Radiation Characteristics and SEU Rates in NEqO Environment Using SPENVIS

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Abstract

RazakSatl was launched at Near Equatorial Orbit (NEqO) where Trapped Protons / Electrons (TP/TE) and Galactic Cosmic Rays (GCR) has intensive effect on satellite's memory like SRAM based FPGA. Due to this devastating effect, it is important to investigate the radiation environment of the orbit to predict the SEU rate for 6T SRAM, which is the building block of SRAM based FPGA. This study investigates the radiation environment in NEqO specifically for the orbit of RazakSat satellite. Solar Event Particles (SEPs), Trapped Protons / Electrons (TP/TE) and Galactic Cosmic Rays (GCR) are the three main sources of radiation which are taken to consideration in this study. The fluxes spectra of these three types are simulated and SEU rates for 180nm 6T SRAM are predicted using SPENVIS models for NEqO orbit. The results show that GCR fluxes are the most dominant at NEqO which reached to 105 MeV whereas TE has 4MeV and TP has the second dominant fluxes with 400 MeV. However, if the magnetic shielding atmosphere is on, there are no solar particles fluxes and almost no SEU was detected. Results also illustrate that SEU rates at NEqO is 0.5 upset / bit day when there is no shielding to the device (6T SRAM) but this rates reduced by 1.6 x 10(6) times when the device shielded by 0.5 g/cm(2) of Aluminium. Comparisons of NEqO with polar orbit in terms of shielding effect and SEU rates are also presented in this study.

Keywords

Author Keywords: Radiation Environment; Galactic Cosmic Rays (GCR); Solar Event Particles (SEP); Trapped Proton (TP); Trapped Electron (TE); Single Event Upset (SEU); SRAM; Near Equatorial Orbit (NEqO)

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