



Program
MAREW 2021
Microwave and Radio Electronics Week 2021
April 19 - 21, 2021



31st International Conference RADIOELEKTRONIKA 2021
20th Conference on Microwave Techniques COMITE 2021

Organizer



Under auspices



Radioengineering
Proceedings of Czech and Slovak Technical Universities



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WELCOME TO MAREW 2021

Dear participants,

This year's edition of the Microwave and Radio Electronics Week 2021 (MAREW 2021) consists of two traditional conventions – The 31st International Conference RADIOELEKTRONIKA 2021 and The 20th Conference on Microwave Techniques COMITE 2021.

The purpose of the three day event of the MAREW 2021 is to create a discussion forum for researchers, academics, people in industry, and students who are interested in the latest research and development in the area of electronics, signal processing and applications, information technologies, microwave techniques and related disciplines.

We have prepared interesting online plenary sessions from respected university professors and academia speakers on visionary topics. In advance, professionals from industry will also speak in the plenary about the future and challenging trends in the radio electronics and microwave techniques.

The technical program and plenary talks are organized by the Department of Radio Electronics, Brno University of Technology in cooperation with Czech and Slovak technical universities and also under auspices of the IEEE Czechoslovakia Section, U.R.S.I., Radioengineering Society and

Czech Electrotechnical Society. The online venue is located in the campus and facility of the Faculty of Electrical Engineering and Communication, Brno University of Technology.

I would like to thank all above mentioned partners for a good cooperation and also for the technical and financial support. Thanks to TPC members, local committee and organizers for their excellent work. Many thanks also to our sponsors. Special thanks are aimed to our colleagues at University of Pardubice for the web pages and in-house conference system that have been used very effectively but again improved this year.

The detailed program is scheduled to several plenary and conference sessions on next pages. I hope you will find MAREW 2021 inspiring and you will spend your time on listening interesting talks and discussing seriously all your related questions. In the meantime, please feel also mutual synergy between academia and industry, sharing of knowledge and social aspects of our meeting and event in general.

Welcome and enjoy your online time with us.

Tomas Kratochvil
General Chair

MAREW 2021 COMMITTEES

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University of Pardubice (CZ)
Slovak University of Technology in Bratislava (SK)
Czech Technical University in Prague (CZ)
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CONFERENCE OVERVIEW

MAREW 2021 Program					
MONDAY 19th April		TUESDAY 20th April		WEDNESDAY 21st April	
9 ⁰⁰ - 10 ³⁰	Opening + Plenary Session 1 Coffee Break (DIY)	9 ⁰⁰ - 10 ³⁰	Plenary Session 2 Coffee Break (DIY)	9 ⁰⁰ - 10 ³⁰	Plenary Session 3 Coffee Break (DIY)
10 ³⁰ - 11 ⁰⁰		10 ³⁰ - 11 ⁰⁰		10 ³⁰ - 11 ⁰⁰	
11 ⁰⁰ - 12 ³⁰	RADIO 2021 Signal Processing and Applications - SPA1 Coffee Break (DIY)	11 ⁰⁰ - 12 ³⁰	RADIO 2021 Signal Processing and Applications - SPA3 Circuits and Systems - CS Coffee Break (DIY)	11 ⁰⁰ - 12 ³⁰	COMITE 2021 Microwaves - MW Coffee Break (DIY)
12 ³⁰ - 13 ⁰⁰		12 ³⁰ - 13 ⁰⁰		12 ³⁰ - 13 ⁰⁰	
13 ⁰⁰ - 14 ³⁰	RADIO 2021 Signal Processing and Applications - SPA2	13 ⁰⁰ - 14 ³⁰	RADIO 2021 Information and Communication Technologies - ICT	13 ⁰⁰ - 14 ³⁰	COMITE 2021 Propagation - PROP Lightwaves - LW
				15 ⁰⁰ - 15 ³⁰	Closing Ceremony + Student Awards

MONDAY 19TH APRIL

Plenary sessions

9:00 - 10:30 Opening + Plenary Session 1

Chairs: Zbynek Raida, Tomas Kratochvil

9:00 - 9:45

Rodney Martinez Alonso

INTEC-WAVES Ghent University (Belgium) and LAC-ETEL (Cuba)

