AES 2017 Incheon - Korea

The 5th Advanced Electromagnetics Symposium

Program

July 26 – 28, 2017
Incheon, Korea

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Edited by

Said Zouhdi | Paris-Sud University, France
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AES 2017 will be held at the **Songdo Convensia**, 123 Central-ro, Yeonsu-gu, 21998, **Incheon**, Korea.
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GETTING TO VENUE

Address

Songdo Convensia, 123 Central-ro, Yeonsu-gu, 21998, **Incheon**, Korea.
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Seoul (Downtown) -> Songdo Convensia

- By Subway

Subway Station	Information
University of Incheon (Incheon Line)	Take Seoul subway line number 1 and get off at Bupyeong Station Transfer Bupyeong Station to Incheon subway and get off at University of Incheon Station Take a walk around 10-15minutes to Songdo ConvensiA (next to Sheraton Hotel)
Dongmak Station (Incheon Line)	Take Seoul subway line number 1 and get off at Bupyeong Station Transfer Bupyeong Station to Incheon subway and get off Dongmak Station Through exit 3, take bus 8, 6, 780 to Songdo ConvensiA Bus Stop

- By Taxi

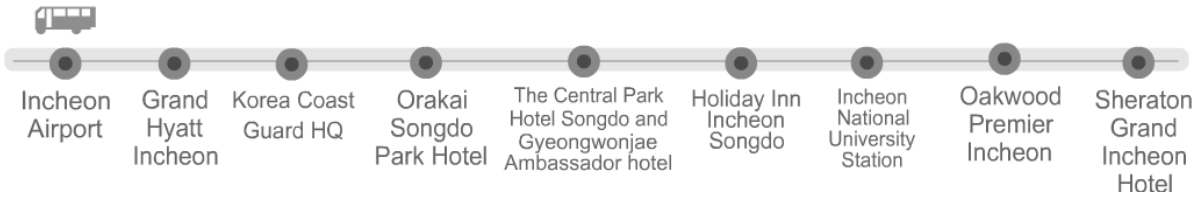
Fee	Taxi Fare ranges from 60,000 – 90,000 KRW ※ Receipt can be collected from driver if needed
Hours	Available 24hours
About	Ask Taxi Driver for 'Songdo ConvensiA' (at Songdo of Incheon City nearby Sheraton Hotel)

Incheon International Airport (ICN) -> Songdo Convensia

1) By KAL-limousine (~40 min, 7,000 KRW)

- Board the limousine bus (6707B) at the platform 4A

- Get off at **Sheraton Grand Incheon Hotel** (last stop)



Time schedule

Departure Point Incheon Airport (Bus Stop #4A) Arrival Point Sheraton Grand Incheon Hotel

Please be advised that actual times may vary depending on traffic conditions.

