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## SERESSA 2020—16th International School on the Effects of Radiation on Embedded Systems for Space Applications

### Abstract

The 16th International School on the Effects of Radiation on Embedded Systems for Space Applications, SERESSA 2020, celebrating 15 years of the Seasonal School, was organized as a full virtual event from Porto Alegre, Brazil. This edition had 27 invited speakers and 15 posters. It had 175 participants from 32 countries. This year SERESSA has the technical support of CASS and CEDA.

### I. Introduction

SERESSA combines academic, government, and industrial communities working in the area of radiation effects on embedded systems. Radiation effects are a significant concern for space and avionics systems, as well as for critical applications operating at ground level such as automotive, high energy facilities, medical or even banking. The school is based on lectures and exercises involving real case studies using the common tools of the domain. The intended audience includes both beginning and experienced researchers, engineers, and post-graduate students wishing to enhance their knowledge base in this rapidly evolving field. Topics covered by SERESSA include: radiation environment, spacecraft anomalies, single-event effects (SEE), total dose effects (TID), radiation effects in power systems, radiation effects in solar cells, architecture hardening in analog, and digital circuits and in memories, software hardening, effects in FPGAs, hardness assurance, rate prediction, radiation testing, laser testing and remote testing experiments.

First SERESSA was organized in 2005, from November 20 to 25, in the middle of the Amazon Jungle, Manaus, Brazil. The location was the Ariau Hotel, a hotel in the level of top of trees (Fig. 1). The location was perfect to improve the networking between participants as everybody was together during the event, even during the nice and interesting set of social events. Then, it moved around the world, being organized in Seville (Spain), Buenos Aires (Argentina), Palm Beach (USA), Takasaki (Japan), São José dos Campos (Brazil), Toulouse (France), Ansan (South Korea), Moscow (Russia), Bariloche (Argentina), Puebla (Mexico), Montrea (Canada), Munich (Germany), Nordwick (The Netherlands) and Seville (Spain).



Figure 1. Ariau Towers, location of the first edition of SERESSA in 2005.

### II. SERESSA 2020

In 2020, it was the celebration of 15 years of SERESSA, and it was organized as full Virtual Edition, from Porto Alegre, Brazil. Fig 2 shows the main flyer of the event. This edition had 27 invited speakers and 15 posters. The 175 participants were from 32 countries. This year SERESSA has the technical support of CASS and CEDA.

The organizers of the 2020 edition were:

General Chairs: Ricardo Reis, UFRGS, Brazil and Raoul Velazco, TIMA, France

Program Chairs: Fernanda Kastensmidt, UFRGS, Brazil and Pedro Martín-Holgado, CNA, Spain

Local Chairs: Raphael Brum, UFRGS, Brazil and Tiago Balen, UFRGS, Brazil

Finance Chairs: Jose Rodrigo Azambuja, UFRGS, Brazil and Paulo Butzen, UFRGS, Brazil

Industry Liaisons: Joao Baptista, UFSM, Brazil and Marcelo Lubaszewski, UFRGS, Brazil



Figure 2. Flyer of SERESSA 2020.

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Poster Chairs: Cristina Meinhardt, UFSC, Brazil and Alexandra Zimpeck, UCPel, Brazil

Web Chair: Gabriel Souza Ribeiro, IFSul, Brazil.

The Program started with an Opening Session including a brief history of SERESSA. The invited talks had 60 min. each, including questions. On Tuesday, December 1, the talks were:

#### **The Effect of Space Weather on the Space Assets**

Joaquim E. R. Costa, INPE (National Institute of Space Research), Brazil

#### **Effects of Radiation on Multijunction Solar Cells for Space Application**

José Ramón González, European Space Agency, The Netherlands

#### **Single Event Effects**

Stephen Buchner, Naval Research Laboratory, Washington DC, USA

#### **SEE Effects on VLSI Devices: Challenges and Solutions**

Luca Sterpone, Politecnico de Torino, Italy

#### **Circuit Level Design Methods to Mitigate Soft Errors**

Ricardo Reis, UFRGS (Universidade Federal do Rio Grande do Sul), Brazil.

