INSTITUTE OF ELECTRODYNAMICS, MICROWAVE AND CIRCUIT ENGINEERING

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WWTF – Vienna Science and Technology Fund

CURRENT RESEARCH AREAS: SYNOPSIS

THz-Electronics group

The THz-Electronics group has been established at TU Wien in November 2016. The group was at the initial planning stage in 2016. The group is focused on the development of sources, detectors, components and complete systems for the THz frequency range. The specific research fields include physics of electronic and optoelectronic semiconductor devices, electromagnetic design of THz antennas and resonators, micro- and nano-fabrication technology, THz and microwave measurements, etc.

The primary focus of the group is on development of THz and sub-THz sources on the basis of the resonant-tunnelling diodes (RTDs). RTDs are the highest-frequency active electronic semiconductor devices, e.g, almost 2 THz RTD oscillators have been reported recently. However, much higher frequencies should be achievable with RTDs and we are aiming to

demonstrate that experimentally. We are investigating different types of RTD oscillators. The most simple version of the oscillators consists of a resonant slot antenna integrated with an RTD. Such oscillators usually require a Si lens for out-coupling and collimation of the emitted radiation. A more complicated version of oscillators we are looking at is also based on slot-antenna resonators with RTDs, but it is fabricated on a thin dielectric membranes and includes an additional planar antenna integrated with the resonator. Such oscillators are much more compact and could be as small as a fraction of mm^2. Another type of RTD oscillators we are studying is constructed in a different way. It is a microstrip travelling-wave RTD oscillator. Conceptually it is similar to a quantum cascade laser (QCL) with the difference that it has a single "cascade" (RTD layers) as its active core, instead of usually 100 cascade periods in QCLs. The microstrip RTDs should, in principle, provide higher output power than the lumped-element RTD oscillators. The group is working on design of different types of THz RTD oscillators, their fabrication technology and THz characterisation.

The group is also investigating photomixing THz sources, detectors and systems. Such systems are based on two (usually tuneable) lasers with a bit different frequencies. The radiation of the lasers is combined together, that leads to a beat note in the combined laser beam. By tuning the difference frequency of the lasers, one can easily tune the optical beat note frequency to be in the THz range. Further, one illuminates a photomixer with the optical beam to generate THz radiation. We are working with conductive photomixers, which are based on the fast photodiodes or they could be also based on photoconductors with very short charge-carrier lifetimes. We are working on the design of THz photomixers and on development of the photomixing systems.

Biomedical Sensing Group

Nerve stimulation

Research activities of the group in the year 2016 included investigations of physiological autonomic effects of the electrical stimulation of the auricular vagal nerve. In particular, chronic wounds in diabetes - local perfusion and their healing - were in the focus within the scope of a designed, operated and already completed clinical study (ethic-approved). Hybrid biosignals were recorded and analysed, incl. heart rate variability and blood flow index. Based on this, personalized treatment concepts and prototypes were developed.

A Spin-Off named Szelestim GmbH was co-founded for the realization of novel stimulation devices, stimulation patterns and application concepts. Animal, numerical and human data were established, analysed and published.

Electrical impedance tomography (EIT)

It is about an imaging method to observe the lung function in clinics in real time. Resulting images are not ready yet for praxis, whereas reverse reconstruction algorithms are still in development. Based on a WWTF project with the Vienna Medical University, reconstruction is significantly improved with computer tomography – in terms of a novel CT-enhanced EIT – to individualize and thus improve images. In addition, another cooperation with University Clinic in Hamburg-Eppendorf favoured EIT use in the assessment of body hemodynamic, e.g., localization of aorta.

Apnea research

Physiological phenomena within the body are analysed in detail while being recorded with non-invasive multiparametric sensors. Individual reactions of the body to voluntary apnea are focussed on.

Perioperative monitoring

Status of the autonomic nervous system is recorded before, during and after surgical procedures for prediction of a potentially impaired cardiovascular status. Recording were jointly performed with the Medical University of Vienna, with advanced and proprietary SW and special device settings.

Prenatal monitoring

ECG recordings were done at the prenatal station of the General Hospital of Vienna with electrodes located on the bell of pregnant woman to assess coherence and empathy between the mother and fetus based on the heart variability changes.

CIRCUIT ENGINEERING GROUP

EASET

The influence of high-energetic particles on ICs is investigated in this FWF project as partner of Prof. Steininger from E182. The work conducted by E354 in 2016 can be divided into the design and characterization of the 2nd generation of the test ASIC, microbeam experiments, experimental data processing, and continuing to develop and refine the 3D semiconductor model in 90nm & 65 nm CMOS.

The design of the 2nd ASIC focused on reducing the power consumption, noise, and improve bandwidth and gain, while keeping the achieved linearity. Re-evaluating design goal priorities allowed this through reducing the number of stages in the signal path, reducing the number of elements that are ON during the operation, and by re-optimizing the design parameters of the building blocks. Additionally, the set of target circuits was extended to include:

- Ring oscillator with 4 programmable oscillation frequencies
- NAND and NOR based SR latches
- Schmitt trigger (as a standalone target as well as an improvement to the existing shift register and Muller-C targets)
- XOR and XNOR gates from the digital library
- Additional inverter chains, that were left out from the 1st ASIC

In 2016, the setup for microbeam experiments was further improved to allow better and faster calibration of the multiplexer gain for each individual target during the experiments. Additionally, the serial interface for controlling the multiplexer state has been updated for the 2nd ASIC to include new targets and handling of the ring oscillator configuration. We were again granted two beam-times at the micro-beam facility at GSI in Darmstadt, Germany. In both experiments the 1st version of the EASET test ASIC was used.

During the first beam-time in April 2016, a gold beam with 945.6 MeV was available. During this time the additional targets could be scanned compared to the November 2015 experiment, while some targets were irradiated again to gather more data and improve statistics.

In June 2016 we were granted a second beam time with calcium ions with 230.4 MeV. Calcium ions produce weaker effects than gold in the test ASIC. Additional data were collected during this time to complement the August 2015 experiment data. The most important targets were scanned with a much smaller step size, providing more traces and more reliable statistics.

A part of collected experimental data was processed during the year of 2016. The position-dependent data from inverter chain targets provided insight into the influence of inverter spacings on the single-event cross sections, which was presented as a poster at the RADECs conference held in Bremen, Germany, from 19th to 23rd of September 2016. An extended paper that further investigates the charge sharing mechanism and its influence on the pulse

propagation in the same set of targets was submitted and later published in the Transactions on Nuclear Science (TNS) journal. Further data analysis is ongoing and additional publications are to follow.

The 3D semiconductor model for 90nm CMOS was refined and now matches the experimental results very well. This model helped to explain why some of the measured SETs seemed to have the wrong polarity. We could show that large shifts of the potentials of the wells, where the transistors are placed in, can explain the observed SET polarities well.