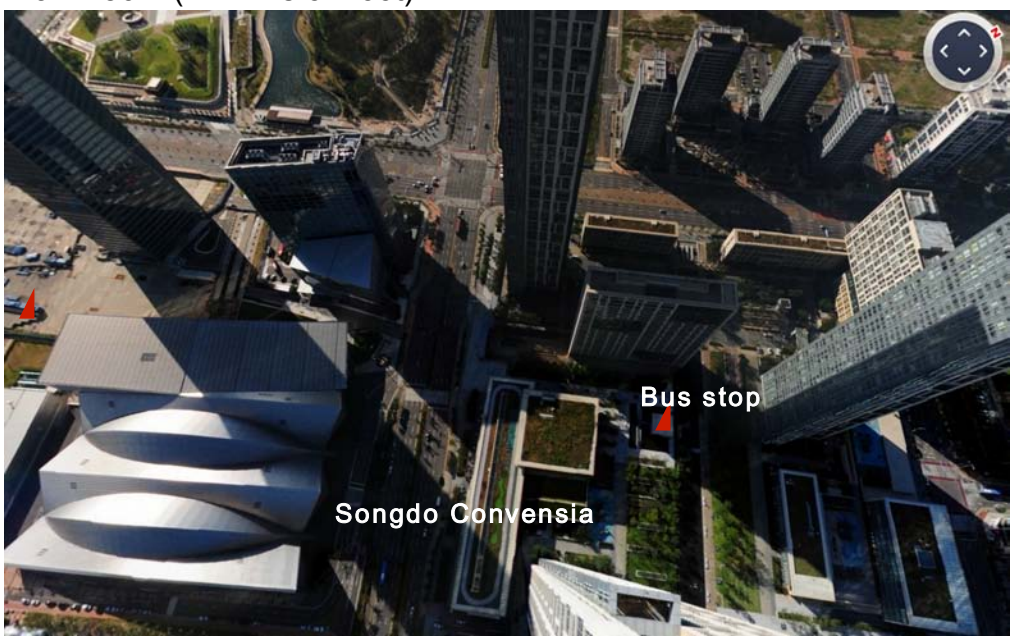
Travel Time : 30min

Departure time					
05:53	06:21	06:58	07:33	08:13	08:58
09:38	10:23	11:13	12:03	12:53	13:43
14:33	15:23	16:14	17:03	17:43	18:22
19:03	19:53	20:42	21:30	22:11	

- For more information, please visit, https://www.kallimousine.com/eng/guide01_en.html or http://www.airport.kr/pa/en/a/3/1/1/index.jsp#none

2) By Bus (~1 hour, ~3,000 KRW)

- Board a bus line 303 at the platform 13A

- Get off at **Songdo The Sharp First World (East gate)** station (~40 mins)
- Walk 450m (~7 mins on foot)
- 

Time schedule

To Incheon	first	05:00	To CAT	first	05:40
	last	21:30		last	23:00
Interval	15min.		Transit time	210분(MI)	
Type	Local City		Fare	KRW 2,800	

GUIDELINES FOR PRESENTERS

ORAL PRESENTATIONS

Each session room is equipped with a stationary computer connected to a LCD projector. Presenters must load their presentation files in advance onto the session computer. Technician personnel will be available to assist you.

Scheduled time slots for oral presentations are 15 mn for regular, 20 mn for invited presentations, 30 mn for keynote talks and 35 mn for plenary talks, including questions and discussions. Presenters are required to report to their session room and to their session Chair at least 15 minutes prior to the start of their session.

The session chair must be present in the session room at least 15 minutes before the start of the session and must strictly observe the starting time and time limit of each paper.

POSTER PRESENTATIONS

Presenters are requested to stand by their posters during their session. One poster board, A0 size (118.9 x 84.1 cm), in portrait orientation, will be available for each poster (there are no specific templates for posters). Pins or thumbtacks are provided to mount your posters on the board. All presenters are required to mount their papers 30mn before the session and remove them at the end of their sessions. Posters must prepared using the standard AES poster template (available on the symposium website).

TECHNICAL PROGRAM

Wednesday 26th July, 2017

Registration

1st floor lobby

08:30 - 18:00

09:00 - 09:45 — Room 118

Session 1A1

Electromagnetic and Nanophotonic Materials

Chaired by: Liudmila Alyabyeva

09:00 : Linking the properties of surface plasmon polaritons and the quality of laser-induced periodic surface structures

Thibault J.-Y. Derrien[1], **Yoann Levy**[1], **J. Bonse**[2], **Laroslav Gnilitskyi**[3], **Leonardo Orazi**[3], **Tomas Mocek**[1], **Nadezhda M. Bulgakova**[1]

[1] *HiLASE Centre - Institute of Physics (Czech Republic),* [2] *Bundesanstalt f r Materialforschung und pr fung (BAM) (Germany),* [3] *University of Modena and Reggio Emilia (Italy)*

Surface plasmon polaritons (SPP) can be triggered by femtosecond-laser pulses on metals and semiconductors leading to formation of sub-wavelength periodic surface structures. In this talk, peculiarities of laser-generated SPP will be analyzed. Plasmonic-based simulations enabled to classify metals in respect of their SPP decay length. Physical insights into SPP propagation indicate that materials with short SPP decay length allow imprinting of highly-regular periodic structures on material surfaces. This result was successfully verified experimentally for several metals.

09:15 : Lattice vibrations and impurity contribution into terahertz electrodynamic response of semi-insulating InP:Fe

Liudmila Alyabyeva[1], **Elena Zhukova**[1], **Mikhail Belkin**[2], **Boris Gorshunov**[1]

[1] *Moscow Institute of Physics and Technology (State University) (Russia),* [2] *The University of Texas at Austin (USA)*

Dispersion of complex dielectric permittivity of semi-insulating iron doped InP crystalline wafers was studied in a 2-700 cm-1 (0.06-21 THz) spectral range at room temperature. The results differ from the data for nominally pure InP since incorporation of iron unveils the InP intrinsic dielectric properties such as weak multiphonon vibrations screened by strong free-carrier absorption processes. The spectra of transmission and reflection have complicated structure including one- and two-phonon resonances and impurity-related absorption lines.

