transformed in order to ensure meeting the requirements on ioninising dose, non-ioninising dose, single events and internal charging hardness within the given limitations?" The standard calculating models and experimental techniques currently used for the space radiation hardness assurance of satellites are of little use for solving the problem in this formulation. The sector analysis methodology widely used in the practice of radiation designing is applicable only for aluminum shieldings and does not allow taking into account the protective properties of real materials. The known programs GEANT4, FLUKA, HZETRN and others, simulating the transport of space radiations through a substance using the Monte Carlo technique, are suitable to solve the task, but the time required for calculations using these tools makes their application in satellite designing extremely problematic. The purpose of the presented studies consists in creation of a tool to solve the problems of space radiation hardness assurance in standard practice of satellite designing. The sector analysis methodology was used as a basis for the developing tool allowing optimization the shielding against the effects of the entire complex of space radiations within the framework of a single calculation model. The expected intensity of single events is estimated taking into account the real configuration of the shielding field surrounding the given element and for an arbitrary geometry of the sensitive volumes, where these events are occurred. The results of the works are implemented in the practice of radiation design of satellites in "Yuzhnoye".