ARFTG-98th Microwave Measurement Symposium

NON-LINEAR METHODS AND MEASUREMENTS FOR RF AND MM-WAVE

January 17th-18th, 2022

Conference Program

Rev.: 2.1, 2020-01-16

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ARFTG-98th Executive Committee would like to thank our sponsors for their great and valued support of the conference and the ARFTG organization.

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Welcome to ARFTG-98th Symposium

As Chairperson of the 98th ARFTG conference, co-located with the Radio Wireless Week (RWW), I'd like to welcome all our attendees, speakers and conference co-chairs who have worked throughout the last year to bring you this program. We have some exciting speakers from such diverse topics of space and satellite to 6G. The focus for this conference is on Non-Linear Design and Test with an emphasis on Digital Pre-Distortion (DPD) techniques, but we also have our usual selection of other topics of interest to the measurement and metrology community. Along with the conference, we haves a special workshop on DPD methods held jointly with our colleagues from the Radio Wireless Week.

While we had originally intended to have a fully live and in-person conference, events have caught up with us and we now are moving to a hybrid event to allow speakers and registered attendees to join remotely. Out of an abundance of caution, we will postpone the short course until the next winter conference, as a key part of its value is the live interaction with experts in the field.

For those of you that will attend in person, I look forward to seeing you live and enjoying in-person discussions, and for those attending remotely, I hope that you will enjoy the presentations and find them interesting.

Finally, I would like to thank all our exhibiters, sponsors, and all the members of the conference steering committee for their work, support and flexibility in preparing this conference during challenging times.

Joel Dunsmore, General Chair.

Joel Dunsmore
General Chair
Keysight Technologies

Rusty Myers
General co-Chair
Keysight Technologies

Marco Spirito
TPC Chair
TU Delft

Basim Noori
TPC co-Chair
Wolfspeed

Program at a Glance

MONDAY 17 JANUARY 2022	TUESDAY 18 JANUARY 2022	WEDNESDAY 19 JANUARY 2022	THURSDAY 20 JANUARY 2022	FRIDAY 21 JANUARY 2022
	8:30 am – 9:40 am PST **Session C** Non-Linear and Broadband Techniques and Short Papers	8:00 am – 12:00 pm PST **Joint RWW/ARFTG Workshop** Behavioral Modelling, Digital Predistortion (DPD) and Measurement Techniques for High-Frequency Power Devices and Amplifiers		
	9:40 am – 10:10 am PST **Break - Exhibits**			
	10:40 am – 12:00 pm PST **Joint ARFTG/RWW Plenary Session**			
	12:00 pm – 1:30 pm PST **Break - Lunch**			
1:00 pm – 2:30 pm PST **Session A** Microwave, mm-Wave Measurement for Circuits, Devices and Systems	1:30 pm – 1:50 pm PST **ARFTG Business Meeting**			
	1:50 pm – 3:10 pm PST **Session D** Other Areas of RF and mm-Wave Measurements			
3:10 pm – 3:40 pm PST **Interactive Forum & Exhibits**	3:10 pm – 3:40 pm PST **Break - Exhibits**			
3:40 pm – 4:40 pm PST **Session B** On-Wafer, In-Fixture and Waveguide Environment Calibration Techniques	3:40 pm – 4:50 pm PST **Panel Session E** Non-Linear Techniques			
6:00 pm – 7:00 pm PST **RWW/ARFTG Reception**				

Monday 1:10 pm – 2:30 pm PST

Session A: Microwave, mm-Wave Measurement for Circuits, Devices and Systems

Chair: Basim Noori

1:10 pm — 1:40 pm PST

A1

New Space Meets Old (Invited)

Erik Luther (CesiumAstro)

The space industry is experiencing unprecedented growth driven by a new wave of business models that span wireless broadband connectivity, climate and weather tracking, asteroid mining, and interplanetary exploration. Entrepreneurs and governments are racing to prove these business models with tight budgets on short timelines blending the latest New Space approaches with the lessons learned from Old Space best practices. The burden now lands on the engineers to deliver by shortening product development lifecycles and reducing test times without sacrificing mission assurance.