09:30 : Nanocarbon based lossy photonic crystal microwave absorbers

G. I. Mark[1], **K. Kertesz**[1], **G. Piszter**[1], **I. Biro**[2], **A. Paddubskaya**[3], **P. Kuzhir**[3], **L. P. Biro**[1]

[1] *Hungarian Academy of Sciences (Hungary),* [2] *3D Kivansag (Hungary),* [3] *Belarusian State University (Belarus)*

Utilizing a combination of dielectric- and conducting materials it is possible to fabricate devices with predefined BRDF (Bidirectional Reflection Distribution Function) and BTDF (Bidirectional Transmittance Distribution Function). We utilized 3D printing to create a new type of lightweight and environmental friendly lossy photonic crystal structure, composed of plastic and nanocarbon composite materials, which shows excellent electromagnetic shielding properties. The method is capable of producing complex structures with tuneable electromagnetic characteristics, which provides a new route for microwave devices. By the help of the optimization of the layer structure we were able to achieve nearly perfect absorption in a large wavelength and incidence angle range.

10:00 - 10:40 — Room 118

Session 1A2

Integrated photonic devices for information processing I

Organized by: Linjie Zhou and Thomas Schneider

Chaired by: Linjie Zhou and Thomas Schneider

10:00 : Invited talk
Recent Progress in Slow Light Modulators
Toshihiko Baba, Y. Terada, Y. Hinakura, K. Hojo, H. Ito
Yokohama National University (Japan)

Photonic crystal slow light waveguides allow Si MZ modulators to enhance the modulator efficiency. We optimized the p-n junction profile in this modulator to balance the phase shift and modulation speed. The device fabricated by CMOS process showed practical performance (32 Gbps, 3 dB extinction ratio, $<$0.2 pJ/bit energy consumption, 20 nm bandwidth, 5 dB insertion loss) is obtained in a 200-micron device. WDM, QPSK, PAM and sub-bandgap photodiode operations are also demonstrated.

10:20 : Invited talk
Advances in quantum dot lasers for silicon photonics
Yasuhiko Arakawa, Bongyong Jang, Jinkwan Kwoen, Satoshi Iwamoto
The University of Tokyo (Japan)

We discuss a hybrid InAs/GaAs quantum dot (QD) laser, evanescently coupled to a silicon waveguides, by using wafer bonding. The direct epitaxial growth of InAs/GaAs QD lasers on silicon (100) on-axis substrates is also demonstrated.

Coffee Break and Exhibit Inspection

10:40 - 11:10

11:10 - 12:10 — Room 118

Session 1A3

Integrated photonic devices for information processing I

Organized by: Linjie Zhou and Thomas Schneider

Chaired by: Linjie Zhou and Thomas Schneider

11:10 : Invited talk
Optical Parametric Oscillators in Silicon: limitations, prospects and applications to Ising machine
Kambiz Jamshidi[1], M. Namdari[1], M. Catuneanu[1], R. Hamerly[2], D. Gray[3], C. Rogers[3], H. Mabuchi[3]
[1] *Technische Universitat Dresden (Germany),* [2] *National Institute of Informatics (Japan),* [3] *Stanford University (USA)*

Circulation of the pump in a silicon ring resonator makes it possible for integrated photonics to have compact-sized devices like: optical parametric amplifiers, optically bistable devices, and optical parametric oscillators. Optical parametric oscillators are basic building blocks for the realization of an Ising machine.

11:30 : Invited talk
2x2 silicon optical switch elements based on coupled ring resonators with tunable coupling coefficient
Liangjun Lu, Linjie Zhou, Jianping Chen

Shanghai Jiao Tong University (China)

We present a silicon 2x2 switch element based on coupled ring resonators. The input and output coupling is enabled by tunable MZI couplers with both thermo-optic and electro-optic phase shifters. Experimental results show that the switch has a low crosstalk of -45 dB at the bar state and -26 dB at the cross state.

11:50 : Invited talk

Nanophotonic Devices Based on Dielectric-nano-posts-array for Small Footprint Si-Photonics Chips

Aimin Wu, H. Y. Huang, C. Qiu, Y. X. Zhao, Z. Sheng, F. W. Gan, X. Wang
Shanghai Institute of Microsystem and Information Technology (China)

Nanophotonic devices based on dielectric-nano-posts-array are promising candidates in subwavelength scale applications. Here, we demonstrate an ultrathin nano-posts-chain that can route and manipulate light, realizing splitting and sharp bending while exhibiting broadband, incident-angle-tolerant, and robust against disorder. The nano-posts-chain is further designed and turns into a novel silicon nano-antenna array, which can direct light vertically emitting to the third dimension. These devices provide small footprint components for Si-photonics chips.

