CNRS - Grenoble INP - UGA

RMS team

Reliable RF and Mixed-signal Systems

Reliable RF and Mixed-signal Systems (RMS team)

Description

The Reliable RF and Mixed-signal Systems group (**R**MS) is focused on the design, test and control of analog/mixed-signal/RF/mm-Wave integrated circuits and systems. The work of the team is included in the Laboratory themes of "Robustness, reliability and test", "Design of AMS/RF devices, circuits and systems" and "Machine learning-based modeling of AMS/RF circuits and systems".

Robustness, reliability and test

The test, control and calibration of AMS-RF-mmW functions in a complex integrated system represent nowadays a major challenge for the IC industry. Our research in this area is focused on two main research lines: a) the development of AMS-RF-mmW state-of-the-art on-chip test instruments for Built-In Self-Test (BIST) applications and dedicated DfT techniques; and b) the development of embedded solutions for performance control, optimization and self-calibration.

Design of AMS/RF devices, circuits and systems

Novel AMS/RF/mmW design solutions are required in a wide variety of state-of-the-art applications, including communications, computing, imaging, etc. In this regard, the **R**MS group explores the multiple challenges of state-of-the-art AMS/RF/mmW current and emerging design paradigms. Our research includes the development of low-power mixed-signal and RF design techniques, state-of-the-art data converters for imaging applications, integrated control electronics for quantum computing, and advanced RF and mmW design techniques for beyond- 5G and 6G applications.

Machine learning-based modeling of AMS/RF circuits and systems

The basis for using machine learning for AMS/RF circuits is to find rich statistical performance models which allow predicting the circuit performance from simple observational data. In this research line, the **R**MS group explores the use of machine learning techniques for reducing test complexity and cost, simplifying the control of complex systems and enabling efficient statistical calibration methods.

Research milestones

- Non-intrusive mm-wave test: we have outlined and experimentally demonstrated a machine learning-based non-intrusive test methodology for mm-Wave circuits
- Advanced modeling of mm-wave couplers for design enhancement: design-oriented model considering frequency-dependent electrical losses
- First-ever OBT technique for mm-wave circuits: we have demonstrated the potential of Oscillation-Based Test techniques for the test and calibration of phased arrays
- Development of Embedded Test Instruments for the static and dynamic test of state-of- the-art ADCs
- Development of machine learning-based image quality evaluation and correction techniques
- Low cost controller synthesis: we have developed a software platform for automatic generation of logic control codes for a wide variety of low-cost microcontroller targets
- Scheduling control for lifetime optimization in Wireless Sensor Nodes technologies: we have proposed a novel solution to the Maximum Lifetime Coverage Problem (MLCP) that takes into account the non-zero energy of nodes in sleep mode

Highlights

- Best Reading Paper in the December 2020 issue of IEEE Trans. on Microwave Theory and Techniques.
- Best Paper Award from the IEEE European Test Symposium 2018
- Best Poster Award from the Journées Nationales de Réseau Doctoral en Micro-nanoélectronique 2017
- Best Paper Award at the 20th IEEE European Test Symposium (ETS 2015)
- Selected Best in Test: Top Papers from the 2015 International Test Conference, by IEEE Design & Test
- Best Special Session Award in IEEE VLSI Test Symposium 2015 (VTS'15)
- Selected Best Paper Candidate in VTS 2018, DATE 2017, ETS 2016, ITC 2015
- Creation of a Joint Research Laboratory with the startup company XDIGIT