In this talk we discuss both the opportunity and challenges of NewSpace communications solutions through the lens of CesiumAstro, a rapidly growing RF and communications payload and flexible software-defined active phased array company that works daily to blend the best practices of Old Space with the demands of New Space where mission assurance is the key metric for success.

1:40 pm — 1:50 pm PST

Q&A

1:50 pm — 2:10 pm PST

A2

Correcting nonlinear distortion of wideband modulated signals using new frequency domain methods

Sam Kusano (Keysight Technologies, Inc.), Augustine Stav (Keysight Technologies, Inc.), Tong Li (Keysight Technologies, Inc.), Jan Verspecht (Keysight Technologies, Inc.)

Distortion -less wideband modulated test signals are generated at high power using a new frequency domain method, called spectral digital pre-distortion (Spectral DPD). This technique extends the power range of signal generators, reducing the need for booster power amplifiers to achieve a good linearity, high-power signal for test. The proposed technique first creates a short slice of the modulated waveform for fast and accurate linearization of the signal at the reference plane. Then, using a pre-distorted waveform created by spectral DPD, a generic memory-polynomial DPD model is identified. This model is then applied to the original waveform to generate a pre-distorted waveform, providing a linearized test signal. An example 5GNR test signal is demonstrated for linearization.

2:10 pm — 2:30 pm PST

A3

Quantifying Noise Floor and Trace Noise in VNA Measurements for the WR-15 Waveguide Band

Aaron Morgan Hagerstrom (National Institute of Standards and Technology), Angela Stelson (National Institute of Standards and Technology), Jeff Jargon (National Institute of Standards and Technology), Christian Long (National Institute of Standards and Technology)

We present a model and measured data to assess the uncertainties in scattering-parameter measurements due to noise floor and trace noise in the receivers of a vector network analyzer operating in the WR-15 waveguide band.

3:10 pm — 3:40 pm PST

Break – Interactive Forum & Exhibits

Exhibit Hall

Session B: On-Wafer, In-Fixture and Waveguide Environment Calibration Techniques

Chair: Jon Martens

3:40 pm — 4:00 pm PST

B1

On the Influence of Metal Chucks in Wideband On-Wafer Measurements

Gia Ngoc Phung (Physikalische Technische Bundesanstalt), Uwe Arz (Physikalisch-Technische Bundesanstalt)

On-wafer measurements are essential for the characterization of electronic devices at millimeter-wave frequencies. They have been known as challenging and ambitious containing a lot of parasitic effects. While a lot of investigations have been performed for on-wafer measurements of coplanar waveguides (CPW) placed on ceramic chucks, the parasitic effects related to the influence of metal chucks have not been fully investigated yet. This paper demonstrates a systematic study of the metal chuck in conjunction with the parasitic probe effects using two different probe types in mTRL-calibrated CPW measurements through a thorough field analysis.

4:00 pm — 4:20 pm PST

B2

Student Paper

Improving the Reliability of the Multiline TRL Calibration Algorithm

Ziad Hatab (Graz University of Technology), Michael Gadringer (Graz University of Technology), Wolfgnag Bösch (Graz University of Technology)

This paper presents an updated version of the multiline Thru-Reflect-Line (mTRL) calibration algorithm. The proposed approach formulates the calibration problem in a single eigenvalue problem, in which all line standards are combined using an optimally derived weighting matrix. This approach eliminates the need for common line selection and line pairing procedures, as documented in MultiCal. Using on-wafer measurements up to 150 GHz and sensitivity analysis based on the Monte Carlo method, we show that this new approach outperforms the MultiCal implementation and delivers consistent results in the presence of additive noise and phase error.

4:20 pm
—
4:40 pm PST

Repeatability of 220 - 330 GHz Variable Waveguide Attenuator and Frequency Extenders for 6G Measurements

Marko E. Leinonen (University of Oulu), Juha-Pekka Mäkelä (university of Oulu), Klaus Nevala (University of Oulu), Nuutti Tervo (University of Oulu), Aarno Pärssinen (University of Oulu)

Mechanical waveguide attenuators are used above 100 GHz frequencies to control signal levels in power sweep measurements to avoid compression of the device or the extender. However, manual settings of the attenuators are prone to human errors, and thus the repeatability of each measurement need be studied case-basis. This paper studies calibration accuracy of extenders, and the repeatability and reproducibility of a waveguide attenuator operating at 220 to 330 GHz. The average calibration variation of S21 with three operators and three repeated calibrations over frequencies was -0.009 dB and 0.072° for directly connected frequency extenders. The measured setting accuracy of any waveguide setting was 1.4 dB (±2σ) over 15 dB range. The primary source of measured variation in S11 and S21 in variable attenuator setting measurements was due to repetition of measurements since there was no significant statistical difference between three operators.