Lunch and Exhibit Inspection

12:10 - 14:00

14:00 - 14:40 — Room 118

Session 1A4

Integrated photonic devices for information processing II

Organized by: Linjie Zhou and Thomas Schneider

Chaired by: Linjie Zhou and Thomas Schneider

14:00 : Invited talk

Stimulated Brillouin Scattering in Nano-Waveguides as Optical Sensors

Thomas Schneider[1], **Ali Dorostkar**[1], **Linjie Zhou**[2]
[1] *Institut fur Hochfrequenztechnik (Germany),* [2] *Shanghai Jiao Tong University (China)*

Stimulated Brillouin scattering (SBS) is an interaction between a pump-wave and a counter-propagating Stokes wave. This interaction will be mediated by an acoustical wave. Usually, SBS in very long waveguides like optical fibers is used to measure the temperature or strain distribution over long distances. However, the coherent interaction of radiation pressure and electrostriction in nano-waveguides leads to strong, radial guided acoustic modes in very short waveguide segments. These waveguides might be used as integrated small-scale sensors.

14:20 : Invited talk

Integrated Twisted Light Emitter for Orbital Angular Momentum Multiplexing Optical Communications

Ting Lei
Shenzhen University (China)

Twisted light carrying orbital angular momentum (OAM) provides additional multiplexing freedom for the high capacity optical communications. We demonstrate an integrated optical OAM emitter on standard SOI, which generates two coaxial twisted light beams across the entire telecom band from 1450nm to 1650nm. We also apply the emitter in OAM communication with 1.2Tbit/s data rate assisted by 30-channels optical frequency combs (OFC).

14:00 - 14:40 — Room 118

Session 1A5

Advanced reconfigurable antennas for modern wireless communications

Organized by: Steve Hang Wong and Laure Huitema

Chaired by: Steve Hang Wong and Laure Huitema

14:00 : Invited talk
Low-Profile Cassegrain-Reflectarray-Fed Transmitarray Antenna
Shi-Wei Qu, Geng-Bo Wu, Shiwen Yang
University of Electronic Science and Technology of China (China)

In this paper, a novel low-profile Cassegrain-reflectarray-fed transmitarray antenna is introduced. A flat Cassegrain reflectarray with compact ring focus feed is employed as the source to illuminate the upper transmitarray. The numerical results of a 6λ x 6λ reflectarray-fed transmitarray antenna with a small focus-to-diameter ratio (F/D) of 0.3 demonstrate that this transmitarray antenna has achieved a gain of 22.6dB at 12GHz, corresponding to an aperture efficiency of about 40 $\%$.

14:20 : Invited talk
Hybrid Dielectric Resonator Antenna with Pattern Reconfigurability
Zhe Chen, Hang Wong, J. Xiang
City University of Hong Kong (Hong Kong)

A hybrid dielectric resonator antenna (HDRA) to realize radiation pattern reconfigurable design is proposed. The inner part of the HDRA is fabricated by solid material with no need for altering, while the outer part is filled with liquid material which can be rebuild conveniently. Therefore, by flowing control of liquid in the outer zone, radiation pattern reconfigurable design is realized.

Coffee Break and Exhibit Inspection

Sponsored by POSTECH Mechanical Engineering Department

16:00 - 16:30

16:30 - 17:10 — Room 118

Session 1A6

Advanced reconfigurable antennas for modern wireless communications

Organized by: Steve Hang Wong and Laure Huitema

Chaired by: Steve Hang Wong and Laure Huitema

16:30 : Invited talk
A 60-GHz Multi-Beam Magneto-Electric Dipole Antenna Array
Yujian Li[1], **Kaixu Wang**[2]
[1] *Beijing Jiaotong University (China),* [2] *City University of Hong Kong (Hong Kong)*

A 4 x 4 magneto-electric (ME) dipole antenna array that can generate sixteen beams scanning in two dimensions is proposed in V-band. By utilizing a passive beamforming network with a novel topology, the entire array configuration can be integrated into multi-layered planar substrates. A bandwidth of 16.4 $\%$, stable radiation patterns and gain up to 14.7 dBi are obtained.