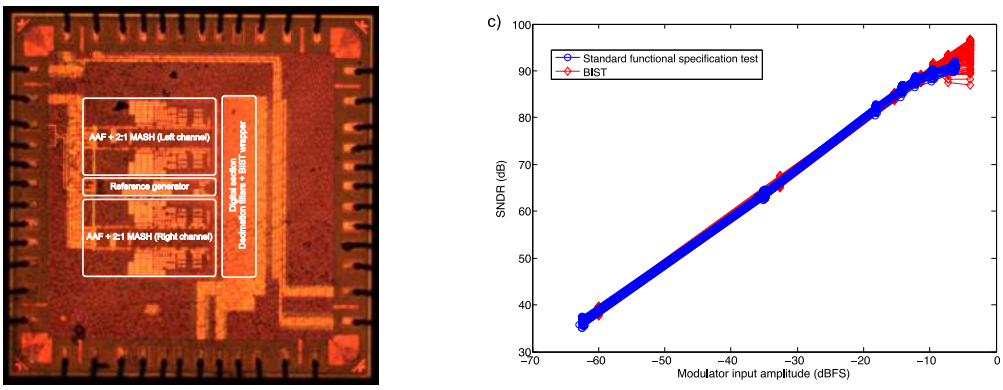

Figure 1: Sigma-Delta ADC with dynamic BIST

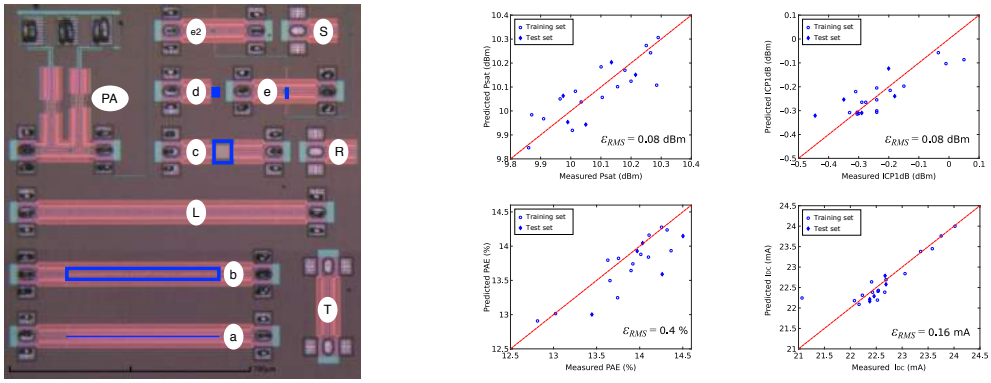

Figure 2: 60 GHz PA with non-intrusive machine learning-based test

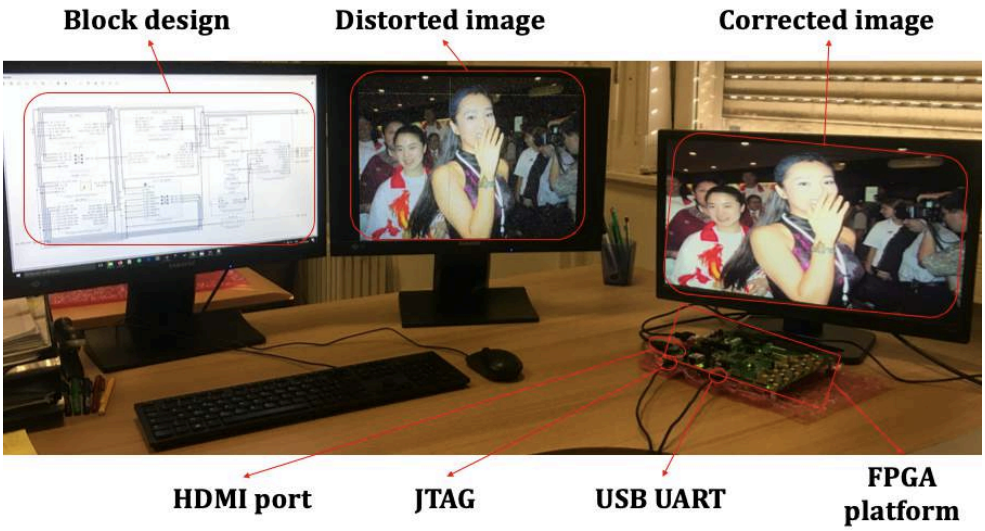

Figure 3: Image quality evaluation and correction

Academic and research members

Manuel BARRAGAN

Position
Researcher at CNRS

Responsibilities
Reseacher in RMS team

Daniel DZAHINI

Position
Research engineer at CNRS

Responsibilities
Researcher in RMS team

MIR Salvador

Position
Research Director at CNRS

Responsibilities
Director of TIMA Laboratory from 01/01/2015 to 31/12/2020
Reseacher in RMS team

Emmanuel SIMEU

Position
Associate Professor at UGA – POLYTECH school

Responsibilities
Leader of RMS team
Reseacher in RMS team

CNRS (French National Center for Scientific Research)
UGA (Université Grenoble Alpes)

Ph. D. candidates

1. BONTEMS William Illich

Title of thesis: **Design of a 15-bit analog to digital converter for ultra low power applications**
Expected date of defense: **2023**
Previous degrees: Engineer – Grenoble INP – Phelma, France (2020)

2. BRITTON OROZCO Giovani Crasby

Title of thesis: **Design of an FD-SOI read / control circuit dedicated to the field of quantum computing under Cryogenic conditions**
Expected date of defense: **2023**
Previous degrees: Engineer - Grenoble INP – Phelma, France (2020)

