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Proceedings - 6th International Conference on Computer and Communication Engineering: Innovative Technologies to Serve Humanity, ICCCE 2016
29 December 2016, Article number 7808359, Pages 454-458
6th International Conference on Computer and Communication Engineering, ICCCE 2016; International Islamic University MalaysiaKuala Lumpur; Malaysia; 25 July 2016 through 27 July 2016; Category numberE5811; Code 125901

Radiation Characteristics and SEU Rates in NEqO Environment Using SPENVIS (Conference Paper)

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Abstract

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RazakSat1 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 106 times when the device shielded by 0.5 g/cm2 of Aluminium. Comparisons of NEqO with polar orbit in terms of shielding effect and SEU rates are also presented in this study. © 2016 IEEE.

SciVal Topic Prominence

Topic: High electron mobility transistors | Gallium nitride | Electron traps

Prominence percentile: 85.137

Author keywords

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

Indexed keywords

Engineering controlled terms: Cosmic rays | Cosmology | Field programmable gate arrays (FPGA) | Orbits | Radiation hardening | Shielding | Static random access storage

Engineering uncontrolled terms: Equatorial orbits | Galactic cosmic rays | Radiation environments | Single event upsets | Solar events | Trapped electrons | Trapped Proton (TP)

Engineering main heading: Computer control systems

ISBN: 978-150902427-8
Source Type: Conference Proceeding
Original language: English
DOI: 10.1109/ICCCE.2016.101
Document Type: Conference Paper
Sponsors:
Publisher: Institute of Electrical and Electronics Engineers Inc.

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