Multi-Objective Optimization of Dynamic Spectrum Access Networks

Abstract: The lack of spectrum availability for satisfying the exponential increase in wireless services demand has become an important concern in the wireless communication community. Paradoxically, several spectrum measurements campaigns have demonstrated that most of the spectrum is not in use or is sub-utilized. These surveys for different spectrum bands show that less than 20% of the spectrum is used at any given location and instant of time. The allocation of spectrum at higher frequency bands has a significant impact on the network investment and operational cost compared to the same technological solution at lower spectrum bands. The improvement of technologies' spectral efficiency has helped to cope with the inefficient static allocation of spectrum. However, there is not a wide margin for improving the spectral efficiency of communication technologies, considering that the state-of-the-art of radio technologies are just 1 dB from the Shannon limit. Hence, the main problem with spectrum scarcity is not related to the technology efficiency itself but how to use it efficiently.

Dynamic spectrum management might have a higher impact on the efficient exploitation of the spectrum. Cognitive radio has become a flexible solution to overcome spectrum scarcity by opportunistically exploiting the spectrum. Cognitive radio technologies allow dynamic access of the spectrum, by sensing, detecting and allocating empty portions of the spectrum. Television White Space (TVWS) technologies have been a leading technology in the field of dynamic spectrum access. TVWS technologies have taken advantage of the excellent propagation conditions in the Ultra High Frequency (UHF) band for providing cost-effective wireless connectivity solutions in rural and suburban underserved areas (e.g., Microsoft Airband Initiative). Beside TVWS applications, manufacturers like CISCO are using dynamic access technologies for managing the spectrum assignment in Wireless Local Area Networks based on WiFi. Similarly, Ericsson 5G platform will dynamically allocate the spectrum for 4G and 5G users.

In this context, we developed a multi-objective optimization algorithm for dynamic spectrum access networks based on cognitive radio technology. Pareto modelling is realized for quantifying the trade-off among three Key Performance Indicators (KPIs): power consumption, spectrum utilization, and global network exposure. Instead of the traditional distributed architecture for the spectrum management, a cloud-based architecture is considered in our network planning. Compared to the traditional cognitive radio network, the proposed architecture and optimization algorithm reduced the network power consumption by 27.5%, the average network global exposure by 34.3%, and spectrum utilization by 34.5% for the best trade-off among the three KPIs. The interference to the primary service is also reduced at least by 27% in rural and suburban areas. The centralized architecture also allows the coexistence of heterogeneous networks with different physical and medium access control layers, as the information exchange occurs in a higher layer.

9:45 - 10:30

Romain Zimmermann

Spirent

Invited talk provided by TR instruments company

A Low-Latency HIL Environment for Automotive Positioning, Navigation and Timing (PNT) Testing

Abstract: To navigate accurately and safely, Autonomous Vehicles (AVs) use multiple sensors and PNT technologies, among them GNSS and inertial sensors. To achieve the performance and accuracy required by an AV, these PNT systems must be thoroughly tested. While different test methodologies coexist, restrictions on real-world location testing, the cost of drive testing, and the critical nature of safety considerations makes simulation an appealing choice. During this presentation, we will share insights into realistic GNSS testing within a Hardware-in-the-Loop (HIL) set-up for automotive applications. We will then introduce a unique approach to simulating GNSS multipath and obscuration based on a true to life synthetic environment. Finally, we will discuss how to enable coherent simulation of GNSS and IMUs to test sensor fusion algorithms in the lab.

MONDAY 19TH APRIL

11:00 - 12:30 Signal Processing and Applications

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Session SPA1: RADIOELEKTRONIKA 2021 - Signal Processing and Applications 1

Chairs: Jitka Pomenkova, Tomas Kratochvil

SPA1/1: **DDS with Noise Reduction by Multiplier-Less Filter Methods**

Stefan Jahn, Hans-Georg Brachtendorf
*University of Applied Sciences Upper Austria
Austria*

SPA1/2: **A Technique of Reducing the RMS Measurement Error for the Low-Pass Filtration Method**

Andrey N. Serov, Nikolay A. Serov, Vadim A. Loginov
*National Research University "Moscow
Power Engineering Institute"
Moscow, Russian Federation*

SPA1/3: **Universal Approach for Estimating the RMS Measurement Error Caused by ADC Nonlinearity**

Andrey N. Serov
*National Research University "Moscow
Power Engineering Institute"
Moscow, Russian Federation*

SPA1/4: **A Plaintext-related Image Encryption Algorithm Usable in Biometric Systems**