Additionally, the work on the development on the 3D semiconductor model in 65 nm CMOS continued.

eRAMP/Excellence in Speed and Reliability for More than Moore Technologies

In this ENIAC project actually two projects are contained:

In WP2 (Design for X in pilot line) with AMS AG as project partner, DC/DC converters were designed by TU Wien, which enable a smaller volume of the converters by three-dimensionally integrating the passives on top of the CMOS chips. A 0.18µm high-voltage CMOS process was used to scale the efficiency advantageously. The measurements at the fabricated DC/DC converters were rather difficult. Improvement of the measurement setup was necessary. Then the measured efficiency of the DC/DC converters was lower than expected from circuit simulations. Finally, however, the difference could be explained successfully by the ESD protection circuit, which must not be used in connection with the bootstrap circuit needed for driving the high-side power NMOS switching transistor in the buck converter. The design kit for the 0.18µm high-voltage CMOS developed by AMS for fast ramp was verified by TU Wien and the demonstrator 4 (DC/DC converter with 3D-integrated passives) was designed successfully; both these major goals were achieved by TU Wien. Three conference publications were made in the project from WP2 results (WP6).

In WP3 (High performance simulation environment for 1st time right in pilot line) with Infineon in Villach and Munich as project partners, TU Wien has achieved considerable simulation methodology improvements via three possible scenarios by programming MATLAB implementations: 1) The use of an optimal design of experiments at the simulation input space instead of random selection of input parameters. 2) Developing a stimuli optimizer in a closed-loop simulation scheme based on fast learning concepts instead of the traditional open-loop input/output simulation scheme for stimuli analysis. 3) The use of effective data extraction and statistical sensitivity analysis methods for faster convergence and optimal utilization of simulation results as compared to the state-of-the-art. The achieved simulation methodology improvements have been verified and evaluated using different concepts and circuit examples. It was possible to detect the parameters, which have the largest influence on the circuits. A new solution for non-linear circuit problems, which can be implemented in Infineon's circuit simulator TITAN, was found. One conference publication (WP6) was made in 2016 from WP3 results.

Electronic-photonic Integration/IRIS

In the European project IRIS a photonic wafer and an electronics CMOS wafer are connected via copper pillars. The photonic layer contains ring resonators as optical switches between input and output waveguides. In total more than 800 ring resonators have to be heated individually and independently (to bring them into resonance or to far from resonance) and controlled simultaneously. The circuit engineering group of EMCE is responsible for all the electronics needed for controlling the optical switches.

Three different approaches for heater control were investigated: analog, digital (pulse width modulation, PWM) and hybrid (analog input and digital PWM output). The best approach was

selected and integrated in a multi-node IC in STM's BCD8sp BCD technology with more than 800 switching nodes. The electrical behavior of the fabricated IC was successfully experimentally characterized.

A offchip control loop was closed with a microcontroller. Programming of the microcontroller for the multi-node heater control also had to be done by EMCE. EMCE also supported the partners with PCB design for the demonstrator and the packaging partner UPVLC with floorplanning, choice of package, mounting of TEC and fiber arrays. The very high complexity of the project needed a huge amount of communication and many iterations.

In 2016 a paper was published in IEEE J. Selected Topics in Quantum Electronics (*Design and Implementation of an Integrated Reconfigurable Silicon Photonics Switch Matrix in IRIS Project*) and another one in Electronics Letters.

Electronic-photonic Integration/PHELICITI

Im FFG-Projekt Pheliciti werden erstmals Ringresonatoren als Modulatoren für binäre und 4-PAM Datenübertragung verwendet. Die Arbeitsgruppe Schaltungstechnik entwickelt einen Ringmodulatortreiber und optische Empfänger, die sowohl für binäre als auch 4-PAM Modulation geeignet sind. Mit 0,35µm SiGe BiCMOS Technologie werden Datenraten von 10Gbit/s erreicht. Es wurden elektronische Testchips im Jahr 2016 entworfen, bei AMS hergestellt und am EMCE elektrisch charakterisiert. Die Integrationsmethode des Oxidbondens in Pheliciti ermöglicht eine sehr geringe parasitäre Kapazität der elektrischen Verbindung zwischen Ringmodulator und Modulatortreiber bzw. zwischen Ge-Fotodiode und Transimpedanzverstärker. Dadurch kann die Emfängerempfindlichket gegenüber dem State-of-the-Art deutlich verbessert werden. Die 3-D Integration der bei CEA LETI hergestellten photonischen Komponenten verzögerte sich aufgrund technischer Probleme bei diesem Projektpartner erheblich. Die Ergebnisse der elektrischen Charakterisierung konnten jedoch in IEEE J. Selected Topics in Quantum Electronics (*10 Gb/s Switchable Binary/PAM-4 Receiver and Ring Modulator Driver for 3-D Optoelectronic Integration*) veröffentlicht werden.

Optische Freiraumkommunikation

In dem TU-internen innovativen Projekt „Advanced Optical Wireless Communication System" wurden Avalanche Photodioden (APDs) in CMOS und BiCMOS OEICs untersucht sowie optische Empfänger realisiert, die im Doktoratskolleg *Cyber-Physical Production Systems* im Teilprojekt „Communication at High Data Rates in Harsh Production Environments" in der optischen Freiraumkommunikation eingesetzt werden.

Die APDs zeichnen sich durch eine dicke Absorptionszone und damit durch eine hohe Fotoempfindlichkeit aus. Aufgrund der Verstärkung der APD konnte der Fotodiodendurchmesser auf 200µm bzw. 400µm erhöht werden, ohne die Empfängerempfindlichkeit bei 2Gbit/s unter -30dBm zu verschlechtern. Es wurden zwei Publikationen aus dem innovativen Projekt zu einem integrierten Empfänger mit einer 200µm großen APD (Electronics Letters) und zu einem mit 400µm großer APD (IEEE PTL) veröffentlicht. Bei der Freiraumkommunikation wurde bei einer Distanz von 6,6m eine Datenrate von 2Gbit/s erreicht. Die Ergebnisse der Freiraumexperimente wurden in Optics Express publiziert.

Optische Empfänger mit Single-Photon Avalanche Dioden (SPADs)

SPADs ermöglichen aufgrund ihrer extrem hohen Verstärkung die Digitalisierung optischer Empfänger und die Elimination des elektronischen Rauschens. Das erklärte Ziel in diesem vom FWF geförderten Projekt SPOR ist die Verkleinerung der Lücke in der Empfindlichkeit optischer Empfänger zum Quantenlimit.

