WICOMT Workshop

Brno University of Technology
Technická 10, room N1.36

Wednesday, the 22nd of May, 2013

08:00 to 08:15	Z. Raida, Brno University of Technology Formal Opening
08:15 to 09:00	H. Hartnagel, Technische Universität Darmstadt Microwave terahertz imaging opportunities
09:20 to 09:40	K. Pítra, Brno University of Technology Design of circularly polarized terahertz antenna (PhD thesis)
09:00 to 09:20	M. Mrnka, Brno University of Technology Antenna range illuminator based on a septum polarizer and dual mode horn (diploma thesis)
09:40 to 10:00	J. Láčík, Brno University of Technology Substrate integrated waveguide ring-slot antennas
10:00 to 10:30	**Coffee break**
10:30 to 11:15	M. Rupp, Technische Universität Wien Upcoming challenges in cellular mobile communications
11:15 to 11:35	T. Bordovský, Brno University of Technology Digitally controlled electronic load (diploma thesis)
11:35 to 11:55	L. Klozar, Brno University of Technology Wireless networks and localization (PhD thesis)
11:55 to 12:15	M. Slanina, Brno University of Technology Adaptive video streaming in mobile networks
12:15 to 13:00	**Lunch**
13:00 to 13:45	K. Hoffmann, Czech Technical University in Prague Microwave measurements
13:45 to 14:15	J. Lazar, Czech Academy v Sciences Interferometry for dimensional nanometrology
14:15 to 14:45	P. Morávek, Honeywell Impulse radio ultra-wideband communication
14:45 to 15:15	M. Zadražil, TESCAN Xe plasma ion source for 3D tomography
15:15 to 15:30	Z. Raida, Brno University of Technology Formal Closing

Microwave and THz imaging opportunities

Prof. Hans Hartnagel
Technical University Darmstadt

Merckstr.25, 64283 Darmstadt, Germany
E-mail: hartnagel@mwe.tu-darmstadt.de

www.mwe.tu-darmstadt.de

Abstract: There are particular advantages for various types of applications to perform imaging at the wavelength range from cm to sub-mm. Imaging is best done by recording the reflected or transmitted phase and amplitude over a selected area by either a matrix of detector elements or by moving mechanically one detector component. Important issues concern noise, speed, accuracy requirement etc. Correspondingly the requirements for such imaging systems are to be reviewed. For illumination, source systems are to be developed providing the required uniformity of radiation power density. For the detection system, antennas are required with small side lobes to avoid the appearance of ghost images.

Design of circularly polarized terahertz antenna

Ing. Kamil Pítra
Brno University of Technology

Purkyňova 118, 612 00 Brno, Czech Republic
E-mail: xpitra01@stud.feec.vutbr.cz

Abstract: I will present the design of a circularly polarized antenna operating at 1 THz. The antenna meets the requirements demanded by security applications where the orientation of the hidden object might not be optimal from the detection viewpoint. The input impedance of the antenna was matched to the impedance of the photomixer to achieve high output power. The presented concept replaces the Si-lens by a properly designed superstrate. The superstrate can increase the directivity of the antenna, but cannot inherently suppress the excitation of surface waves. The superstrate of a specific size can significantly influence the antenna performance and can act like a lens. The realized gain of the proposed antenna can be increased.

Antenna range illuminator based on a septum polarizer and dual mode horn

Bc. Michal Mrnka
Brno University of Technology

Purkyňova 118, 612 00 Brno, Czech Republic
E-mail:xmrnka01@stud.feec.vutbr.cz

Abstract: Transmitting antennas for compact indoor measurement ranges are mostly designed as standard pyramidal horns with well-defined gain and radiation patterns. These antennas are linearly polarized with side lobe levels in E plane about -15 dB. If circular polarization and better side lobe suppression is required, one has to use a different configuration. A so-called septum polarizer is a very interesting waveguide device for generating both senses of the circular polarization with an excellent axial ratio. This device can be used with a wide range of beam formers based on a target application. Two different beam formers for a septum polarizer were designed, manufactured and measured. The focus is mainly drawn to a dual mode horn solution since superior radiation characteristics were obtained compared to a conventional square horn.

Substrate integrated waveguide ring-slot antennas

Ing. Jaroslav Láčík, Ph.D.
Brno University of Technology

Purkyňova 118, 612 00 Brno, Czech Republic
E-mail: lacik@feec.vutbr.cz

Abstract: The substrate integrated waveguide (SIW) technology is a promising candidate for centimeter and millimeter wave applications. This is mainly caused by the fact that the SIW is electrically similar compared to a conventional waveguide, can be easily integrated with planar circuits, and can be easily fabricated by a low-cost printed circuit board process.

The main attention of the contribution is concentrated on ring-slot radiators placed in the SIW broad wall. Possible operation modes of such antennas are discussed and their typical performance is demonstrated.

Upcoming challenges in cellular mobile communications

Prof. Markus Rupp
Vienna University of Technology

Gußhausstraße 25/E 389, 1040 Wien, Austria
E-mail: markus.rupp@tuwien.ac.at

Abstract: While 4th generation Long Term Evolution (LTE) technology is currently being rolled out in many countries world-wide, new challenges already arise for the near future. This talk provides an overview of what performance, based on measurements, we can expect in LTE transmissions. We will show that multi-user transmissions with multiple antennas (MU-MIMO) are still an open field to explore in which many substantial improvements are to be expected. We further discuss how to address in future high mobility scenarios as they may occur in airplane to ground station connections or high speed trains. A large area of research is today related to interference mitigation techniques. Modern heterogeneous networks (HetNet) allow the interoperability of low cost pico and nano base stations at the expense of increased interference. Modern machine type communications (M2M) will enlarge such interference even more and needs to be addressed as well. The presentation will discuss all such open problems and demonstrate first steps in the direction of solving them.