Jakub Oravec, Lubos Ovsenek, Jan Turan
*Technical University of Košice
Košice, Slovakia*

SPA1/5: **Estimating the perceived audio quality based on Multigene Symbolic Regression for broadcasting systems and web-casting applications**

Martin Jakubik, Peter Pocta
*University of Zilina
Zilina, Slovakia*

SPA1/6: **Cross-content evaluations in the subjective quality assessment of light field images**

Adam Zizien, Karel Fliegel
*Czech Technical University in Prague
Prague, Czech Republic*

MONDAY 19TH APRIL

13:00 - 14:30 Signal Processing and Applications

Session SPA2: RADIOELEKTRONIKA 2021 - Signal Processing and Applications 2

Chairs: Milan Sigmund, Jan Kufa

SPA2/1: **Speaker recognition with ResNet and VGG networks**

Maros Jakubec, Eva Lieskovska, Roman Jarina
*University of Zilina,
Zilina, Slovak Republic*

SPA2/2 : **Shape Reconstruction of Multiple Objects – A Time-Domain Radar Imaging Technique**

Tomas Dolezal, Martin Stumpf
*Brno University of Technology
Brno, Czech Republic*

SPA2/3: **Image recognition using Spiking Neural Networks**

Erik Sadvovsky, Roman Jarina, Richard Orjesek
*University of Zilina,
Zilina, Slovak Republic*

SPA2/4: **Performance study of AV1 encoders and presets for 360-degree video in virtual reality**

Jan Kufa, Ladislav Polak, Tomas Kratochvil
*Brno University of Technology
Brno, Czech Republic*

SPA2/5: **SDR Interference Emulator for RFID Applications**

Michal Harvanek, Vojtech Derbek, Jan Kral, Martin Pospisil, Ales Povalac
*Brno University of Technology
Brno, Czech Republic*

SPA2/6: **Radio Modulation Classification Using Deep Learning Architectures**

Kristyna Pijackova, Tomas Gotthans
*Brno University of Technology
Brno, Czech Republic*

TUESDAY 20TH APRIL

Plenary sessions

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9:00 - 10:30 Plenary Session 2

Chairs: Tomas Fryza, Tomas Kratochvil

9:00-9:45

Eduardo Garro Crevillen

Universitat Politècnica de Valencia (Spain)

iNGENIOUS: Next Generation IoT for the Next-Generation Supply Chain

Abstract: In the last 10 years, Internet of Things (IoT) is deeply transforming every sector subject to be digitalized in a way that it is redefining the traditional way of living and working. One of the main verticals that has the potential to grow due to the introduction of IoT is the industrial sector, which ranges from manufacturing, to smart mobility and logistics, forming a complete end-to-end supply chain, and representing about one half of the global economy. However, new functionalities will be needed to support next-generation automation, or wide area track-and-trace operations with enhanced scalability compared to current IoT systems. IoT is therefore called to evolve into more trusted and energy-efficient smart networks and infrastructures by leveraging thriving technologies, piloting and applying technologies such as tactile and cognitive sensors and actuators, trustworthy Distributed Ledger Technologies (DLT), decentralised edge architectures, or future cost-effective communication systems based on Artificial Intelligence (AI) and Machine Learning (ML) to traditional supply chain. Under this paradigm, iNGENIOUS (Next-GENeration IoT sOolutions for the Universal Supply chain) will exploit some of the most innovative and emerging technologies in line with the standardised trend, contributing to the Next-Generation IoT, and proposing technical and business enablers to build a complete platform for supply chain management solutions. The project will bring to light a system-wide and global perspective that will pave the way for European parties to achieve a universal practical leadership capability.

9:45-10:30

Ezer Bennour

Invited talk provided by Rohde & Schwarz company

Oscilloscope-based solutions for Radar applications: use cases and benefits

Abstract: Modern radar architectures are showing a multitude of technological advancements that raise the need for more flexible testing approaches. Originally a pure analog domain, radar modules are getting more and more integrated and exhibit a variety of digital interfaces, especially with the extensive adoption of advanced Digital Signal Processing (DSP) techniques for a fast and accurate signal analysis. Furthermore, Sophisticated radar systems are increasingly relying on electronically steered phased array antennas. To characterize these types of systems, test equipment must exhibit multichannel capabilities and ensure that all channels are constantly phase-coherent. When characterizing and debugging their designs, developers of such systems are often looking for versatile instruments that can handle both their RF and digital test requirements and thus reduce the test effort and costs. In this context, state-of-the-art oscilloscopes represent a good fit by combining powerful RF signal analysis capabilities with a large set of features for signal integrity and digital interface test.

