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Ionizing Radiation Effects in Electronic Devices

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The ionizing radiation absorbed by semiconductor devices can change their properties by modifying the electrical parameters that characterize them and, in the case of memories, processors, can modify the information contained in these devices. In this way, the development of electronic devices resistant to radiation and the qualification of devices confirming that they are more tolerant to the effects of ionizing radiation, require a qualified workforce with the specific knowledge of the physical mechanisms acting on the devices when exposed to the radiation. It is also necessary to know all internationally existing standards for the qualification of devices. Digital systems are often used in space applications to process data, implement control logic, or even store data from sensors. These systems are composed of electronic devices, such as transistors, microcontrollers and microprocessors, which are exposed to ionizing radiation. The use of Field-Programmable Gate Arrays (FGPAs) in aerospace & defense field has become a general consensus among Integrated Circuits (ICs) and embedded system designers. Radiation-hardened electronics used in this domain is regulated under important political and commercial treaties. In order to refrain from these undesired political and commercial barriers COTS FPGAs have been considered as a promising alternative to replace ICs. The development of instrumentation that makes it possible to design new electronic devices, based on new materials and new technologies, as well as knowing how to properly characterize a device, is extremely important for this research area to be self-sufficient in our country. This research project aims to study the effects of ionizing radiation from X-rays, alpha source, protons and heavy ions on electronic devices. The specific objective of the project is to operationalize a system for radiation testing and a methodology for the qualification of electronic devices and components when subjected to radiation doses induced by heavy ions, particles and X-rays. We intend to study the physical phenomena responsible for the effects of radiation and generate training in this strategic area.

Author: GUAZZELLI, Marcilei Aparecida (Centro Universitário FEI)

Presenter: GUAZZELLI, Marcilei Aparecida (Centro Universitário FEI)

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