4:40 pm PST

End of Monday's Symposium Sessions

Tuesday 8:30 am – 5:00 pm PST

Session C: Non-Linear & Broadband Techniques and Short Papers

Chair: Rusty Myers

8:30 am — 8:40 am PST

C1

Contactless in-Situ Probe Tilt Adjustment on Co-Planar Devices (Short Paper)

Ryo Sakamaki (National institute of Advanced Industrial Science and Technology)

This paper demonstrates a contactless in-situ planarity adjustment of a ground-signal-ground (GSG) probe on practical planar devices. The proposed technique completes the adjustment with minimizing footprints on the devices. Furthermore, repeatability of tilt angle was 0.6 degrees, which was compatible to a conventional manual inspection technique. No footprint was observed after the adjustment process. The proposed technique can realize in-situ planarity adjustment just above a device-under-test (DUT).

8:40 am — 8:50 am PST

C2

Student Paper

Self-Interference Cancellation in Full-Duplex MIMO System (Short Paper)

Shipra Bhadoria (IIT Roorkee)

In this paper, a self-interference cancellation method is contemplated to remove the self-interference signal using the pilot-based channel estimation technique in MIMO full-duplex system. Since the most prominent issue in implementing MIMO full-duplex system is both hardware non-linearities and signal interference. The proposed approach is utilized to significantly cope with self-interference due to other channels in the same chip of the MIMO system. Specifically, we offer a two-step procedure to estimate the channel between the desired output and signal of interest and the channel with desired output and an interfering signal. In the next step, perform self-interference cancellation. Numerical evaluation of the technique shows that the bit-error rate was reduced from an order of 10-1 to an order of 10-4, and the error vector magnitude was reduced from -6 dB to a value of -35 dB.

8:50 am — 9:00 am PST

Q&A

9:00 am — 9:10 am PST

C3

Generating Wide Bandwidth Signals by Coherently Combining Vector Signal Generator Outputs (Short Paper)

Jan Verspecht (Keysight Technologies, Inc.), Augustine Stav (Keysight Technologies, Inc.), Troels Nielsen (Keysight Technologies, Inc.)

We provide a method to generate wide bandwidth modulated signals by coherently combining vector signal generator outputs. This results in a signal with a bandwidth that is equal to the sum of the individual bandwidths.

9:10 am — 9:20 am PST

C4

Probe Measurement System for Surface Mount Devices at Radio Frequencies (Short Paper)

Ryoko Kishikawa (National Institute of Advanced Industrial Science and Technology), Masahiro Horibe (AIST), Toshi Ohi (T Plus), Akito Yamamoto (T Plus), Noriyoshi Hashimoto (Keysight Technologies), Ryo Takeda (Keysight Technologies)

This paper presents a new probe system for measuring the scattering parameters of surface mount devices in radio frequency range in response to the demand for operating power devices at higher frequencies. Two ground-source probes with 3.7 mm pitch and a probe station for controlling these probes were designed as original components of the proposed system. When used with a commercially available vector network analyzer, a dc source supply, two bias-Ts, and cables, the scattering parameters with the dc bias voltage supplied can be measured. This is a pioneer probe measurement system for surface mount devices in the power electronics operated at the radio frequencies. Because the probes can be used in direct contact with a surface mount device under test, precise measurement results can be obtained. The evaluation results for the stability of the developed system and contact reproducibility are also presented.

9:20 am — 9:40 am PST

C5

Mixer Residual Phase Noise Measurements Using Clock-Locked DDS Sources and Receivers (Short Paper)

Joel Dunsmore (Keysight Technologies), Junichi Iwai (Keysight Technologies)

Methods for residual measurements on mixers are difficult and require at least one other mixer making it difficult to separate the residual effects between them. Here we introduce a novel scheme that uses a system completely clocked off a single reference oscillator using pairs of DDS sources to produce an input and LO signal as well as a third DDS source to re-convert the mixer output. We show the close-in phase noise is largely canceled with this method resulting in a good measure of the mixer residual phase noise somewhat independent of the raw phase noise of the DDS sources. This improvement can also be shown for close-in residual measurements of amplifiers.