During this presentation, we will cover the current trends and measurement challenges related to modern radar systems and explore how oscilloscope-based solutions can significantly help addressing these challenges.

TUESDAY 20TH APRIL

11:00 - 12:30 Signal Processing and Applications Circuits and Systems

Session SPA3: RADIOELEKTRONIKA 2021 - Signal Processing and Applications 3

Chairs: Roman Marsalek, Jakub Gotthans

SPA3/1: **Prediction of Object Position from Aerial Images Utilising Neural Networks**

Jakub Gotthans, Tomas Gotthans, Roman Marsalek
*Brno University of Technology
Brno, Czech Republic*

SPA3/3: **Support Vector Machine - based classification of wireless transceivers**

Roman Marsalek, Kristina Youssefova, Martin Pospisil
*Brno University of Technology
Brno, Czech Republic*

SPA3/2: **Spectral Efficient Time-Domain Equalization Single-Carrier System**

Radim Zedka, Tomas Gotthans, Roman Marsalek
*Brno University of Technology
Brno, Czech Republic*

Session CAS: RADIOELEKTRONIKA 2021 - Circuits and Systems

Chairs: Jiri Petrzela, Roman Sotner

CAS/1: **Optimal Load Transient response of the Boost DC-DC converter based on the Stochastic Duty-cycle Sequence Generator**

Vratislav Michal
*STMicroelectronics
Grenoble, France*

CAS/3: **Design of High Frequency Oscillators for Ultra Wideband Systems**

Patrik Jurík, Miroslav Sokol, Pavol Galajda
*Technical University of Kosice
Kosice, Slovakia*

CAS/2: **Design of a 7-bit Flash AD Converter for M-Sequence UWB Sensor Systems**

Miroslav Sokol, Pavol Galajda
*Technical University of Kosice
Kosice, Slovakia*

CAS/4: **Voltage Tunable Building Blocks Using Compact Active Device in Design of Filtering Applications**

Roman Sotner, Jiri Petrzela, Lukas Langhammer
*Brno University of Technology
Brno, Czech Republic*

TUESDAY 20TH APRIL

13:00 - 14:30 Information and Communication Technologies

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Session ICT: RADIOELEKTRONIKA 2021 - Information and Communication Technologies

Chairs: Ales Prokes, Ladislav Polak

ICT/1: **Bit Error Rate Validation for Aeronautical Communication System LDACS for Higher Modulation Schemes**

Michael Zaisberger, Holger Arthaber
*TU Wien
Vienna, Austria*

ICT/4: **Reducing Memory Requirements of Convolutional Neural Networks for Inference at the Edge**

Tomas Bravenec, Tomas Fryza
*Brno University of Technology
Brno, Czech Republic*

ICT/2: **Heuristics for Program Code Optimization in Heterogeneous Systems**

Anna Voloshko, Alexey Ivutin, Alexander S. Novikov
*Tula State University
Tula, Russia*

ICT/5: **On the Performance of DVB-T2 MISO System: Special Fixed Transmission Scenarios**

Ladislav Polak, Jan Kufa, Roman Sotner, Tomas Kratochvil
*Brno University of Technology
Brno, Czech Republic*

ICT/3: **Concept for a Geo-Awareness-System for Civilian Unmanned Aerial Systems**

Stefan Kunze, Alexander Weinberger
*Deggendorf Institute of Technology
Freyung, Germany*

WEDNESDAY 21ST APRIL

Plenary sessions

9:00 - 10:30 Plenary Session 3

Chairs: Zbynek Raida, Tomas Kratochvil

9:00-9:45

Holger Arthaber
TU Vienna (Austria)

Spread-Spectrum based Ranging/Localization of UHF RFID Tags

Abstract: Ranging/Localization of passive RFID labels is an enabler for a multitude of applications. Commonly used approaches like RSSI or angle-of-arrival (AoA) show limited accuracy due to the used signals' narrowband nature and multipath propagation. The talk, therefore, introduces a new ranging concept, based on superimposing spread-spectrum signals to the legacy RFID communication. After presenting the underlying math, the talk discusses regulatory requirements before showing initial measurement results. Additionally, an SDR-based hardware platform is shown, used to study the algorithm's performance further. Finally, simulation and measurement results for both 1D-ranging and 2D-localization will be presented and the achievable accuracy is discussed.