SPADs, SPAD Arrays, eine aktive Quencher-Schaltung und acht verschiedene Empfängerschaltungen in 0.35µm PIN-Fotodioden CMOS Technologie wurden im Jahr 2016 entworfen. Ausführliche Untersuchungen unter Zuhilfenahme von Bauelementesimulationen ergaben, dass die Isolationsfähigkeit der 0.35µm PIN-Fotodioden CMOS Technologie ausreicht, um SPADs und Quencher- sowie Empfängerschaltungen auf dem gleichen Chip zu integrieren. Es war deshalb nicht notwendig, eine Hochvolt-CMOS Technologie zu verwenden. Es wurde die Standarddotierung (n+, p-Wanne, p- Epi, p+ Substrat) und Modulationsdotieren (reduzierte Dotierung in der p-Wanne) bei den SPAD Entwürfen in den Layouts realisiert. Bei den SPAD Array Layouts wurden unterschiedliche Anzahlen von SPADs und unterschiedliche Abstände zwischen den SPADs untersucht. In den Empfängerschaltungen wurden SPAD und Quencher Arrays in 4, 6, 7 und 9 Kanälen mit unterschiedlicher SPAD-Fläche eingesetzt. Die Schaltungen wurden simuliert, layoutet, verifiziert und es wurden Postlayout Simulationen durchgeführt, um auch den Einfluss von Parasiten auf das Schaltungsverhalten zu berücksichtigen. Es stehen alle Quencher-Ausgangssignale zur Charakterisierung zur Verfügung. Die einzelnen Kanäle sind jedoch auch auf den Chips mit digitaler Kombinationslogik verknüpft, so dass auch ein kompletter Bit-Strom für die Bit-Fehleranalyse zur Verfügung steht. Die Quencher-Schaltung zeichnet sich durch die Verdopplung der Quencher-Spannung auf 6,6V aus; dies ist unter Ausnutzung von Kaskodentransistoren möglich. Die integrierten Komparatoren und aktiven Quencher wurden auf eine Totzeit von 4ns optimiert. Alle Ausgänge wurden mit Treibern ausgestattet, um die Messungen mit 50-Ohm Equipment durchführen zu können.

Zusätzlich zu den Empfängern mit aktiven Quenchern wurden Empfänger mit zwei verschiedenen Arten von Gatern untersucht und entworfen. Der erste Gater eignet sich für diskrete SPADs und kann laut Simulationen bis ca. 1 GHz getaktet werden. Der zweite Gater steuert integrierte SPADs an. Ein Rail-to-Rail Komparator ermöglicht die Verwendung stark unterschiedlicher Entscheiderschwellen. Beide Gater-Arten verwenden kaskodierte Transistoren und ermöglichen Gater-Spannungen von bis zu 6,6V, der doppelten nominellen Versorgungsspannung der 0.35µm CMOS Technologie.

Es wurde ein Tapeout im Juli 2016 durchgeführt. Während des Herstellungsprozesses der ASICs wurde die aus CW Laser und externem Modulator bestehende Lichtquelle mit hohem Extinktionsverhältnis mit einer Wellenlänge von 635nm aufgebaut. Ferner wurden rote RC-LEDs und zwei unterschiedliche Treiberschaltungen bestellt und charakterisiert. Eine spezielle Dunkelkammer mit Probenhalterung und Faserjustiereinrichtung wurde konstruiert, um Hintergrundlicht bei der Charakterisierung der SPAD-Empfänger auch auf der Ebene einzelner Photonen sicher auszuschließen. Es wurden im Oktober zwei Wafer geliefert. Nach dem Sägen und Drahtbonden sowie dem Bestücken der Testplatinen begannen die Messungen an den Testchips.

Aufgrund der kaskodierten Quencher konnte die Photonennachweiswahrscheinlichkeit der SPAD bei 635nm auf 36,7% gesteigert werden. Bei 850nm wurde eine Photonennachweiswahrscheinlichkeit von 22% gemessen und damit ein dreifach höherer Wert als in der Fachliteratur erreicht.

Mit der Entwicklung des Bit-Fehlermodells der SPAD-Empfänger wurde begonnen. Es bildet das SPAD-Empfängerverhalten schon qualitativ ab und erlaubt bereits einfache Vorhersagen zu neuen Entwürfen.

Zusammenfassend kann festgestellt werden, dass die Arbeiten in allen 5 Arbeitspaketen im Plan liegen. Ein Manuskript mit ersten Ergebnissen wurde bei Scientific Reports zur Veröffentlichung eingereicht.

Technical Magnetism

The focus of activities is given by the following fields of research:

Combined 2D/3D assembling of ultra-thin sensor bands *(with ABB-Transformers, Sweden; FWF-project "Mag Foil Sensors") -*

A computer-controlled assembler is developed that allows for the manufacturing of multiple sensors on a substrate foil of about 20 µm thickness and up to 1 m length. 2D printing technologies are combined with 3D ones, in specific ways for conducting and non-conducting print materials. Detected quantities comprise 3D magnetic induction components, mechanical strain (magnetostriction), temperature (energy losses) and vibrations. Minimum thickness of complex sensors take advantage of thin nano-crystalline or amorphous sensor-nuclei. The detector bands are designed for flexible arrangement in machine cores at different locations, connections to electronics being arranged externally. For diagnoses of machine faults, it is planned that the detector bands remain within the core in permanent ways, to be contacted in cases of demand.

Experimental analyses of magnetic machine cores *(with Siemens Transformers, Austria; FFG BRIDGE project "3D Core Loss") -*

The focus was put on 3D distributions of magnetic fluxes, energy losses, strains and audible noise generation in transformer cores assembled of novel laser-scribed silicon iron. We apply very different sensor types that partly are moved by a computer-controlled scanning system. This enables detailed analyses though fully-automatic over-night processing. As a main conclusion of current work, modern cores represent complex 3D systems, due to their multi-package design. The individual packages prove to be in interactions that vary with time. In comparisons to model cores, industrial cores reveal less defined mechanisms.

Numerical analyses of magnetic machine cores *(with ABB-Transformers, Sweden) -*

Apart from applying Finite Element Modelling (Comsol), the focus is put on MACC (multi-directionally nonlinear magnetic circuit calculation), a completely novel own methodology. With very rapid processing, it yields compact numerical images of flux distributions, including data on local flux distortions and dynamic rotational magnetization. For straight-forward optimization of the involved algorithms, the next step will be concentrated on theoretical aspects of modelling.

Rotational magnetization tests (with *JFE Steel Corp., Japan, and Nippon Steel & Sumitomo Metal Corp., Japan) -*

Rotational magnetization enhances both losses and audible noise in all three transformers, shunt reactors and rotating machines. With a world-wide unique hexagonal Rotational Single Sheet Tester (RSST), we characterize novel types of materials, e.g. of minimum thickness, with novel stress coatings, or for compact motors that are specifically designed for electro-mobility. The industrially relevant results of the RSST concern time patterns of induction vector and field vector, energy losses, magnetostriction and domain configurations.

