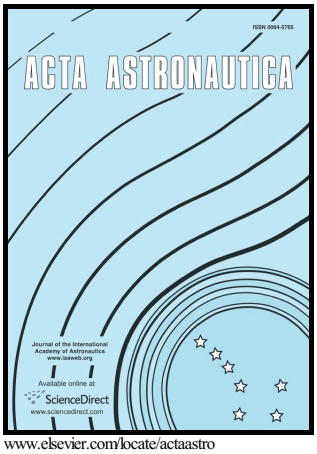

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Academy Transaction Note
Characterization of FRAM microcontrollers to radiations

Federica Lacirignola[a], Claudio Sansoè[a]

[a]*DET Department of Electronics And Telecommunications, Politecnico di Torino*
Corso Duca Degli Abruzzi 24, 10129 Turin, Italy

Abstract

This work is focused on the development of a payload tile for the AraMIS structure called 1B521 Radiation characterization Payload to test new FRAM microcontrollers. These components are very appealing for space applications because of low power consumption compared with standard FLASH based ones.

Keywords: AraMIS, FRAM, Aerospace, Payload, radiations test

1. Introduction

The space radiation environment can have serious effects on spacecraft electronics. Transiting cosmic rays of galactic and solar origin and their interaction with the Earth's magnetic field limit system endurance and reliability. Transient effects from individual high-energy protons or heavy ions can in fact disrupt system operation irreversibly causing system faults that can be very dangerous [1].
To test radiation effects on COTS Ferroelectric Random Access Memory (**FRAM**) microcontrollers we developed a payload tile for the AraMiS-C1 structure (modular architecture for small satellites, developed by Politecnico di Torino)[2]. The satellite that includes this payload will be launched in a **LEO** (Low Earth Orbit) approximately between 600-800 km distance from the Earth. Spacecraft systems operating in this area must be hardened to withstand the radiation environment, and the electronics must be designed with several layers of redundancy. The damages produced by radiations are the cumulative effects of the dose received that can cause functional failures, and the effects of a single particle hit that mainly causes single event upset and single event latch-up. Finding single event sensitivity of the microcontroller is the main goal of the mission. FRAM cells store the information as a Lead Zirconate Titanate (PZT) film polarization (Fig.1) and a charged particle hit has a very small possibility to cause a change in the polarization. The ferroelectric dielectric (Fig.2) leads to a different behaviour of the cell compared with a DRAM one, producing many advantages especially for what concerns the overall power consumption in read/write cycles and the non-volatility properties of

Email addresses: federica.lacirignola@polito.it (Federica Lacirignola), claudio.sansoe@polito.it (Claudio Sansoè)