Digitally controlled electronic load

Bc. Tomáš Bordovský
Brno, University of Technology

Technická 12, 612 00 Brno, Czech Republic
E-mail: xbordo02@stud.feec.vutbr.cz

Abstract: The project is focused on an analysis and design of high precision electronic load for laboratory purpose. There are already such devices on the market. However, available devices are too expensive which prevents their wider usage. According to low cost, simple but clever construction, high precision and wide ranges of operating condition,s the digitally controlled load was designed and built. Also the electronic load subsystems, control algorithms and calibration methods were optimized to fulfill all requirements.

Wireless networks and localization

Ing. Lukáš Klozar
Brno University of Technology

Purkyňova 118, 612 00 Brno, Czech Republic
E-mail: xkloza00@stud.feec.vutbr.cz

Abstract: Rising density of wireless networks evolve to smaller cell dimensions. WPAN, RFID, on body communications, WSN, in car and other wireless networks take place in every-day life. Therefore, possibilities of localization are evolving. Various techniques for localization in the wireless networks were developed. Demands on network parameters, computation power, and versatile usage are summarized and compared. Perspective algorithms for localization are introduced. Positioning based on the measured received signal power offers versatile application by sensing adequate frequency channel. It is possible to implement it in any wireless network, but the achievable accuracy suffers from dependency on a propagation environment. However, by the combination of multi system measurements is possible to improve localization capabilities. Modern radio devices enables communication in wide frequency range, exploiting principles of software defined radio.

Optimization algorithm based on the measured received signal power is presented as one of the possibilities for the universal positioning. Particle swarm optimization approach is exploited in both, localization and channel modeling algorithms involved in localization process.

Adaptive video streaming in mobile networks

Ing. Martin Slanina, Ph.D.
Brno University of Technology

Purkyňova 118, 612 00 Brno, Czech Republic
E-mail: slaninam@feec.vutbr.cz

Abstract: The expansion of advanced systems for mobile communication brings along increasing bit rates available for data services. At the same time, video in mobile terminals, enabled by the increased transmission bit rates, is becoming increasingly popular. Especially in mobile environment, the bit rate available to the user is typically varying over time with changing propagation characteristics and network utilization. For video, however, variable user bit rate is a problem leading to annoying video stalling and re-buffering. Adaptive video streaming techniques are designed to change the content bit rate during playback so that no re-buffering needs to be done and the video is played back smoothly. We will make an overview of the solutions and summarize the performance measurement of such approaches.

Microwave measurements

Prof. Karel Hoffmann
Czech Technical University in Prague

Technická 2, 166 27 Praha, Czech Republic
E-mail: hoffmann@fel.cvut.cz

Abstract: In the talk, the latest trends in the area of microwave measurements will be presented. Attention will be turned to the measurement of extremely small or extremely high impedances.

Interferometry for dimensional nanometrology

doc. Dr. Ing. Josef Lazar
Institute of Scientific Instruments,
Academy of Sciences of the Czech Republic

Královopolská 147, 612 64 Brno, Czech Republic
E-mail: joel@isibrno.cz

Abstract: Precise position sensing allows upgrading microscope techniques designed primarily only for imaging up to quantified measuring. Especially imaging techniques in the micro- and nanoworld overcoming the barrier of resolution given by the wavelength of visible light are a suitable basis for design of measuring systems with the best resolution possible. Atomic force microscopy, other local probe techniques and electron microscopy when equipped with precision positioning and measurement of the probe and sample may become a tool for nanometrology – measurement of geometrical quantities on the nanoscale. An overview of the methods, techniques and approaches in dimensional nanometrology is presented.

Impulse radio ultra-wideband communication

Patrik Morávek
Honeywell

Tuřanka 100, 61200 Brno, Czech Republic
E-mail: patrik.moravek@honeywell.com

Abstract: Impulse based ultra-wideband communication is a solution for low power PANS offering data rates up to 27 Mbps. It is specified in IEEE 802.15.4 standard as one of optional PHY layers. This technology allows to use high data rate transmissions while keeping low EM emissions and yet being little vulnerable to narrow band interference. Moreover, besides its communication capabilities it offers very high precision ranging achieving ranging error in order of centimeters. Therefore, the interest of industry increases seeing the potential of this technology in broad range of applications.

Xe plasma ion source for 3D tomography

Ing. Martin Zadražil, Ph.D.
TESCAN

Libušina třída 21, 623 00 Brno – Kohoutovice
Email: martin@tescan.cz

The Xe plasma ion source integrated on TESCAN FERA3 plasma FIB-SEM instrument offers an extremely high milling and material removal rate, which is important in many application fields, such as failure analysis in the semiconductor industry (e.g. through-silicon vias or flip chip cross sectioning) or MEMS fabrication and analysis [1]. The high resolution of SEM column expands the intrinsic advantages of the Xe plasma ion source. SEM allows observation of the sample during the milling process by utilizing two separate specially designed backscattered electron detectors and a precise end-point detection based on SEM or FIB image information. With powerful control software, the creation of complex tasks can be automated.

Failure analysis at the package level was traditionally relying on methods like mechanical polishing or broad ion beam etching, which are often too destructive and time-consuming. FIB-SEM 3D Tomography with Ga beam works locally only, but it is too slow for the required volumes ~100^3 Îźm^3. The increased current of Xe plasma ion beam allows to use powerful 3D Tomography method, while still taking advantage of FIB operation which damages the sample locally only and allows to analyze many sites on a small sample area. The method gives enough data to be able to find even a small failure in the analyzed volume, without the risk of missing it during the continual milling operation.