To-be-standardized magnetic metrology (with *ABB-Transformers, Sweden) -*

Since more than hundred years, energy losses of magnetic materials are determined by means of testers that simulate complete magnetic circuits. In particular, this is valid for Single Sheet Testers and Epstein Frame Testers. In recent theoretical work, we found that these IEC-standardized testers exhibit systematic errors, since not considering dynamic changes of instantaneous flux distributions. We now developed a concept for a novel methodology that should enable "physically correct" results, actual demand coming from severe world-wide energy politics and from electro-mobility. The final target is to suggest the method for international standardization.

Microwave Engineering

The research of the microwave-engineering group spreads over a wide range of different topics. One is about designing communication systems and highly efficient power amplifiers, used for telecommunication applications. Therefore, the research is currently focused on robust aeronautical communication and the concept of digital transmitters. In this field, modelling plays a major part in the research of the group. Another expertise of the group is Radio Frequency Identification (RFID), especially for ranging applications. Furthermore, the research interests are complemented by material characterization for printed circuit boards (PCBs).

Device modelling

In many applications having a black box measurement based behavioural model is indispensable. These models offer high accuracy, but they often are not able to model nonlinear effects. X-parameter models offer the possibilities to provide such models, but there are several limitations, which concern modelling devices under highly mismatched environments and modelling memory effects.

The main research activities concern the generation of X-parameter models for highly mismatched environments, hence, load dependent X-parameters. Therefore, the focus was set on the generation of such models using a nonlinear vector network analyser including load pull techniques.

UHF RFID

For evaluation and verification of a novel time of flight (ToF) based ranging algorithm to be used with backscatter tags, an SDR platform was adapted. To further enable research on MIMO based localization, the SDR testbed was extended with an RF and baseband synchronization. Furthermore, with our partner NXP a custom tag was developed which can be used for ranging on 2.4GHz. Additionally, tag pattern measurements in an anechoic chamber were conducted to analyse the frequency dependent reflection coefficient, which plays an important role for the localization accuracy.

HF RFID

The enhancement and implementation of a novel resonance frequency measurement method for 13.56 MHz RFID transponders was part of the research. Therefore, the goal is to develop a tool, which fulfills all requirements in terms of accuracy, reproducibility, execution time and usability. This includes analysis and improvement of the existing measurement method, definition and simulation of the test procedure, determination of the measurement uncertainty, as well as integration into the test bench.

Material characterization

Knowledge of the electrical characteristics of dielectric material is from great interest, especially for high frequency operation. Therefore, different types of substrate material were analysed regarding their dielectric properties up to 110 GHz. This was done by using wafer prober measurements with custom landing pad and TRL calibration to mitigate the influence of the probes.

Based on the measurements and additional simulations, analytical models for the dielectric properties were developed.

Digital Transmitters

Digital transmitters are a radical concept for building flexible transmitters, which are able to operate on high data rates. For the design of such digital transmitters a co-design of all the components is necessary, hence, an accurate model of the circuit in necessary for the design.

However, due to the architecture of such transmitters load modulations leads to deep memory, which is hard to model.

To handle such deep memory a look-up-table based model was developed in order to provide a stable and accurate model for such a circuits. This is possible due to a limited signal space of the modulator, hence, the model was generated by using measurements on an actual transmitter.

Robust aeronautical communication

To meet the needs for sustainable air traffic growth a modernisation of the air traffic management is required. Therefore, one research focus of the microwave group is set on designing a robust aeronautical communication system in the L-band. Currently, the focus is on the receiver design. Therefore, interference mitigation was emphasised particularly since in the L-band many frequency bands are already in use like for example aircraft surveillance and navigation systems.

For the design of the receiver, Bit-error rate simulations for typical aeronautic scenarios were carried out in order to get insight on the desired performance. Also focus was set onto system synchronization for low SNR scenarios, since it is a major part for a functioning and robust receiver.

Low elevation channel capacity

For designing communication systems, the environment is an important factor. This means, important properties like coverage, range and maximum data rate are influenced.

Consequently, one research focus of the microwave engineering group is in analysing common communication systems, which operated mainly in the ISM bands at 2.4 GHz and 5.8 GHz. Therefore, the maximum range under the condition of fulfilling the maximum permitted transmission power by regulation is carried out, under the consideration of transmitting HD videos. Special attention was taken on the influence of the low installation height of mobile antennas as well as the used modulation scheme. Based on the gained results an optimum modulation scheme for the data transmission under a specific data rate can be estimated.

NOMINATIONS AND AWARDS

Seal of Excellence for the project "*From pills to a bio-electronic device: a wearable to treat and prevent chronic wounds and pain, with no side-effects*" from EU H2020

Best Masterthesis Award of ETIT: Konstanze Krommer "*Evaluation of Anesthesia Fitness in High Risk Patients by Voluntary Apneas*" in Kooperation mit der Medizinischen Universität Wien

EVENTS

Proposer and organizer of a Workshop on Vagus Nerve Stimulation within EU COST Action BM1309: European network for innovative uses of EMFs in biomedical applications (EMF-MED), Warsaw, Poland, 2016-2017.

International Conference of Austrian, German, and Swiss Societies for Biomedical Engineering, Co-chair and reviewer for the track "Biosensors and Bioanalytics" of International Conference of Austrian, German, and Swiss Societies for Biomedical Engineering (BMT 2016)

Joint International Conference of Bioelectromagnetics Society and the European Bioelectromagnetics Association (BIOEM 2016), Reviewer for the Joint International

Conference of Bioelectromagnetics Society and the European Bioelectromagnetics Association (BIOEM 2016)

COURSE PROGRAM

Academic year 2016

COMPULSORY SUBJECTS

351.009	UE	Elektrotechnik 1	3.0	WS	SS	Schönhuber
351.011	VO	Elektrotechnik 2	3.0	---	SS	Schönhuber
351.012	UE	Elektrotechnik 2	3.0	WS	SS	Goll
351.018	VO	Technik und Gesellschaft	2.0	--	SS	Buchinger
351.019	VU	Elektrodynamik	3.0	--	SS	Prechtl
354.059	LU	Labor RF Techniques	2.0	--	SS	Arthaber
351.008	VO	Elektrotechnik 1	3.0	WS	--	Schönhuber
354.019	VU	Schaltungstechnik	2.0	--	WS	Zimmermann
354.026	VU	Analoge Integrierte Schaltungen	2.0	WS	--	Zimmermann
354.058	VU	RF Techniques	4.0	WS	--	Arthaber
354.062	UE	Labor Analoge integrierte Schaltungen	2.0	--	SS	Schneider-Hornstein
351.015	VU	Signale und Systeme 1	3.0	WS	--	Prechtl
354.040	VO	Projektmanagement	2.0	--	SS	Lorenz
354.995	PR	Bachelorarbeit mit Seminar	10.0	WS	SS	Dietrich, Arthaber