Joint RWW/ARFTG Plenary Session

10:10 am
—
12:00 pm PST

Artificial Intelligence and Machine Learning for the era of Hyperconnected IoT Devices

Dr. Frank Schirrmeister (Cadence)

We are at the cusp of an Era of Hyperconnectivity and Hyperscale Computing, fueled by billions of devices in the Internet of Things (IoT) and its industrial sibling, the Industrial IoT (IIOT). Ericsson predicts that data traffic through commercial networks grows to 164 exabytes per month in 2025. Video already accounted for 63% of the traffic of 2019's 33 exabytes per month and will become 76% of the estimated 164 exabytes per month in 2025. At that time, 5G adoption could reach 2.8 billion subscriptions, and 5G population coverage is forecast at 55%. Seagate and IDC predict storage in the "global datasphere" to grow to 175 zettabytes by 2025, up from 45 zettabytes in 2019.

This presentation will discuss requirements for designing systems on chips (SoCs) and systems enabling the era of Hyperconnectivity. Specifically, we will and introduce solutions that the Electronic Design Automation (EDA) industry provides today for Artificial intelligence (AI) and machine learning (ML), as well as trends to address future challenges. In addition, we will also discuss how AI/ML technologies increase development productivity and optimize EDA design processes.

Specifically, we will discuss enabling processor and design IP and high-level synthesis to enable optimized circuitry for AI/ML algorithms. Furthermore, we will introduce the requirements for optimized AI/ML designs and specific verification tools for this design category. Advanced node and low power implementation are vital to linking verification to SoC implementation, and we will discuss particular optimizations and 3DIC and Chiplet based integration and analysis. To utilize AI/ML for EDA, we will introduce trends and experiences using AI/ML for formal verification, simulation, and implementation.

6G: Is it Really DC to Daylight?

Roger Nichols, Keysight Technologies, Inc.

By the time of this ARFTG event, the primary group driving 5G standardization will have finished the scoping of the 2nd update (Rel-18) to the implementable 5G standard. 5G brought new capabilities to commercial radio systems placing new demands on RF measurement. These include things like "massive MIMO": active transceiver-chain and antenna systems that adapt to user need, physical location and movement, and user-density; taking new radio bands mainstream—everything from 3-7GHz to 28-52. These drove the need for complex measurements of active systems, wide bandwidths with complex modulation, and so much integration that over-the-air is the only feasible (and indeed the only standardized) technique to make some measurements. But even though most Rel-16 capabilities are not yet in production networks, the industry is in active dialogue and research on the sixth generation. 6G presentations are full of glorious descriptions of how wireless will improve society. While this all may be true, we technologists have plenty of work to do to ensure the system works. Like 5G, realizing 6G will take far more than simply adding new frequency bands and increasing the related bandwidths. This talk will cover an overview of the 6G vision and then dive into a few examples of how this vision will impact RF, microwave, and millimeter-wave systems and the associated challenges of measurements. Some of these are obvious (but difficult) next steps, like radio information bandwidths of at least 15 GHz, and some are not-so-obvious like AI-driven real-time determination of waveform and modulation schemes. I will attempt to cover examples that span DC-to-Daylight issues and show that analogy as closer to reality than what we have seen before.

12:00 pm — 1:30 pm PST	Lunch Break Palermo/Pisa
1:30 pm — 1:50 pm PST	ARFTG Business Meeting

Session D: Other Areas of RF and mm-Wave Measurements

Chair: Ron Ginley

1:50 pm — 2:10 pm PST

D1

Student Paper

Measurement Method for Beam Steer Execution Time

Thomas Harz (Physikalisch-Technische Bundesanstalt (PTB)), Thomas Kleine-Ostmann (Physikalisch-Technische Bundesanstalt (PTB))

For the last thirty years, data rates in mobile networks have been increasing. To satisfy the demand for mobile data transfer, the use of mobile networks has to be more effective and more frequency bandwidth has to be allocated. In the already heavily used sub-6-GHz spectrum, no additional bandwidth is available. Therefore, the mobile network has to operate in the millimeter wave regime to provide a high data rate for the user. In this challenging part of the spectrum, the new antenna systems must be characterized to comply with 3GPP rules. This paper addresses a part of the metrological challenges, which is the measuring of the beam steer execution time.