9:45-10:30

Adam Pavlis
Invited talk provided by H TEST company

Analysis of ultra-wideband signals - signal analyzer vs. oscilloscope

Abstract: High-frequency ultra-wideband signals used in the latest rf technologies place high demands on the measuring instrumentation used during the development, testing and calibration of the new products. Traditionally, rf signal analyzers (SA) developed originally from swept spectrum analyzers played a key role in this area. Modern SAs can have a multi-GHz analysis bandwidth and they can in most cases still offer the best accuracy and signal integrity. Latest higher-end oscilloscopes somewhat change this by offering similar capabilities with even higher bandwidths and the possibility of multi-channel measurements.

In this presentation, we would like to talk about the N9042B UXA - the latest and the best signal analyzer currently available from Keysight Technologies. This instrument was introduced recently along with the new external "RCal" receiver calibrator which brings quite a significant innovation to this area. It can be used on frequencies up to 110 GHz to increase the measurement accuracy and remove the influence of all external signal path components present between the input of the SA and the DUT.

Next, we would mention the UXR – Keysight's (and world's) fastest and most advanced oscilloscope. This instrument can be used both as a traditional oscilloscope for example for analysis of the latest high speed communication buses and also as a multichannel ultra-high bandwidth signal analyzer. This is possible thanks to the superb signal integrity of this instrument and the new functions like the DDC (digital down-conversion) which fastens up signal processing and increases the available signal capture length.

WEDNESDAY 21ST APRIL

11:00 - 12:30 Microwaves

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Session MW: COMITE 2021 - Microwaves

Chairs: Jaroslav Lacik, Tomas Mikulasek

MW/1: **Broadband Target Simulator for FMCW Radar Sensors With Mirror Target Suppression**
Viktor Adler, Petr Ourednik, Premysl Hudec,
Karel Hoffmann
CTU in Prague
Prague, Czech Republic

MW/2: **An Excitation of Anisotropic Homogeneous Impedance Elliptic Metasurface by Electric or Magnetic Current Filaments**
Andrey I. Semenikhin, Diana V. Semenikhina
Southern federal university
Taganrog, Russian Federation

MW/3: **Stationary Phase Evaluation of Surface Wave Scattering by a Vertical PEC Plate**
Burak Polat, Ramazan Daşbaşı
Yıldız Technical University
Istanbul, Turkey

MW/4: **Analysis of Conical Horn Antenna Radiation over Ground by Directional Currents Method**
Burak Polat, Ramazan Daşbaşı
Yıldız Technical University
Istanbul, Turkey

MW/5: **Doppler Analysis of Dipole Antennas in Arbitrary Motion**
Burak Polat, Ramazan Daşbaşı
Yıldız Technical University
Istanbul, Turkey

MW/6: **Performance Comparison of W-band Luneburg Lens Antenna: Additive versus Subtractive Manufacturing**
Petr Kadera, Jaroslav Lacik
Brno University of Technology
Brno, Czech Republic

WEDNESDAY 21ST APRIL

13:00 - 14:30 Propagation Lightwaves

Session PROP: COMITE 2021 - Propagation

Chairs: Lucie Hudcova, Peter Barcik

PROP/1: **Classical Processing of Attenuation on Alphasat Satellite Link in Prague**
Maria Kovalchuk, Ondrej Fiser
*University of Pardubice,
Pardubice, Czech Republic*

PROP/2 : **Dyadic Green's Function of a Cylindrical Isotropic Metasurface**
Masoud Hamidi, Hamed Khayam Nekoei,
Mohsen Ghaffari-Miab
*Tarbiat Modares University
Tehran, Iran*

Session LW: COMITE 2021 - Lightwaves

Chairs: Lucie Hudcova, Peter Barcik

LW/1: **Refractive Index Vs. Group Delay: Numerical Investigation of Fiber Bragg Gratings for Slow Light Applications**
Matus Vanko, Jarmila Mullerova, Milan Dado
*University of Zilina
Zilina, Slovak Republic*

LW/2 : **Service Data Transmission System for Free Space Optics**
Marek Novak, Peter Barcik, Petr Skryja,
Zdenek Kolka
*Brno University of Technology
Brno, Czech Republic*