3. KRIEKOUKI Ioanna

Title of thesis: **Fabrication and characterization of spin-based quantum bits with embedded control in 28 nm UTBB FD-SOI technology and at very low temperatures**
Expected date of defense: **2022**
Previous degrees: Engineer – Université Grenoble Alpes, France (2017)

4. MADHVARAJ Manasa

Title of thesis: **IPS for mixed-signal/high speed integrated circuits dependability and control**
Expected date of defense: **2023**
Previous degrees: Master of technology “VLSI design and embedded systems” – Bangalore, India (2015)

5. MAMGAIN Ankush

Title of thesis: **Design of embedded test instrument for mixed signal application**
Expected date of defense: **2023**
Previous degrees: Master of technology “Electronic and communication engineering” – New Delhi, India (2014)

6. MARGALEF ROVIRA Marc

Title of thesis: **Design of mm-wave Reflection-Type Phase Shifters with Oscillation-BasedTest capabilities**
Completed on: **September 11th, 2020**
Previous degrees: Engineer – Université Grenoble Alpes, France (2017)

7. MELIS Tommaso

Title of thesis: **Diagnosis tool developement for failure analysis of analog an mixed signal devices**
Expected date of defense: **2022**
Previous degrees: Engineer - Università degli Studi di Cagliari, Italy (2018)

8. SILVEIRA FEITOZA Renato

Title of thesis: **Desigh-for-test strategies for built-in static test of high-performance SAR ADCs**
Expected date of defense: **2021**
Previous degrees: Engineer – Pontifícia Universidade Católica do Rio de Janeiro, Brazil (2017)

9. TROUSSIER Chloé

Title of thesis: **Study of ESD/CDM stresses phenomena from elementary charged devices to package discharge: failure mechanism, protection strategy and predictive tools**
Expected date of defense: **2021**
Previous degrees: Engineer – IMT Atlantique Bretagne Pays de Loire, France (2018)

Other members

Post-doctoral position – Engineers – Experts – Teaching Assistants (ATER)

Name	Forename	Country	Duration
1. BEN AZIZA	Sassi	TUNISIA	1 month, 10 days
2. TAKAM TCHENDJOU	Ghislain	CAMEROON	12 months

Visitors

No visitors in 2020.

Trainees

Name	Forename	Country	Duration
1. BERLINGARD	Quentin	FRANCE	7 months, 9 days
2. MONGUILO MANTOVANI	Javier Alejandro	ITALY	1 month

Contracts

TIMA has a long tradition of international cooperation, both with industrial and academic partners in the context of multinational projects. This chapter provides a short abstract of the topics and objectives of the contracted partnerships that were active in 2020.

ANRT

CIFRE Giovanni BRITTON
Responsable scientifique : MIR Salvador
Co-partage d'équipes (RFIC Lab, RMS)
Durée : 2020 - 2023

CIFRE Chloé TROUSSIER
Titre : "Etude des phénomènes de décharge électrostatique (ESD/CDM) : du composant au circuit intégré"
Responsable scientifique : SIMEU Emmanuel
Durée : 2018 - 2021

CIFRE Tommaso MELIS
Titre : "Développement d'outils de diagnostic pour l'analyse des défaillances des circuits intégrés analogiques et mixtes"
Responsable scientifique : SIMEU Emmanuel
Durée : 2018 - 2021

CIFRE Ioanna KRIEKOUKI
Titre : "Fabrication et caractérisation de bits quantiques avec contrôle embarqué en technologie 28nm UTBB FD-SOI et au delà à température cryogénique"
Responsable scientifique : MIR Salvador
Durée : 2018 - 2021

COLLECTIVITES TERRITORIALES

MESSI
Programme : nano 2022
Titre : Mixed-Signal Self-Test IPs for on-chip testing and technology qualification
Responsable scientifique : MIR Salvador
Durée : 2019 - 2022

EPST

Conception Analogique
Responsable scientifique : BARRAGAN ASIAN Manuel
Durée : 2019 - 2020

EUREKA

HADES
Programme : PENTA
Titre : Hierarchy-Aware and secure embedded test infrastructure for Dependability and performance Enhancement of integrated Systems
Responsable scientifique : MIR Salvador
Co-partage d'équipes (AMfoRS, RMS)
Durée : 2017 - 2020

INDUSTRIE

XDIGIT -Easytech 2020
Programme : PYXCAD/EASYTECH
Titre : "Développement microélectronique pour la technologie MASSAR"
Responsable scientifique : MIR Salvador
Durée : 2020 - 2021

Organization and participation of international conferences, workshops, forums

4th International Conference on Control, Automation and Diagnosis (ICCAD (Control Automation and Diagnosis)'2020)
October 7-9, 2020, Paris, FRANCE
Rang : NC
technical program committee: SIMEU E.
industry liaison: SIMEU E.