16:50 : Invited talk
BST thin film capacitors integrated within a frequency tunable antenna

Laure Huitema, Aurelian Crunteanu, Areski Ghalem
University of Limoges (France)

Ferroelectric thin film varactors can be a convenient technology for tuning miniature antennas. In this paper we present the design of a compact, agile, slot antenna integrating BST capacitors. Capacitances values were measured at different temperatures and bias voltages ranging from 0V to 20V showing a capacitance variation of more than 90 % up to 5 GHz. Their integration within a compact antenna design allows tuning its operating frequency on a large frequency band, with efficiencies higher than 50 %.

Thursday 27th July, 2017

08:45 - 10:30 — Ballroom

Session 2A1

Plenary Session

Chaired by: Xiang Zhang

08:45 : Plenary talk
Towards Scalable Semiconductor Quantum Networks
Dirk Englund
Massachusetts Institute of Technology (USA)

The Internet is among the most significant inventions of the 20th Century. We are now poised for the development of a quantum internet to exchange quantum information and distribute entanglement among quantum memories (and ultimately quantum computers) that could be great distances apart. This kind of quantum internet would have a range of applications that aren't possible in a classical world, including long-distance unconditionally-secure communication, certain types of precision sensing and navigation, and distributed quantum computing. But we still need to develop or perfect many types of components and protocols to build such a quantum internet.

09:20 : Plenary talk
Optical Antennas: Spontaneous Emission Faster Than Stimulated Emission
Eli Yablonovitch
UC Berkeley (USA)

Over 100 years after the radio antenna, we finally have tiny optical antennas which can extract radiation from molecules and quantum dots. With optical antennas, spontaneous light emission can become faster than stimulated emission. Antenna physics has been poorly covered in education. It does not require plasmonics, nor the Purcell effect.

09:55 : Plenary talk
Metaoptics in the Visible
Federico Capasso
Harvard University (USA)

Metasurfaces based on sub-wavelength patterning have major potential for arbitrary control of the wavefront of light by achieving local control of the phase, amplitude and polarization and allowing greater functionality and more compact devices. We have introduced a new CMOS compatible technology based on atomic layer deposition of TiO2 which has enabled high performance metalenses, achromatic lenses, immersion objectives, axicons, vortex plates, holograms and ultracompact spectrometers for a wide range of applications.

Coffee Break and Exhibit Inspection

10:30 - 11:00

11:00 - 12:20 — Room 118

Session 2A2

Electromagnetic Theory, Simulation and Modeling I

Organized by: Konstantin Vytovtov and Laurent Santandrea

Chaired by: Mohamed Bakr

11:00 : Invited talk

Femtosecond laser induced dynamics of the processes in transparent solids: Insights from Maxwell's-based model

Nadezhda M. Bulgakova[1], **Vladimir P. Zhukov**[2]
[1] *Institute of Physics of the ASCR (Czech Republic),* [2] *Novosibirsk State Technical University (Russia)*

Based on Maxwell's equations supplemented by the hydrodynamics-type equations for laser-generated free-electron plasma, the processes inside transparent materials induced by ultrashort laser pulses have been studies for the regimes of irradiation typical for direct laser writing of photonic structures. Simulations have been performed for fused silica irradiated by laser beams with linear and radial polarization. Effects of spatio-temporal features of laser beams and pump-probe irradiation on laser energy deposition are also analyzed. Post-irradiation evolution of material is discussed.

11:20 : Invited talk

Motion and the Fourth Dimension

Sara Liyuba Vesely[1], **Alessandro Alberto Vesely**[2], **Sibilla Renata Dolci**[2], **Caterina Alessandra Dolci**[3]
[1] *ITB-CNR (Italy),* [2] *(Italy),* [3] *Politecnico di Milano (Italy)*

In the functions representing solutions to Maxwell equation system, unlike in Newtonian trajectories, space and time are variables on a par with each other. Accordingly, electromagnetic field solvers seem to require four-dimensions. For the purpose of graphical rendition and modeling, attempts to reduce dimensions have to take care of the relationship among space-time variables, motion, and the evolution of the field. This article illustrates the point by considering a case of motion mechanically analogous to reflection in space.

11:40 : Invited talk

Theoretical and experimental approaches on galvanometer scanners for high-end biomedical imaging applications

Virgil-Florin Duma
Aurel Vlaicu University of Arad (Romania)

Galvanometer-based scanners have been studied and optimized, especially for high-end applications like biomedical imaging, with a focus on Optical Coherence Tomography (OCT). Based on experimental investigations, a mathematical model have been developed, in order to maximize the duty cycle of these scanners for different input signals and to collate individual OCT images for larger fields-of-view. The optimal scanning functions that can provide the maximum possible duty cycle of such scanners have been demonstrated theoretically.