OPTIONAL SUBJECTS

354.043	PA	Biomedical Instrumentation & Signals	6.0	WS	SS	Kaniusas
354.001	VO	Schnelle Messsignalverarbeitung	1.5	WS	--	Griesmayer
351.029	PR	Biomedical Sensors ans Signals	2.0	WS	SS	Kaniusas
354.000	KO	Messgeräte der Hochfrquenztechnik	1.5	--	SS	Ehrlich-Schupita
354.005	PV	Privatissimum für Doktoranden	2.0	WS	SS	Zimmermann
354.007	PV	Privatissimum für Doktoranden	2.0	WS	SS	Magerl
354.008	SE	Diplomandenseminar	2.0	WS	SS	Zimmermann
354.015	SE	Diplomandenseminar	2.0	WS	SS	Magerl
354.049	VU	Functional Electrostimulation (theory and praxis 2)	3.0	--	SS	Mayr
354.066	VO	Optoelektronisch integrierte Schaltungen	2.0	--	SS	Zimmermann
354.067	SE	Neue Entwicklungen der integrierten Schaltungstechnik	2.0	--	SS	Zimmermann
354.072	SE	Seminar Mixed-Signal ICs	2.0	--	SS	Schneider-Hornstein
354.640	VO	Automatisierte Testsysteme				
354.996	PA	Projektarbeit (Übergangsregelung Bakk.)	2.0	WS	SS	Dietrich, Kaniusas
354.999	VU	Fachvertiefung – Computergesteuerte Messsysteme – Virtuelle Instrumentierung	4.0	--	SS	Dietrich
354.038	PV	Privatissimum für Dissertanten	2.0	WS	--	Kaniusas
354.039	PV	Privatissimum für Diplomanden	2.0	WS	--	Kaniusas
354.048	VU	Functional Electrostimulation (theory and praxis 1)	3.0	WS	--	Mayr
354.069	SE	Nanoelektronische Schaltungen	2.0	WS	--	Zimmermann
354.070	PV	Privatissimum für Doktoranden	2.0	WS	--	Griesmayer
354.073	VU	Biosignalanalyse mittels Matlab	2.0	WS	--	Kaniusas
354.261	VO	Konstr. Systemfähiger Messgeräte	1.5	WS	--	Kern

ELECTIVE SUBJECTS

354.028	VO	Integrierte Schaltungstechnik	2.0	--	SS	Zimmermann
354.042	VU	Biomedizinische Technik	2.0	--	SS	Kaniusas
351.027	VO	Biomedical Sensors and Signals	2.0	WS	--	Kaniusas
362.111	VO	Biophysik + SS	2.0	WS	--	Kaniusas
354.060	VU	Advanced RF Techniques	4.0	WS	--	Arthaber
354.064	VU	Schaltungstechnik Vertiefung	4.0	WS	--	Schneider-Hornstein
354.061	SE	Seminar RF Techniques	3.0	WS	--	Arthaber
354.065	SE	Schaltungstechnik	2.0	WS	--	Schneider-Hornstein
354.073	VU	Biosignalanalyse mittels Matlab	2.0	WS	--	Kaniusas

GUEST TALKS BY MEMBERS OF THE INSTITUTE

M. Feiginov, "*THz resonant-tunnelling diodes*", KTH Royal Institute of Technology, Stockholm, Sweden, November 2016.

M. Feiginov, "*THz resonant-tunnelling diodes*", University Duisburg-Essen, Duisburg, Germany, December 2016.

H. Zimmermann, "*Advanced analog and optoelectronic integrated circuits*", Summer School, Infineon, Villach, 30.08.2016

H. Zimmermann, "*From Integrated Optoelectronics to Electronic-Photonic Integration*", Vortrag: Seminar Science & Coffee, OSRAM, Regensburg, 11.2.2016

RESEARCH PROJECTS

Biomedical Sensing

2016-2021 International cooperation with MED-EL Elektromedizinische Geräte GmbH: Selective muscle and nerve stimulation, coordinator

2016-2019 Austrian Research Promotion Agency (FFG): Biomedical system for personal auricular neurostimulation - AuriMod, CTO SzeleStim GmbH and coordinator from TU Wien

2015-2017 International cooperation with Swisstom AG and University Clinics Hamburg-Eppendorf: Physiologic data acquisition, analysis and interpretation based on electrical impedance tomography and computertomography, coordinator

2015-2017 National cooperation with Medical University of Vienna: Physiologic data acquisition, analysis and interpretation in perioperative medicine, coordinator

2015-2018	Vienna Science and Technology Fund: Novel approach to individualized mechanical ventilation of critically ill patients through Computed Tomography-enhanced bedside Electrical Impedance Tomography Imaging, co-principal investigator
2014-2017	EU COST Action BM1309: European network for innovative uses of EMFs in biomedical applications (EMF-MED), member of management committee, working modules coordinator

Technical Magnetism

08.2015-07.2019	Magnetic Foil Sensors for Analyses in Transformer Cores (FWF Grant P 28481-N30) *Contact:* H. Pfützner, *Partner: ABB Transformers Sweden*
04.2012-03.2016	3-Dimensional Loss Distribution in Transformer cores (FFG Grant 2584 109) *Contact:* H. Pfützner, *Partner: Siemens Transformers Austria*

CIRCUIT ENGINEERING

04.2014-12.2017	EASET (FWF) *Contact*: H. Zimmermann *Partner*: E182, Prof. Steininger
04.2014-05.2017	eRAMP (ENIAC) *Contact*: H. Zimmermann *Partner*: AMS AG, Infineon AG
01.2014-12.2017	IRIS (EU, FP7) *Contact*: H. Zimmermann *Partner*: Ericson, ST Microelectronics, CEA-LETI, Univ. Pisa, Univ. Valencia, Univ. Trento, ETRI
01.2014-12.2017	PHELICITI (FFG, Produktion der Zukunft) *Contact*: H. Zimmermann *Partner*: AIT, AMS AG, CEA-LETI
01.2016-12.2019	SPOR (FWF) *Contact*: H. Zimmermann

Microwave Engineering

10.2014-09.2017	REFlex (FFG) *Contact:* Holger Arthaber, *Partner:* NXP, CISC, Enso Detego
02.2016-03.2017	Reichweite Funkübertragung (Auftragsforschung), *Contact:* Holger Arthaber, *Partner:* Mission Embedded
05.2016-02.2017	RFID Ranging Demonstrator (Auftragsforschung), *Contact:* Holger Arthaber, *Partner:* Kathrein
04.2011-01.2017	TX4Green (WWTF), *Contact:* Holger Arthaber
01.2014-12.2016	HF-PCB (Auftragsforschung), *Contact:* Holger Arthaber, *Partner:* AT&S
08.2015-09.2016	ChipCard (Auftragsforschung), *Contact:* Holger Arthaber, *Partner:* Infineon Graz

DOCTORAL DISSERTATIONS

Rolandas Gircys "*Development and study of a wearable real-time hemodynamic parameter monitoring system*", external expert at Kaunas University of Technology Betreuer/in(nen): E. Kaniusas; E354

M. Hofbauer "*Single Event Transients in 90nm CMOS*", Betreuer: H. Zimmermann, Gutachter: A. Steininger, Rigorosum: 27.09.2016

P. Brandl "*ICs for Optical Wireless Communication*", Betreuer: H. Zimmermann, Gutachter: E. Leitgeb, M. Gröschl, Rigorosum: 06.12.2016

DIPLOMA AND MASTER THESES

M. Schlegel: *"Untersuchung des Einflusses von LED-Belichtungssystemen auf die Entwicklung sekundärer Pflanzeninhaltsstoffe";* Betreuer/in(nen): E. Kaniusas; E354, 2016; Abschlussprüfung: 18.11.2016.