2:10 pm — 2:30 pm PST

D2

Student Paper

Complex Permittivity Measurement of Liquids Using Half Mode Corrugated Substrate Integrated Waveguide Structure

Shivakumar Chedurupalli (University of Hyderabad), Vishwam T (GITAM University Hyderabad), James Raju K.C (University of Hyderabad)

Complex permittivity measurement of medium loss liquids with low sample volume determined in the discrete microwave ($6.50 < v/GHz < 10$) frequency region using partially filled half mode corrugated substrate integrated waveguide (PFHMCSIW) structures. The ANSYS high frequency structure simulator (HFSS) is used to simulate the test structure mechanism. The transmission as well as reflection parameters are considered to evaluate the complex permittivity of the samples. The obtained permittivity data values are compared with the Open-ended coaxial probe technique data. The merits and demerits of both measurement techniques are discussed.

2:30 pm — 2:50 pm PST

D3

Student Paper

Experimental Study on Coexistence of a Spiking Neural Network and 77 GHz VCO on a Single Chip

Hendrik Magnus Lehmann (Infineon Technologies AG), Cyprian Grassmann (Infineon Technologies AG), Pietro Brenner (Infineon Technologies AG), Vadim Issakov (TU Braunschweig)

Spiking Neural Networks (SNN) becomes popular for numerous applications. A physical circuit-level SNN implementation and feasibility of its integration with millimeter-wave circuit blocks towards a system on chip (SoC) has not been reported yet. A voltage-controlled oscillator (VCO)

	is the core element of FMCW radar transceivers and one of the most sensitive blocks in the system. This work evaluates empirically for the first time the potential interferences during concurrent operation of an SNN and a 77GHz VCO integrated on the same chip. The coupling effects are investigated experimentally in time- and frequency-domain, particularly by phase noise measurements. The VCO exhibits a low phase noise of −100.25 dBc/Hz at an offset frequency of 1MHz from 77 GHz carrier, while the SNN activity is turned off. By an intentional triggering of the SNN, a significant impact on VCO is observed and the phase noise is deteriorated up to as much as −89.75 dBc/Hz at the same offset frequency.
2:50 pm — 3:10 pm PST	Broadband Microwave Materials Characterization Jim Booth (National Institute of Standards and Technology)
D4	Broadband Microwave Materials Characterization Broadband material property measurements are important for connecting the fundamental physical response of materials to finite-element device models and circuit models. We apply on-wafer error correction and de-embedding to achieve accurate determination of electromagnetic properties of materials for integrated materials and devices. We present results demonstrating broadband measurements of complex permittivity and estimates of the permeability μ*(ω) for flexible composite materials. We also discuss quantification of nonlinear effects in materials and devices.
3:10 pm — 3:40 pm PST	Break – Exhibits Exhibits Hall
	Panel Session E: Non-Linear Techniques from Fundamental to Harmonic Environment, Challenges and Opportunities **Chair: Basim Noori**
3:40 pm — 5:00 pm PST	Panelists: TBD
5:00 pm PST	End of ARFTG-98th Conference

Wednesday 8:00 am – 12:00 pm PST

Joint ARFTG-RWW 2021 Workshop

Behavioral Modelling, Digital Predistortion (DPD) and Measurement Techniques for High-Frequency Power Devices and Amplifiers

Organizers: Roberto Quaglia (Cardiff University), Patrick Roblin (Ohio State University)

This workshop consists of a series of talks from prominent international research groups, providing a comprehensive overview of the latest advancements in the measurement, modeling and linearization techniques used for accurate device characterization and conditioning of complex transmitters.

These novel techniques focus on optimizing the resources needed for model extraction and signal conditioning, without compromising the accuracy of the models and correction algorithms, in order to minimize the costs (time, hardware, firmware) and achieve sustainable techniques to support high frequency systems of the next generations.