12:00 : Invited talk

Spiral Bull's Eye Structure for Multi-frequency High-transmission Plasmonic Antenna

Xiangying Deng, Shunri Oda, Yukio Kawano
Tokyo Institute of Technology (Japan)

We built a simulation model and conducted simulation for axial symmetric bull's eye antenna. The structure was proven to have potential in large transmission enhancement and high electric field concentration together with multi-frequency selection. These advantageous features enabled frequency-selective plasmonic antennas and their applications to various investigations.

Lunch and Exhibit Inspection

12:20 - 14:00

Session 2P1

Poster Session I

14:00 - 14:40

P1: Electromagnetic Wave Absorption Properties of Novel Green Composites Coconut Fiber Coir and Charcoal Powder over X-band Frequency for Electromagnetic Wave Absorbing Applications

Nurul Fatihah Nabila Yah[1], Hasliza A. Rahim[1], Yeng Seng Lee[2], F. H. Wee[2], H. H. Zainal[2]
[1] *Universiti Malaysia Perlis (UniMAP) (Malaysia),* [2] *Universiti Malaysia Pelis (UniMAP) (Malaysia)*

This paper presents the electromagnetic wave (EW) absorption properties, complex permittivity and permeability, of novel green composites coconut fiber coir and charcoal powder materials. The samples were fabricated using raw agricultural waste coconut fiber coir, charcoal powder, epoxy resin and hardener with varied composition. The dielectric properties of the materials were characterized using two-port waveguide measurement method over the X-band frequency (8.2 -12.4GHz). The result shows the composite material is a promising organic material for electromagnetic absorber applications.

P2: Simulation of multilayer waveguide solar cell structure based on nanoparticles

Hala J. El-Khozondar[1], Rifa J. El-Khozondar[2], Mohammed M. Shabat[1], Daniel M. Schaadt[3]
[1] *Islamic University of Gaza (Palestine),* [2] *Al-Aqsa University (Palestine),* [3] *Clausthal University of Technology (Germany)*

The purpose of this study is to model solar cell waveguide structure based on nanoparticles due to their ability of controlling the light transmission and reflection. Mixture of Ag and Au nanoparticles impeded in a dielectric media are considered in the model. The reflectance is shown to be dependent on the ration of the nanoparticle in the dielectric media.

P3: Directional thermal infrared absorption and emission of zero refractive index dielectric metamaterials

Byungsoo Kang, Hyeon-Don Kim, Hyun-Sung Park, Kanghee Lee, Sunwoo Han, Jaeman Song, Bong Jae Lee, Bumki Min
Korea Advanced Institute of Science and Technology (Korea)

The zero refractive index metamaterial is numerically simulated, proven to exhibit an abrupt change in reflection with respect to the incident angle from the surface normal direction and highly directional infrared absorption, from which directional thermal emission can be inferred.

P4: Dielectric response of Al substituted Ba0.8Pb0.2Fe(12-x)AlxO19 single crystal hexaferrites in terahertz spectral region

Liudmila Alyabyeva[1], Denis Vinnik[2], Victor Torgashev[3], Svetlana Gudkova[1], Elena Zhukova[1], Anatoly Prokhorov[1], Dmitry Zherebtsov[2], Boris Gorshunov[1]
[1] *Moscow Institute of Physics and Technology (State University) (Russia),* [2] *South Ural State University (Russia),* [3] *Southern State University (Russia)*

The phonon spectra of Al substituted M-type Ba0.8Pb0.2Fe(12-x)AlxO19 hexaferrites (x=0, 1, 3.3) are studied in the region 5-1000 cm-1. An intensive line with complicated structure and dielectric contribution of about 10-20 into real part of dielectric permittivity is observed in the low-frequency region. Temperature change of dielectric parameters of this line is studied in 6-300 K temperature range. The presence of phase transition in Ba0.8Pb0.2Fe12O19 around 100 K is suggested.