28th IFIP/IEEE International Conference on Very Large Scale Integration (VLSI-SoC'2020)
October 5-7, 2020, Salt Lake City, USA
Rang : A
steering committee member: MIR S.
topic chair : MIR S.

26th IEEE International Symposium on On-Line Testing and Robust System Design (IOLTS'2020)
July 13-15, 2020, Virtual event from Naples (Italy), ITALY
Rang : B
technical program committee: BARRAGAN M., MIR S

18th IEEE International NEWCAS Conference (NEWCAS'2020)
June 16-19, 2020, Montréal, CANADA
Rang : B
program chair: BARRAGAN M.

25th IEEE European Test Symposium (ETS'2020)
May 25-29, 2020, Tallinn, ESTONIA
Rang : A
technical program committee: BARRAGAN M., MIR S

IEEE International Symposium on Circuits and Systems (ISCAS'2020)
May 17-20, 2020, Seville, SPAIN
Rang : A
technical program committee: BARRAGAN M.

23rd Symposium on Design & Diagnostics of Electronic Circuits & Systems (DDECS'2020)
April 22-24, 2020, Novi Sad, SERBIA
Rang : B
technical program committee: BARRAGAN M.

38th IEEE VLSI Test Symposium (VTS'2020)
April 5-8, 2020, San Diego, USA
Rang : A
technical program committee: MIR S., BARRAGAN M.

21st IEEE Latin-American Test Symposium (LATS'2020)
March 30-April 2, 2020, Jatiúca (Maceió), BRAZIL
Rang : NC
technical program committee: MIR S, SIMEU E.

Design, Automation & Test in Europe (DATE'2020)
March 9-13, 2020, Grenoble, FRANCE
Rang : A+
track chair: BARRAGAN M.

11th IEEE Latin American Symposium on Circuits and Systems (LASCAS'2020)
February, 25-28, 2020, San José, COSTA RICA
Rang : B
technical program committee: MIR S.

Responsibilities

Role	TIMA member	Starts	Ends	Comments
Faculties / Schools				
POLYTECH Grenoble				
Manager of Risks Prevention department	SIMEU E.	01/09/2017		
Restricted council member	SIMEU E.	01/09/2017		Examine promotion files, invited professors, teaching assistants
School council member	SIMEU E.	01/09/2017		Elected members - School Strategy, relations with industrial partners
Research structures				
AIP PRIMECA **Productique et ressources informatiques pour la mécanique**				
Manager of CIM AIP PRIMECA platform	SIMEU E.	01/09/2017		
Carnot LSI **Logiciel et Systèmes Intelligents**				
TIMA representative	MIR S.	01/09/2009		
École doctorale EEATS **Électronique Électrotechnique Automatique & Traitement du signal**				
Council member of EEATS doctoral school	SIMEU E.	01/09/2017		
FMNT **Fédération des Micro et Nanotechnologies**				
Manager of Telecommunications Axis	BARRAGAN M.	01/09/2017		

Scientific production

International journals

Margalef-Rovira M., Lugo-Alvarez J., Bautista A., Vincent L., Lepilliet S., Saadi A., Podevin F., Barragan M., Pistono E., Bourdel S., Gaquière C., Ferrari P., Design of mm-Wave Slow-wave Coupled Coplanar Waveguides, IEEE Transactions on Microwave Theory and Techniques, Ed. IEEE, Vol. , DOI: 10.1109/TMTT.2020.3015974, 2020

Melis T., Simeu E., Auvray E., Armagnat P., Analog and mixed-signal circuits simulation for product level EMMI analysis, Microelectronics Reliability, Ed. Elsevier, Vol. 114, DOI: 10.1016/j.microrel.2020.113881, novembre 2020

Margalef-Rovira M., Saadi A., Vincent L., Lepilliet S., Gaquière C., Gloria D., Durand C., Barragan M., Pistono E., Bourdel S., Ferrari P., Highly Tunable High-Q Inversion-Mode MOS Varactor in the 1–325-GHz Band, IEEE Transactions on Electron Devices, Ed. IEEE, Vol. 67, No. 6, pp. 2263-2269, DOI: 10.1109/TED.2020.2989726, juin 2020

Cilici F., Barragan M., Lauga-Larroze E., Bourdel S., Leger G., Vincent L., Mir S., A Nonintrusive Machine Learning-Based Test Methodology for Millimeter-Wave Integrated Circuits, IEEE Transactions on Microwave Theory and Techniques, Ed. IEEE, Vol. , pp. 1-1, DOI: 10.1109/TMTT.2020.2991412, mai 2020