J. Weber: "*Analysis of 24h Mobil-O-Graph pulse wave analysis measurements in a normative population cohort*"; Betreuer/in(nen): E. Kaniusas, B. Hametner, C. Mayer; Institute of Electrodynamics, Microwave and Circuit Engineering, 2016; Abschlussprüfung: 07.10.2016.

Christian Andreas Clodi: „*Thermographische Veränderungen während der perkutanen elektrischen Stimulation des Ramus auricularis nervi vagi bei Patienten mit diabetischem Fußsyndrom und gesunden Vergleichspersonen",* 2016, Abschlussprüfung an der Medizinischen Universität Wien

I. Matkovic: "*A nanocrystalline sensor for local induction measurements in laminated machine cores"*; Betreuer/in(nen): G. Shilyashki, H. Pfützner; Abschlussprüfung: 11.2016;

D. Amberger: "*LSNA Characterization and Calibration*"; Betreuer/in(nen): H. Arthaber, T. Faseth; E354, 2016; Abschlussprüfung: 14.04.2016.

T. Eitel: "*LTCC-Strukturen für Hochfrequenzanwendungen*"; Betreuer/in(nen): H. Arthaber, N. Leder; E354, 2016; Abschlussprüfung: 17.11.2016.

BOOKS AND BOOK CHAPTERS

M. Atef, H. Zimmermann: "*Optoelectonic Circuits in Nanometer CMOS Technology*"; Springer International Publishing, Switzerland, 2016, ISBN: 978-3-319-27336-5; 243 S.

PUBLICATIONS IN SCIENTIFIC JOURNALS

B. Hametner, C. Mayer, J. Köster, J. Weber, M. Reppel, K. Franzen, E. Kaniusas, S. Wassertheurer, K. Mortensen: "*Diurnal changes in central pressure and pulse wave parameters in healthy subjects*"; Artery Research, 16 (2016), S. 65.

S. Kampusch, E. Kaniusas, F. Thürk, D. Felten, I. Hofmann, J. Szeles: "*Device development guided by user satisfaction survey on auricular vagus nerve stimulation*"; Current Directions in Biomedical Engineering, 2 (2016), 1; S. 593 - 597.

E. Kaniusas, S. Kampusch, J. Szeles: "*Percutaneous auricular vagus nerve stimulation*"; European Journal of Translational Myology - Basic and Applied Myology (eingeladen), 26 (2016), 1; S. 57.

E. Kaniusas, F. Thürk, S. Kampusch, S. Traxler: "*Angehaltene Atmung aus physiologischer Sicht: Theorie, Experiment und Forschung*"; Caisson (eingeladen), 31 (2016), 2; S. 6 - 16.

C. Prahm, K. Eckstein, M. Ortiz-Catalon, G. Dorfner, E. Kaniusas, O. Aszmann: "*Combining two open source tools for neural computation (BioPatRec and Netlab) improves movement classification for prosthetic control*"; BMC research notes, 9(1) (2016), 429; S. 1 - 7.

F. Thürk, S. Kampusch, E. Kaniusas: "*Management Framework for Biosignals in Biomedical Studies: From Study Design to Data Statistics*"; IEEE Transactions on Instrumentation and Measurement, 65 (2016), 4; S. 776 - 782.

F. Thürk, A. Waldmann, N. Verdier, A. Wielander, C. Braun, E. Kaniusas: "*Assessment of regional lung filling characteristics by electrical impedance tomography and dynamic computed tomography. Experimental study in porcine lavage injury*"; European Journal of Anaesthesiology, 33 (2016), 54; S. 428.

F. Thürk, A. Waldmann, K. Wodack, C. Trepte, D. Reuter, S. Kampusch, E. Kaniusas: "*Evaluation of reconstruction parameters of electrical impedance tomography on aorta detection during saline bolus injection*"; Current Directions in Biomedical Engineering, 2 (2016), 1; S. 511 - 514.

F. Toemboel, A. Waldmann, S. Kampusch, C. Bardach, E. Kaniusas, S. Böhme: "*Assessment of tidal recruitment during inhalation by electrical impedance tomography and dynamic computed tomography - feasibility study in porcine model lavage injury*"; European Journal of Anaesthesiology, 33 (2016), 54; S. 409.

K. Wodack, F. Thürk, A. Waldmann, M. Grässler, S. Nishimoto, S. Böhm, E. Kaniusas, D. Reuter, C. Trepte: "*Identification of the aorta by electrical impedance tomography*"; Intensive Care Medicine Experimental, 4 (2016), 1; S. 165.

P. Brandl, T. Jukic, R. Enne, K. Schneider-Hornstein, H. Zimmermann: "*Optical Wireless APD Receiver With High Background-Light Immunity for Increased Communication Distances*"; IEEE Journal of Solid-State Circuits, vol 51 (2016), S. 1663 - 1673.

R. Enne, M. Hofbauer, N. Zecevic, B. Goll, H. Zimmermann: "*Integrated analogue-digital control circuit for photonic switch matrices*"; Electronics Letters, vol 52 (2016), no 12; S. 1045 - 1047.

T. Jukic, B. Steindl, R. Enne, H. Zimmermann: "*200 µm APD OEIC in 0.35 µm BiCMOS*"; Electronics Letters, vol 52 (2016), 2; S. 128 - 130.

T. Jukic, B. Steindl, H. Zimmermann: "*400 µm Diameter APD OEIC in 0.35 µm BiCMOS*"; IEEE Photonics Technology Letters, vol 28 (2016), no 18; S. 2004 - 2007.

D. Milovancev, T. Jukic, P. Brandl, B. Steindl, H. Zimmermann: "*OWC using a monolithically integrated 200 µm APD OEIC in 0.35 µm BiCMOS technology*";Optics Express, vol 24 (2016), 2.

C. Sánchez-Azqueta, B. Goll, S. Celma, H. Zimmermann: "*Synchronous OEIC Integrating Receiver for Optically Reconfigurable Gate Arrays*"; Sensors, 6 (2016), 761; S. 1 - 6.