P5: Influence of the Metallic Loop-like Accessory on the SAR of Broadband Wearable Planar Monopole Textile Antenna

Hayati Hasibuan Zainal[1], Hasliza A. Rahim[1], P. J. Soh[1], H. Lago[1], M. S. Zulkefli[1], N. F. N. Yah[2]
[1] *Universiti Malaysia Perlis (Malaysia),* [2] *Bioelectromagnetics Research Group (BioEM) (Malaysia)*

This paper presents the investigation of influence of the common metallic loop-like accessory on the Specific Absorption Rate (SAR) averaged over 10g of body tissue. Numerical analysis conducted using a broadband textile monopole antenna (TM) with variations of orientation and distance showed that peak SAR values increased when the TM is horizontally polarized. This is up to 70 % more than vertically polarized TM placed closest to the metallic item at 10 mm.

P6: RCS Evaluation from Small Scatters in Automotive Collision Avoidance Rader Band
Hao-Ju Hsieh, Tai-Heng Hsieh, Shu-Kai Tuan, W.-J. Liao
National Taiwan University of Science and Technology (Taiwan)

An effective and accurate RCS evaluation procedure is developed for small-sized scatters in the 24 GHz band using an antenna measurement range. Simple targets of known RCS values are measured. Results indicate that the proposed method can yield relatively accurate results. This technique can be applied to the evaluation of RCS properties from small scatters on the road, such as pedestrians and bicycles. The results can be forwarded to the development of corresponding detection algorithms.

P7: T-Shaped Slot Antenna Design for Handsets with Metal Back Cover
Tai Heng Hsieh, Wan Rou Lin, Shu-Kai Tuan, W.-J. Liao
National Taiwan University of Science and Technology (Taiwan)

Broadband LTE antenna design is challenging for handsets with metal body enclosures. In this work, a T-shape open-ended slot antenna embedded in the metal back cover is proposed. Two feeds are placed on different slot locations. The low-band feed excites the one-end open slot to cover the 698 to 960 MHz band. The other feed excites the two-end open slot arm to operate in both 1710 to 2690 and 3400 to 3600 MHz bands.

P8: Performance Optimization of Copper Tube Antenna Design for Outdoor Access Points
Shu Kai Tuan, Wan Rou Lin, Hao-Ju Hsieh, W.-J. Liao
National Taiwan University of Science and Technology (Taiwan)

This work aims to optimize the copper tube antenna design, which contains radiating elements connected in series. It provides an omnidirectional coverage for outdoor access point uses. In-depth analyses are performed by establishing a numerical model. Various parametric studies are conducted to explore measures for improving the performance. An eight-element design is optimized to yield a 6 to 7 dBi gain on the azimuthal plane. The antenna operation frequency ranges from 5.15 to 5.85 GHz.

P9: Design and Realization of A Patch Array Integrated with System Board of WLAN Point-to-Point Link Device.
Wan Rou Lin[1], Tai Heng Hsieh[2], Hao Ju Hsieh[2], W.-J. Liao[1]
[1] *National Taiwan University of Science and Technology (Taiwan),* [2] *National Taiwan University of Science and Tecnology (Taiwan)*

This paper presents a low-cost, low-profile, two-element patch array design, that utilizes the system board of a WLAN device as the patch ground plane. Due to imperfections on the circuit board, realizations of air transmission line and resonant cavity are challenging. By developing a detailed numerical model, effects of connector pins and apertures on the board can be assessed. Measurement results suggest that matching, pattern, and cross polarization performances can be maintained using the system board.

P10: Computational Analysis of a Novel Yagi-Uda Antenna for VHF Band
R. E. Musril[1], Hasliza A. Rahim[1], M. Abdulmalek[2], M. Jusoh[1]
[1] *Universiti Malaysia Perlis (UniMAP) (Malaysia),* [2] *University of Wollongong in Dubai (United Arab Emirates)*

This paper presents computational analysis of a novel Yagi-Uda antenna for Very High Frequency (VHF) band. The analysis is performed using CST Microwave Studio Suite software. The structure of this directional antenna integrates three main parts which are directors, reflectors and feeder point of 50Ω. The gain of the antenna increases up to 2 $\%$ when added with 7 elements of reflector than with one element of reflector and enhanced significantly by 23.6$\%$ compared to the conventional Yagi-Uda antenna.

P11: Cross dipole EBG based high efficiency dual band dual beam antenna for millimeter wave communication systems
Abhishek Kandwal, Qingfeng Zhang, Xiaolan Tang, Yifan Chen
Southern University of Science and Technology (China)

This paper proposes a cross dipole EBG based dual band antenna design for millimeter wave communication systems. Design consists of a slotted rectangular patch with cross dipoles on a thin substrate of 300 microns. The antenna provides a dual band with a gain of 10 dB and reduced side lobes of -22 dB. The radiation pattern shows a single radiating beam at the lower frequency and a dual beam at higher frequency with a high efficiency of 97 $\%$.