Chegari B., Tabaa M., Moutaouakkil F., Simeu E., Medromi H., Local energy self-sufficiency for passive buildings: Case study of a typical Moroccan building, Journal of Building Engineering, Ed. Elsevier, Vol. 29, No. 101164, DOI: 10.1016/j.jobe.2019.101164, mai 2020

Takam Tchendjou G., Simeu E., Detection, Location and Concealment of Defective Pixels in Image Sensors, IEEE Transactions on Emerging Topics in Computing, Ed. IEEE, Vol. , DOI: 10.1109/TETC.2020.2976807, février 2020

International conferences

Melis T., Simeu E., Auvray E., Analog and Mixed Signal Diagnosis Flow Using Fault Isolation Techniques and Simulation, 46th International Symposium for Testing and Failure Analysis (ISTFA 2020), Virtual event, UNITED STATES, 7 au 9 décembre 2020

El-Chaar M., Lisboa de Souza A.A., Barragan M., Podevin F., Bourdel S., A Non-Closed-Form Mathematical Model for Uniform and Non-Uniform Distributed Amplifiers, IEEE MTT-S International Conference on Microwaves for Intelligent Mobility (ICMIM 2020), Linz, AUSTRIA, DOI: 10.1109/ICMIM48759.2020.9299099, 23 novembre 2020

Melis T., Simeu E., Auvray E., Armagnat P., Analog and mixed-signal circuits simulation for product level EMMI analysis, 31st European Symposium on Reliability of Electron Devices Failure Physics and Analysis (ESREF 2020), Virtual event, GREECE, 4 au 8 octobre 2020

Portolan M., Silveira Feitoza R., Takam Tchendjou G., Reynaud V., Senthamarai Kannan K., Barragan M., Simeu E., Maistri P., Anghel L., Leveugle R., Mir S., A Comprehensive End-to-end Solution for a Secure and Dynamic Mixed-signal 1687 System, 2020 International Symposium on On-Line Testing and Robust System Design (IOLTS 2020), Naples (Napoli), ITALY, DOI: 10.1109/IOLTS50870.2020.9159721, 13 au 15 juillet 2020

Melis T., Simeu E., Auvray E., Automatic Fault Simulators for Diagnosis of Analog Systems, 26th IEEE International Symposium on On-Line Testing and Robust System Design (IOLTS 2020), Virtual event, ITALY, 13 au 15 juillet 2020

Margalef-Rovira M., Saadi A., Bourdel S., Barragan M., Pistono E., Gaquière C., Ferrari P., mm-Wave Through-Load Switch for in-situ Vector Network Analyzer on a 55-nm BiCMOS Technology, 18th IEEE International NEWCAS Conference (NEWCAS 2020), Montreal, CANADA, 16 au 19 juin 2020

Silveira Feitoza R., Barragan M., Gines A., Mir S., Static linearity BIST for Vcm-based switching SAR ADCs using a reduced-code measurement technique, 18th IEEE International NEWCAS Conference (NEWCAS 2020), Montreal, CANADA, DOI: 10.1109/NEWCAS49341.2020.9159839, 16 au 19 juin 2020

Silveira Feitoza R., Barragan M., Gines A., Mir S., On-chip reduced-code static linearity test of Vcm -based switching SAR ADCs using an incremental analog-to-digital converter, IEEE European Test Symposium (ETS 2020), Tallinn, ESTONIA, DOI: 10.1109/ETS48528.2020.9131588, 25 mai au 1 juin 2020

Takam Tchendjou G., Simeu E., Parametric faults detection and concealment on imager with FPGA implementation, IEEE Latin-American Test Symposium (LATS 2020), pp. 1-6, Maceio, BRAZIL, DOI: 10.1109/LATS49555.2020.9093671, 30 mars au 2 avril 2020

Other communications

Aouimeur W., Margalef-Rovira M., Lauga-Larroze E., Gloria D., Gaquière C., Arnould J.D., A Fully-Integrated High-Isolation Transfer Switch for G-band in-situ Reflectometer applications, IEEE MTT-S International Conference on Microwaves for Intelligent Mobility (ICMIM 2020), Linz, AUSTRIA, 2020

Troussier C., Bourgeat J., Simeu E., Arnould J.D., Jimenez J., Jacquier B., Study of Inter-Power Domain Failures during a CDM Event, IEEE 42nd EOS/ESD symposium (ESDA 2020), Virginia St, Reno, UNITED STATES, 2020

Theses

Margalef-Rovira M., Design of mm-wave Reflection-Type Phase Shifters with Oscillation-Based Test capabilities, These de Doctorat, 11 septembre 2020