The second day, December 2, included the following talks:

#### **SEE test methods**

Pavel Chubunov, URSC-ISDE, Russia

#### **Error-rate Prediction for Programmable Circuits: Methodology, Tools and Studied Cases**

Raoul Velazco, TIMA, France

#### **Accelerator Radiation Environment: Modeling and Monitoring Tools and Approaches**

Giuseppe Lerner, CERN (European Organization for Nuclear Research), Switzerland

#### **Brazilian Facilities and Case-studies**

Marcilei Guazzelli da Silveira, Nilberto Heder Medina, Tiago Balen, Claudio Federio, FEI, Brazil/USP, Brazil/IEAv, CTA, Brazil/UFRGS, Brazil

#### **Hardness Assurance**

Stephen Buchner, Naval Research Laboratory, Washington DC, USA

#### **Assurance Guidelines for Next-Generation Exploration Systems**

Jonathan Pellish, NASA, USA

#### **Characterizing FPGA Failure Probabilities for Critical Space Systems**

Melanie Berg, Space R2 LLC, USA.

On Thursday, December 3, the talks were:

#### **COTS In Space: Qualified Commercial Components for Space**

Jaime Estela, Spectrum Aerospace Technologies, Munich, Germany

#### **System Hardening and Real Space Applications**

Michel Pignol, CNES, France

#### **Fault Injection and Formal Verification Methodologies**

Luis Alfonso Entrena Arrontes, Universidad Carlos III de Madrid, Spain

#### **Ionizing Radiation Effects on CMOS Image Sensors**

José Lipovetzky, Centro Atómico Bariloche, CNEA, Argentina

#### **Analyzing the Reliability of Neural Networks in Programmable SoC Devices**

Fernanda Lima Kastensmidt, UFRGS (Universidade Federal do Rio Grande do Sul), Brazil

The last session of the day was a poster one with 15 posters. The posters are still available in the webpage of the school: [www.ufrgs.br/seressa2020/](http://www.ufrgs.br/seressa2020/) [1].

The last day, December 4, included the following talks:

#### **Radiation Test Requirements for Functional Safety Standards**

Sung Chung, QRT, South Korea

#### **Analyzing Data Extracted From Radiation Tests in Advanced SRAMs**

Juan A. Clemente, Universidad Complutense de Madrid, Spain

#### **Transistor- and System-Level Approaches for Hardened-by-Design Silicon Integrated Circuits in Harsh Radiation Environments**

Yann Deval, IMS, University of Bordeaux, France

#### **Routing in Fault-Prone Delay-Tolerant Networks**

Juan A. Fraire, Universidad Nacional de Córdoba, Argentina and Universität Des Saarlandes, Germany

#### **NanosatC-Br Program and Development of Radiation Hardened Integrated Circuits for Satellites Applications**

João Baptista Martins and Nelson Jorge Schuch, UFSM/INPE, SM, Brazil

#### **Radiation Effects and Mitigation Techniques in GPU**

Paolo Rech and José Rodrigo Azambuja, UFRGS, Brazil.

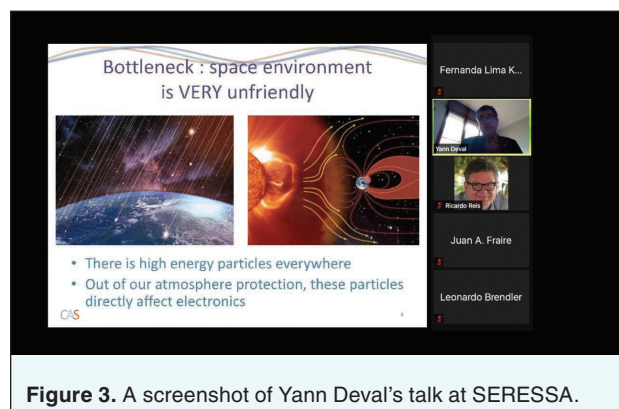


Figure 3. A screenshot of Yann Deval's talk at SERESSA.