08:00 am — 12:00 pm PST

DPD under Wideband Modulated Signal Drive Using New VNA Based Methods

Sam Kusano (Keysight Technologies)

Digital Predistortion of 5G Massive MIMO Wireless Transmitters Using OTA Data Acquisition

Anding Zhu (University College Dublin)

Low Complexity Predistortion Techniques for Power Amplifiers in Multiple Input Multiple Output Transmitters

Meenakshi Rawat (IIT Rookee)

Digital Predistortion for Multiple-Input, Single Output Power Amplifiers

Pere Gilabert (Polytechnic University of Catalonia)

Latest Cardiff Model Developments

Ehsan Azad, Paul Tasker (Cardiff University)

Digital and Analog Predistortion for Energy-Constrained Terminals

Roman Maršálek, Tomáš Götthans (VUT)

Detailed Workshop Program can be found here.

ARFTG Executive Committee Election

ExCom Candidate Biographies

Joel Dunsmore

Since graduating from Oregon State University with an MSEE (1983), Joel Dunsmore has worked for Keysight Technologies (formerly Agilent and Hewlett-Packard) at the Santa Rosa Site. He received his Ph.D. from Leeds University in 2004. He is a Keysight R&D Fellow focused on component test. He was a principal contributor to the HP 8753 and PNA family of network analyzers, with recent work in non-linear test, including differential devices, and mixer measurements, as well as modulated and spectrum measurements. He was principally responsible for many of fundamental algorithm designs in the PNA applications including the frequency converter, spectrum-analyzer, gain compression, IQ, and Hot S-parameter measurements. He has received 35 patents related to this work, and authored the "Handbook of Microwave Component Measurements, 2nd Edition (John Wiley, 2020)". He is a senior member in the IEEE and MTT, as well as an executive committee member of the Automated RF Techniques Group (ARFTG).

Dennis Lewis

Dennis Lewis received his BS EE degree with honors from Henry Cogswell College and his MS degree in Physics from the University of Washington. He has worked at Boeing for 32 years and is recognized as a Technical Fellow, leading the enterprise antenna measurement capability for Boeing Test and Evaluation. Dennis holds ten patents and is the recipient of the 2013 & 2015 Boeing Special Invention Award. He is a senior member of the IEEE and several of its technical societies including the Microwave Theory and Techniques Society (MTT-S), the Antennas and Propagation Society and the Electromagnetic Compatibility (EMC) Society. He actively contributes to these societies as a member of the IEEE MTT-S subcommittee 3 on microwave measurements and as a Board Member and a past Distinguished Lecturer for the EMC Society. He is a Senior Member and served as Vice President on the Board of Directors for the Antenna Measurements Techniques Association (AMTA) and chaired its annual symposium in 2012. Dennis is a part time faculty member teaching a course on Measurement Science at North Seattle College and is chairman of the Technical Advisory Committee. His current technical interests include aerospace applications of reverberation chamber test techniques as well as microwave and antenna measurement systems and uncertainties.

Chong Li

I am passionate on developing RF and microwave measurement techniques for both fundamental research and industry, especially on-wafer measurements. I have more than 30 peer reviewed papers and patents in the relevant fields. I am also enthusiastic about prompting measurement science to wider communities and I strongly believe ARFTG is the right platform. As a regular conference paper contributor and past TPC member of ARFTG, I have enjoyed my experience. However, I don't just want to "enjoy" it but contribute and serve to the conference and the group. Although having failed three times in a row, I still want to campaign for the upcoming election as I have accumulated more experience at leadership roles in the past 12 months and that has made me the right candidate for the executive committee. Here below is my updated biography.

I am a Senior Lecturer in Electronics and Nanoscale Engineering and the Director of Electronic Systems Design Centre in James Watt School of Engineering, University of Glasgow, UK. Before re-joining Glasgow University in 2017, I was a Higher Research Scientist at UK's National Physical Laboratory (NPL) and a postdoc researcher at Glasgow University. My expertise includes on-wafer measurements, III-V semiconductor devices and micro-/nanofabrication.

I am the Group 4 (United Kingdom, Ireland, Gibraltar, Malta) representative to the European Microwave Association (EuMA) General Assembly and the Chair of Workshop & Short Courses, EuMW2021. I have served as a member of the technical program committee for several conferences including ARFTG. I am a Member of IET, a Senior Member of IEEE and an Associate Editor of Royal Society Open Science.