N. Tadic, B. Goll, H. Zimmermann: "*100 MHz current generator with T/(T-t) time waveform in 0.35 µm BiCMOS technology*"; Electronics Letters, vol 52 (2016), S. 744 - 746.

F. Testa, C. Oton, C. Kopp, J. Lee, R. Ortuno, R. Enne, S. Tondini, G. Chiaretti, A. Bianchi, P. Pintus, M. Kim, D. Fowler, J. Ayucar, M. Hofbauer, M. Mancinelli, M. Fournier, G. Preve, N. Zecevic, C. Manganelli, C. Castellan, G. Pares, O. Lemonnier, F. Gambini, P. Labeye, M. Romagnoli, L. Pavesi, H. Zimmermann, F. Di Pasquale, S. Stracca: "*Design and Implementation of an Integrated Reconfigurable Silicon Photonics Switch Matrix in IRIS*

Project"; IEEE Journal of Selected Topics in Quantum Electronics, vol 22 (2016), no 6, 3600314.

N. Vokic, P. Brandl, K. Schneider-Hornstein, B. Goll, H. Zimmermann: "*10 Gb/s Switchable Binary/PAM-4 Receiver and Ring Modulator Driver for 3-D Optoelectronic Integration*"; IEEE Journal of Selected Topics in Quantum Electronics, vol 22 (2016), no 6, 6100309.

N. Vokic, D. Milovancev, B. Goll, H. Zimmermann: "*Highly sensitive 10 Gb/s PAM-4 optical receiver circuit for three-dimensional optoelectronic integration*"; The Journal of Engineering, 2016 (2016), 4 S.

H. Pfützner, G. Shilyashki, E. Gerstbauer, G. Trenner, "*Multi-directionally non-linear magnetic equivalence circuit calculation (MACC) of rotational magnetization intensity in transformer cores*," *Int.J.Appl.El.Magn.Mech* 50, pp. 81-95 (2016).

G. Shilyashki, H. Pfützner, E. Gerstbauer, G. Trenner, P. Hamberger, M. Aigner, "*Numerical prediction of rhombic rotational magnetization patterns in a transformer core package*," *IEEE Trans.Magn.* 52*,* 7200110*,* pp.1-9 (2016).

G. Shilyashki, H. Pfützner, E. Gerstbauer, G. Trenner, P. Hamberger, M. Aigner, "*Inhomogeneity and local distortions of magnetic flux in a single-phase transformer core package*," IEEE Trans.Magn. 52, 7210109, pp. 1-9 (2016).

G. Shilyashki, H. Pfützner, P. Hamberger, M. Aigner, A. Kenov, I. Matkovic, "*Spatial distribution of magnetostriction, displacements and noise generation of model transformer cores,*" Int.J.Mech.Sci. 118*,* pp. 188-194, (2016).

H. Pfützner: "*Hot Nano Spots as an interpretation of so-called non-thermal biological mobile phone effects*," J.Electrom.Anal.Appl.8, pp. 62-69, 2016

Lambor, J. Lacik, Z. Raida, H. Arthaber: "*High-gain wideband SIW offset parabolic antenna*"; Microwave and Optical Technology Letters, vol 58 (2016), S. 2888 - 2892.

J. Puskely, J. Lacik, Z. Raida, H. Arthaber: "*High Gain Dielectric Loaded Vivaldi Antenna for K_a Band Applications*"; IEEE Antennas and Wireless Propagation Letters, vol 15 (2016), S. 2004 - 2007.

CONFERENCE CONTRIBUTIONS

CONTRIBUTIONS IN CONFERENCE TRANSCRIPTS

D. Milovancev, P. Brandl, N. Vokic, B. Goll, K. Schneider-Hornstein, H. Zimmermann: "*Optical Receivers in 0.35 µm BiCMOS for Heterogeneous 3D Integration*"; Vortrag: 19th IEEE International Symposium on Design & Diagnostics of Electronic Circuits & Systems, Kosice; 20.04.2016 - 22.04.2016; in: "*19th IEEE International Symposium on Design and Diagnostics of Electronic Circuits and Systems*", (2016), ISBN: 978-1-5090-2466-7;S. 35 - 39.

N. Mitrovic, R. Enne, H. Zimmermann: "*A Bootstrap Circuit for DC-DC Converters with a Wide Input Voltage Range in HV-CMOS*"; Vortrag: Microelectroncs, Electronics, and Electronic Technologies (MIPRO), Opatija, Croatia; 30.05.2016 - 03.06.2016; in: "*2016 39th International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO)*", (2016), S. 62 - 65.

N. Mitrovic, R. Enne, H. Zimmermann: "*High-Efficiency CMOS Buck Converter with Wide Output Voltage Range*"; Vortrag: Austrochip, Villach, Österreich; 19.10.2016; in: "*Austrochip 2016*", (2016), ISBN: 978-1-5090-1040-0; S. 13 - 18.

C. Sánchez-Azqueta, B. Goll, S. Celma, H. Zimmermann: "*Synchronous OEIC Integrating Receiver for ORGA applications*";Poster: 30th Eurosensors Conference, EUROSENSORS 2016, Budapest, Hungary; 04.09.2016 - 07.09.2016; in: "*Procedia Engineering*", Procedia Engineering / Elsevier, 168 (2016), ISSN: 1877-7058; S. 1291 - 1295.

G. Shilyashki, H. Pfützner, C. Huber, "*An ultra-thin printed sensor foil for Off-plane flux detection in transformer cores,*" peer reviewed short paper, *AIM 1*, P-031, pp. 1-2, Bormio, March 2016.

H. Pfützner, G. Shilyashki, G. Trenner, E. Gerstbauer, P. Hamberger, M. Aigner, "*Mixed core materials for transformers?,*" peer-reviewed short paper, *AIM 1*, P-024, pp. 1-2, Bormio, March 2016.

H. Pfützner, G. Shilyashki, "*Magnetic foil detectors - a novel sensor family for the assessment of the interior physical performance of laminated soft magnetic systems*," *Abstr*., *EMSA* 11, B01-05, p.1, Turin, Italy, July 2016.

H. Pfützner, G. Shilyashki, "*Magnetic Circuit Calculation (MACC) for effective interpretations of experimental analyses of soft magnetic core ,*" *Abstr*., *EMSA 11*, B03-19, p.1, Turin, Italy, July 2016.

H. Pfützner, G. Shilyashki, P. Hamberger, M. Aigner, "*A Flux-Bridge Model (FBM) for the interpretation of 3D flux distributions in multi-package transformer cores*," *Digest 1&2-D Magn. Meas. & Test.* 16, PE-5, pp. 1-2, Tianjin, China, September 2016.