LW/3: **Security Threats for Free Space Optics due to Fog Scattering Phenomena**
Otakar Wilfert, Peter Barcik, Zdenek Kolka
*Brno University of Technology
Brno, Czech Republic*

LW/4: **Calculation of the Applicable Wavelengths in Underwater Communication**
Lucie Hudcova, Otakar Wilfert
*Brno University of Technology
Brno, Czech Republic*

WEDNESDAY 21ST APRIL

15:00 - 15:30 Closing Ceremony + Students Awards

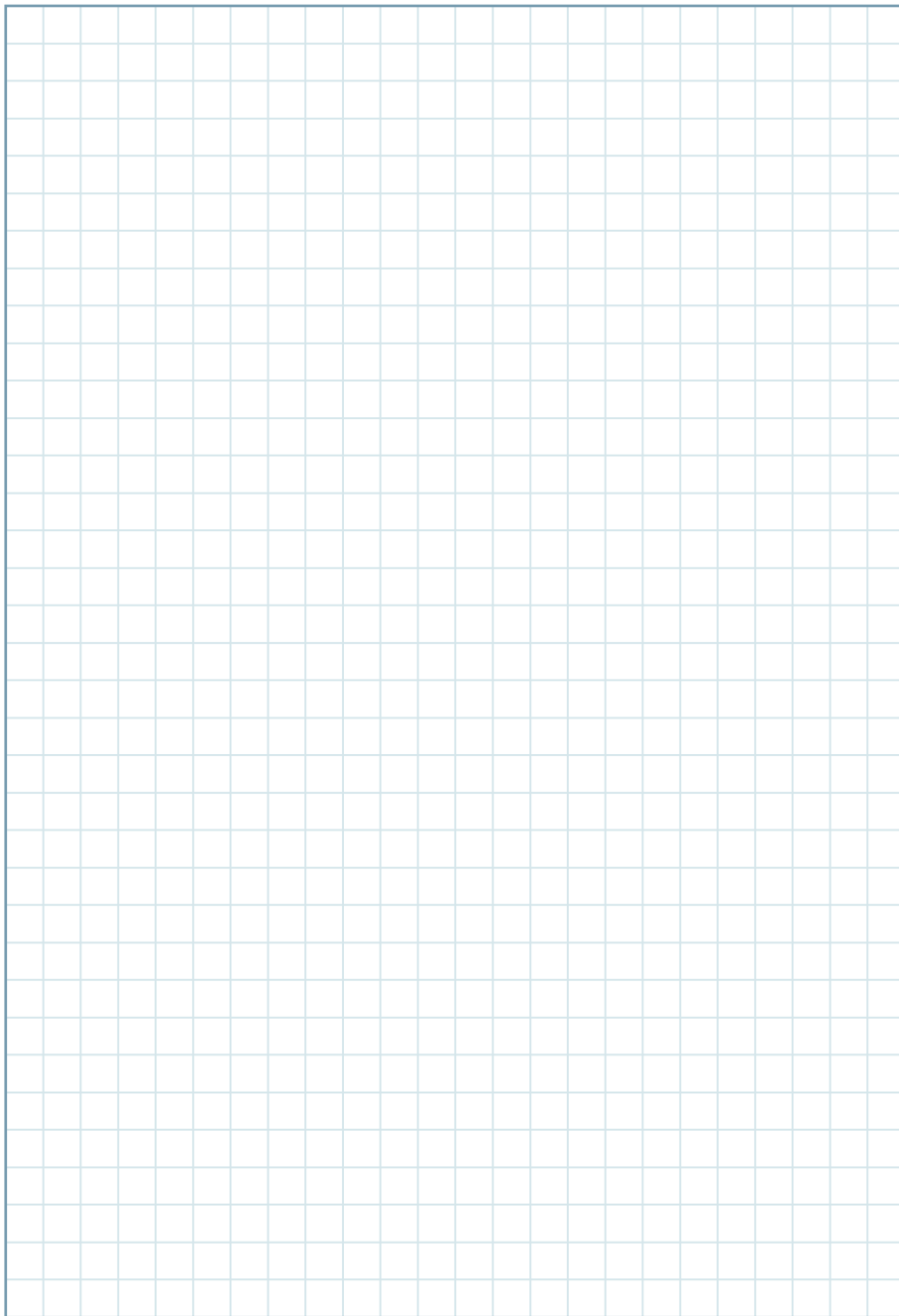
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Chairs: Zbynek Raida, Tomas Kratochvil, Tomas Fryza,