Patrick Roblin

Patrick Roblin received the Maitrise de Physics degree from the Louis Pasteur University, Strasbourg, France and the D.Sc. degrees in Electrical Engineering from Washington University in St. Louis, in 1980 and 1984, respectively. He is the founder of the Non-Linear RF research lab at OSU. He has authored and co-authored three textbooks on the nonlinear modeling and characterization of microwave devices and on high-efficiency PA design. He served as a DML for MTT from 2016-2018 and is a member the MTT-3 Microwave Measurement Committee. He is currently one of the lead coordinators for the NVNA Users Forum and for the ARFTG workshops.

Dominique Schreurs

Dominique Schreurs has been involved with ARFTG since previous millennium. She attended her first ARFTG conference as a PhD student in 1996, and has attended most ARFTG conferences since, resulting in receiving the ARFTG Life Member status in 2013. She organized the very first workshop at a Fall ARFTG Symposium in 2001 and has been (co-)organiser and speaker in various ARFTG Spring and Fall workshops over the years. She was one of the co-initiators of the NVNA Users' Forum in 2002 and is still acting as its advisor. Dominique got elected to the ARFTG Executive Committee in 2003 and has assumed various ExCom positions over the years (Workshop Chair, Education Chair, Technical Coordination, Secretary, Nominations, Awards, Website, …), including ARFTG President in 2018-2019. Dominique is also serving regularly on the ARFTG TPC as a reviewer, and was the co-TPC chair of 2002 Fall ARFTG conference, 2016 Spring ARFTG conference, and will be TPC chair for the 2023 Winter ARFTG

conference. She was General Chair of the Spring ARFTG conferences in 2007, 2012, and 2018. She also served as instructor at the ARFTG Short Course numerous times.

In daily life, Dominique is a full professor at KU Leuven in Belgium. Belgium is the birthplace of the early NVNA prototypes (called LSNA at the time), and therefore it is natural that her research embarked on nonlinear microwave measurements. In recent years, her students have been working on topics such as experiment design, measurement uncertainty, measurement-based modelling of active devices and circuits, dielectric spectroscopy measurements, …, to name a few. Her research is documented in about 750 publications (books, journal papers, and conference contributions), among which a substantial number were presented at ARFTG conferences. When Dominique was a post-doc, she performed scientific stays at Agilent Technologies (now Keysight Technologies) in Santa Rosa, CA, and NIST in Boulder, CO. As a professor, she has been sending her PhD students to these places.

Dominique is highly motivated to continue serving the ARFTG community, if re-elected. As ARFTG past president and ARFTG Life Member, she can leverage on her longstanding experience in her future contributions on ExCom.

Andrej Rumiantsev

Andrej Rumiantsev received the Diploma-Engineer degree (with highest honors) in Telecommunication systems from the Belarusian State University of Informatics and Radio Electronics (BSUIR), Minsk, Belarus, and the Dr.-Ing. Degree (with summa cum laude) in Electrical Engineering from Brandenburg University of Technology (BTU) Cottbus, Germany, in 1994 and 2014, respectively.

He joined SUSS MicroTec Test Systems (from January 2010 Cascade Microtech) in 2001 where he held various engineering, product management and marketing positions. He significantly contributed to the development of the RF wafer probe, the |Z| Probe, wafer-level calibration standards, calibration software and probe systems. At Cascade Microtech, he was RF Probes Product Manager and, after successful completion of the SUSS/Cascade RF products consolidation, he joined Systems Business Unit in 2011. As Product Marketing Manager of Device Characterization for Modeling and Process Development he was responsible for Elite300 system product line. In March 2013, he joined Ulrich L. Rohde Chair for RF and Microwave Techniques at Brandenburg University of Technologies (BTU), Cottbus, Germany. Dr. Rumiantsev is currently with MPI Corporation, holding a position of Director of RF Technologies of the Advanced Semiconductor Test Division. His research interests include RF calibration and wafer-level measurement techniques for advanced semiconductor devices and related metrology aspects.