In the Closing Session the best poster awards were announced. The best poster was a tie between:

**Component Reliability Analysis on Resource Constrained NN Accelerators**, by Panayiotis Corneliou, Panagiota Nikolaou, Maria K. Michael and Theocharis Theocharides

and

**Robustness of a commercial GaN HEMT to TID effects**, by Alexis C. Vilas Bôas, M. A. A. de Melo, R. B. B. Santos, R. C. Giacomini, N. H., L. E. Seixas, S. Finco, F. R. Palomo, A. Romero-Maestre and Marcilei A. Guazzelli.

The second best poster was:

**Radiation Estimation of Layouts of Radiation Hardened Flip-flops to High Energy Radiations**, by Kamakshi Pandey, Anuj Grover and Abhishek Jain.

The third best poster was:

**Radiation Hardness Improvement based on the SET Input Dependence**, by Ygor Q. Aguiar, Frédéric Wrobel, Jean-Luc Autran, Paul Leroux, Frédéric Sagne, Antoine Touboul and Vincent Pouget.

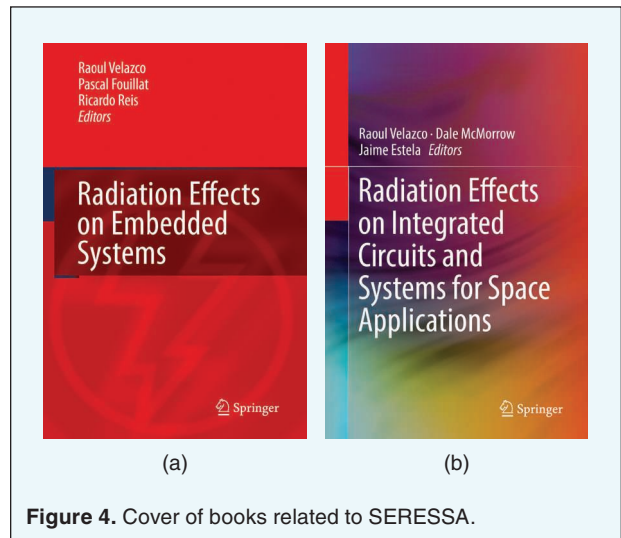
For more details about the awarded posters as well the other posters, please go to the event webpage [1]. The webpage includes the abstract of talks and short CV of speakers.

### III. Books From SERESSA

The talks related to the first edition of SERESSA in 2005, was the origin of a book published by Springer in 2007 [2] and of another one published in 2019 [3] (see the cover of both books in Fig. 4).

### IV. Conclusions

The series of SERESSA seasonal schools is being very successful and the 2020 edition had a record of participation, getting 175 participants from 32 countries



around the world. It is expected to have a face-to-face the next edition, in November 2021, at Porto Alegre, Brazil. The 2022 edition is schedule to happen at CERN (European Organization for Nuclear Research), Geneve, Switzerland.

### Acknowledgment

To the Universidade Federal do Rio Grande do Sul that provide the infrastructure, to IEEE CASS for the technical support and to IEEE CEDA that provide the Zoom platform. Also we want to talks Synopsys for their sponsoring.

### References

- [1] [www.ufrgs.br/seressa2020/](http://www.ufrgs.br/seressa2020/)
- [2] R. Velazco, P. Fouillat, and R. REIS, *Radiation Effects on Embedded Systems*. New York: Springer-Verlag, 2007. doi: 10.1007/978-1-4020-5646-8.
- [3] R. Velazco, D. McMorrow, and J. Estela, *Radiation Effects on Integrated Circuits and Systems for Space Applications*. New York: Springer-Verlag, 2019. doi: 10.1007/978-3-030-04660-6.

## President's Message *(continued from page 5)*

- 4) Provide the governance of our Society with an information management system,
- 5) Our Society has 14 technical committees which is one of our strengths and we are proud of them, however with the rapid evolution of our field of expertise it is important to align our technical fields with our publication's main topics. This requires a fine analysis based on artificial intelligence that I intend to launch quickly.
- 6) Our Society is giving a great importance in its 2020-2024 strategic plan to Global Education, we

are planning to launch in 2021 the CASS Institute for Global Education with our Resource Center as the backbone. To start, the Institute will coordinate all our education activities and initiatives.

To conclude, I count on all members of our Society to support our initiatives.

I wish you an excellent end-of-year holidays and a fruitful, safe and healthy year 2021.

Prof. Amara Amara  
IEEE CASS President