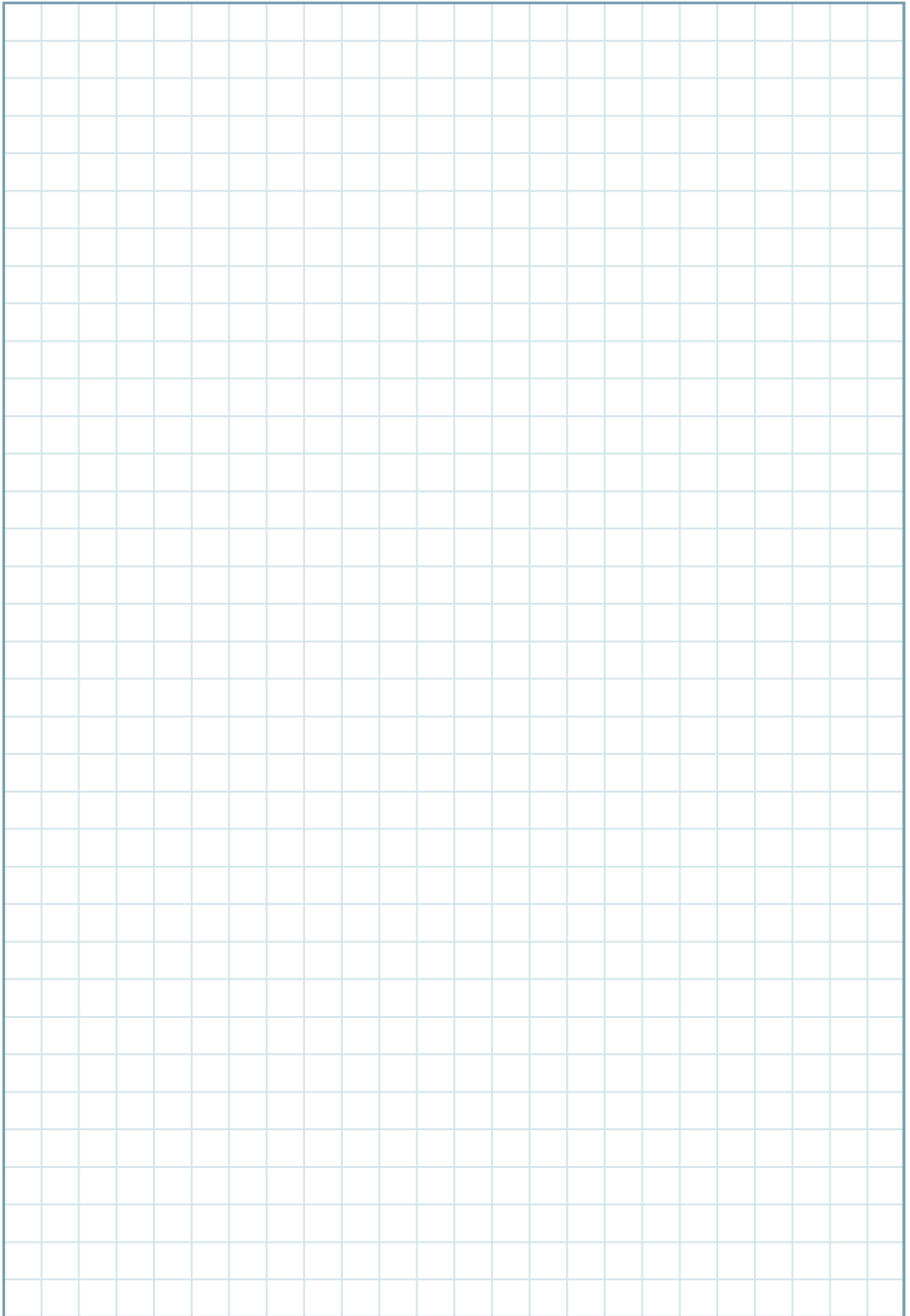
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Tomas Korinek (Czechoslovakia Section of IEEE),
Jiri Petrzela (Radioengineering Society),
Roman Marsalek (Union Radio-Scientifique International)



NOTES



NOTES



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