Dr. Rumiantsev is a member of the IEEE MTT-3 Microwave Measurements Committee and the ExCom member of Automatic RF Techniques Group (ARFTG). He is the past ExCom member and Chair of the Modeling and Simulation Sub-Committee of IEEE Bipolar/BiCMOS Circuits and Technology Meeting (BCTM), TPC member of BCICTS, past Technical Program Chair of ARFTG-92nd and ARFTG-93rd, the General Chair of ARFTG-94th and General co-Chair of ARFTG-96th conferenced. He is the Chair of IEEE MTT-S P2822 Working Group “Recommended Practice for Microwave, Millimeter-wave and THz On-Wafer Calibrations, De-Embedding and Measurements".

He holds multiple patents in the area of wafer-level RF calibration and measurements techniques. Dr. Rumiantsev received the ARFTG-71st Best Interactive Forum Paper Award. His doctoral thesis was awarded as “Best Dissertation of 2014 at Brandenburg University of Technologies”.

Marc Vanden Bossche

Marc Vanden Bossche received the degree of electrotechnical - mechanical engineer from the Vrije Universiteit Brussel (VUB), Brussels, Belgium in 1984 and the Ph.D. degree from the same university in electrical engineering in 1990 focusing on the foundation of high frequency large-signal network analysis.

From 1985 to 1987, he was a Research Assistant of the National Fund for Scientific Research, Belgium, before joining the Hewlett Packard Company in 1987 working towards his PhD. In 1991 he established a Hewlett Packard R&D team in Belgium continuing to work on characterization and system-level modelling tools for high frequency nonlinear electrical components. In collaboration with NIST, a phase calibration standard was established in the second half of the 90's merging network and signal analysis. As part of Agilent Technologies, he led the team, developing large - signal network analysis tools for RF, microwave and high-speed digital components, resulting into the nonlinear capabilities of the VNA. In June 2003 Marc founded NMDG to develop, commercialize and evolve large-signal characterization services and solutions. NMDG was acquired by National Instruments in October 2012. At NI, team and himself introduce vector calibration techniques into the NI RF production test systems. Presently he is technically leading forth looking projects related to realistic wideband and over the air characterization.

Marc is senior IEEE member and member and 2022 vice chair of MTT-3 - Microwave Measurements Committee. He was a corecipient of the 2002 ARFTG Technology Award and recipient of two ARFTG Best Paper Awards and is author of 10 patents

See you again at the ARFTG-99th Conference!

99th ARFTG Microwave Measurement Conference

From Fundamental to Cutting-Edge Microwave Measurement Techniques to Support 6G and Beyond

Colorado Convention Center, Denver, CO, USA, June 24th, 2022

www.arftg.org

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CALL FOR PAPERS

The 99th ARFTG Microwave Measurement Conference, which is part of IMS week 2022, will be held at the Colorado Convention Center in Denver, Colorado with an exciting collection of measurement topics to be presented. The theme for this conference is:

"From Fundamental to Cutting-Edge Microwave Measurement Techniques to Support 6G and Beyond"

Technical papers are solicited describing original work in areas of measurement for state-of-the-art and next-generation technologies for communications and sensing including, but not limited to:

- Millimeter-wave Over-the-Air (OTA) and MIMO Characterization
- Millimeter-wave Modulated Waveform Measurements
- On-Wafer Techniques up to Terahertz Frequencies
- Techniques for Connector-less Environments

Topics of interest always include:

- RF/Digital Mixed-Signal Measurement and Calibration
- Nonlinear / Large-Signal Measurement and Modeling Techniques
- Traceability in Calibrations and Measurement Uncertainty
- Material Properties Characterization
- Applications and Advances in Vector Network Analysis

Deadlines

February 11th, 2022	Paper summary due in PDF format.
March 11th, 2022	Paper acceptance and classification will be communicated
April 1st, 2022	Publication-ready paper is due in PDF format

Instructions for Authors

Contributed papers will be presented as 20-minute talks or in an interactive poster session. The final version of the papers will be published in the conference proceedings, and will be submitted as well to IEEE Xplore, provided it has been presented during the conference

We request that authors submit a 4-page summary paper with supporting figures of both experimental setups and measurement results to enable evaluations of the novelty of the work. More details and submission instructions can be found at:

http://www.arftg.org/index.php/upcoming-conference/author-instructions.

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