G. Shilyashki, H. Pfützner "*3-Dimensional Measurements of Local Distributions of Induction and Distortion in a 3-phase, 3-package Model Transformer Core*," *1&2-D Magn. Meas. & Test.* 16, PE-3, pp. 1-2, Tianjin, China, September 2016.

H. Pfützner, G. Shilyashki, "*Concept for numero-experimental modelling of soft magnetic cores,*" *1&2-D Magn. Meas. & Test.* 16, OG-3, pp. 1-2, Tianjin, China, September 2016.

G. Shilyashki, H. Pfützner "*Nanocrystalline ribbons for induction measurements in laminated machine cores*," *1&2-D Magn. Meas. & Test.* 16, OC-3, pp. 1-2, Tianjin ,China, September 2016.

LECTURES AND POSTER PRESENTATIONS

E. Kaniusas, S. Kampusch, F. Thürk, M. Krenn: "*Optimization of waveform shapes for electrical neuromuscular stimulation based on conductive and displacement membrane currents*"; Vortrag: 12th Vienna International Workshop on Functional Electrical Stimulation, Wien; 08.09.2016 - 09.09.2016; in: "*Proceedings of 12th Vienna International Workshop on Functional Electrical Stimulation*", (2016), ISBN: 978-3-900928-12-4; S. 11 - 14.

E. Kaniusas, F. Thürk, S. Kampusch, A. Wielander, H. Prosch, F. Toemboel, S. Böhme: "*Lung aeration in EIT using probability-weighted respiration*"; Vortrag: 16th International Conference on Electrical Bio-Impedance and 17th International Conference on Electrical Impedance Tomography, Stockholm, Sweden; 19.06.2016 - 23.06.2016; in: "*Book of Abstracts of 16th International Conference on Electrical Bio-Impedance and 17th International Conference on Electrical Impedance Tomography*", Karolinska Institute, (2016), S. 123.

U. Pale, F. Thürk, E. Kaniusas: "*Heart rate variability analysis using different wavelet transformations*"; Vortrag: The 39th International ICT Convention - MIPRO 2016, Opatija, Croatia; 30.05.2016 - 03.06.2016; in: "*Proceedings of 39th International Convention (IEEE, MIPRO)*", (2016), S. 1930 - 1935.

F. Thürk, A. Waldmann, K. Wodack, M. Grässler, S. Nishimoto, C. Trepte, D. Reuter, S. Böhm, S. Kampusch, E. Kaniusas: "*Hypertonic saline injection to detect aorta in porcine EIT*"; Vortrag: 16th International Conference on Electrical Bio-Impedance and 17th International Conference on Electrical Impedance Tomography, Stockholm, Sweden; 19.06.2016 - 23.06.2016; in: "*Book of Abstracts of 16th International Conference on Electrical Bio-Impedance and 17th International Conference on Electrical Impedance Tomography*", Karolinska Institute, (2016), S. 121.

A. Wielander, C. Bardach, P. Agarwal, F. Thürk, F. Toemboel, E. Kaniusas, C. Braun, S. Böhme, C. Herold, H. Prosch: "*Critical Evaluation of lung ultrasound findings compared with dynamic computed tomography: Preliminary data*"; Vortrag: Scientific Assembly of Radiological Society of North America (RSNA 2016), Chicago; 26.11.2016 - 01.12.2016; in: "*Abstracts of Scientific Assembly of Radiological Society of North America*", (2016), S. 96.

D. Milovancev, P. Brandl, N. Vokic, B. Goll, K. Schneider-Hornstein, H. Zimmermann: "*Optical Receivers in 0.35 µm BiCMOS for Heterogeneous 3D Integration*"; Vortrag: 19th IEEE International Symposium on Design & Diagnostics of Electronic Circuits & Systems, Kosice; 20.04.2016 - 22.04.2016; in: "*19th IEEE International Symposium on Design and Diagnostics of Electronic Circuits and Systems*", (2016), ISBN: 978-1-5090-2466-7; S. 35 - 39.

N. Mitrovic, R. Enne, H. Zimmermann: "*A Bootstrap Circuit for DC-DC Converters with a Wide Input Voltage Range in HV-CMOS*"; Vortrag: Microelectroncs, Electronics, and Electronic Technologies (MIPRO), Opatija, Croatia; 30.05.2016 - 03.06.2016; in: "*2016 39th International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO)*", (2016), S. 62 - 65.

N. Mitrovic, R. Enne, H. Zimmermann: "*High-Efficiency CMOS Buck Converter with Wide Output Voltage Range*"; Vortrag: Austrochip, Villach, Österreich; 19.10.2016; in: "*Austrochip 2016*", (2016), ISBN: 978-1-5090-1040-0; S. 13 - 18.

C. Sánchez-Azqueta, B. Goll, S. Celma, H. Zimmermann: "*Synchronous OEIC Integrating Receiver for ORGA applications*"; Poster: 30th Eurosensors Conference, EUROSENSORS 2016, Budapest, Hungary; 04.09.2016 - 07.09.2016; in: "*Procedia Engineering*", Procedia Engineering / Elsevier, 168 (2016), ISSN: 1877-7058; S. 1291 - 1295.

H. Zimmermann: "*From Integrated Optoelectronics to Electronic-Photonic Integration*"; Hauptvortrag: Seminar Science & Coffee, OSRAM, Regensburg (eingeladen); 11.02.2016.

H. Arthaber: "*Ranging and Positioning of UHF RFID Tags*"; Vortrag: Rain Meetings, Graz (eingeladen); 22.02.2016 - 23.02.2016.

E. Auerbach, H. Arthaber, C. Abert, N. Leder, D. Süss: "*Measurement and Characterization of Nonlinearities in Magnetic Tunnel Junctions*"; Vortrag: 61st Annual Conference on Magnetism and Magnetic Materials, New Orleans, Louisiana, USA; 31.10.2016 - 04.11.2016.

N. Leder, B. Pichler, H. Arthaber: "*Hierarchical Table Based Model for All Digital RF Transmitters*"; Vortrag: 4th Workshop of the Radio Frequency Engineering Working Group of the Austrian Research Association, Villach; 17.10.2016 - 18.10.2016.

B. Pichler, N. Leder, H. Arthaber: "*Considerations on X-Parameter Model Extraction Based on High Power NVNA Measurements*"; Vortrag: 4th Workshop of the Radio Frequency Engineering Working Group of the Austrian Research Association, Villach; 17.10.2016 - 18.10.2016.

M. Zaisberger, H. Arthaber: "*BER and Synchronization Performance Simulation of an LDACS1 Receiver*"; Vortrag: 4th Workshop of the Radio Frequency Engineering Working Group of the Austrian Research Association, Villach; 17.10.2016 - 18.10.2016.

LECTURES AND POSTER PRESENTATIONS (WITHOUT CONTRIBUTION IN THE CONFERENCE TRANSCRIPT)

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