P12: Absorption and Transmission of Electromagnetic Radiation from a Maxwellian Plasma Slab
M. Bawa'aneh[1], Y. C. Ghim[2], Ahmed M. Al-Khateeb[1]
[1] *Yarmouk University (Jordan),* [2] *KAIST (Korea)*

The problem of reflection and transmission of electromagnetic radiation fromplasma has attracted many researchers for decades because of its wide range of applications in telecommunications, stealth technology and industry. In this work, we investigate the problem of reflection and transmission fromMaxwellian plasma, where the dielectric function of the plasma is obtainedby calculating the Fried -Conteplasma dispersion function numericallyfor a given set of plasma parameters.

P13: Auto-parts Logistic System Using Long Range UHF RFID Smart Metal Pallet
Byondi Franck Kimetya, Berhe Hintsa Teklebrhan, Chang-Hwan Suel, Youchung Chung
Daegu University (Korea)

This paper presents a passive RFID(Radio Frequancy Identification) 920MHz long read range UHF band tag to attach to metal cart and pallet for car products logistic to incease company's profit.

14:40 - 16:00 — Room 118

Session 2A3

Electromagnetic Theory, Simulation and Modeling II

Organized by: Konstantin Vytovtov and Laurent Santandrea

Chaired by: Patrick Bouchon

14:40 : Invited talk
Adjoint Sensitivity of Nonlinear Structures Using the FDTD Method
Mahmoud Maghrabi[1], Mohamed Bakr[1], Shiva Kumar[1], Atef Elsherbeni[2], Veysel Demir[3]
[1] *McMaster University (Canada),* [2] *Colorado School of Mines (USA),* [3] *Northern Illinois University (USA)*

We present a novel finite-difference time-domain (FDTD)-based algorithm for adjoint sensitivity analysis of nonlinear electromagnetic (EM) structures. Using only one extra FDTD simulation, our approach estimates the sensitivities of the desired objective function or response with respect to all deign parameters of the problem. The validity and efficiency of the proposed approach is illustrated here through a one-dimensional (1D) EM example.

15:00 : Invited talk
Imaging of photogenerated electron dynamics on a semiconductor surface
Keiki Fukumoto[1], Shin-Ya Koshihara[2]
[1] *High Energy Accelerator Research Organization (Japan),* [2] *Tokyo Institute of Technology (Japan)*

We have developed and optimized a system for time-resolved photoemission electron microscopy (TR-PEEM) conducted with femtosecond laser pulses to visualize the electron dynamics with time, space and energy resolutions. In this contribution, we introduce the details of the equipment and present recent results obtained by application of the system on to nano-structures, such as surface defects, Si quantum dots, and graphene.

15:20 : Invited talk
Simulating the linear and nonlinear response of nanostructures under a focused beam with a B-spline modal method
Patrick Bouchon
ONERA (France)

The linear and non linear responses of nanostructures are investigated with the B-spline modal method. The study is depicted for both plane waves and focused beam illumination. The simulation of a focused beam can be used to simulate the real conditions of experiments.

15:40 : Invited talk
Graphene Electromagnetics from Modelling to Applications

X. Zhang[1], **X. Huang**[1], **T. Leng**[1], **K. Pan**[1], **Habiba Ouslimani**[2], **Zhirun Hu**[1]
[1] *University of Manchester (United Kingdom),* [2] *Paris Ouest University (France)*

Graphene electromagnetic simulation, device design, fabrication and analysis from RF to microwave are presented. Both exfoliated and Chemical Vapor Deposited (CVD) graphene are studied and used to fabricate transmission lines and resonators. Raman spectroscopy has been adopted to confirm the layer number of graphene. In addition, printed graphene nano-flakes ink enabled RF/microwave devices such as radar absorber have been studies numerically and verified experimentally.

Coffee Break and Exhibit Inspection

Sponsored by POSTECH Mechanical Engineering Department

16:00 - 16:30

16:30 - 17:10 — Room 118

Session 2A4

Electromagnetic Theory, Simulation and Modeling II

Organized by: Konstantin Vytovtov and Laurent Santandrea

16:30 : Invited talk
Modeling linear and nonlinear optical wave dynamics in nanophotonic devices
Qiang Lin
University of Rochester (USA)

In this talk, we will discuss our recent progress in modeling linear and nonlinearoptical wave dynamics in micro/nanophotonic waveguides and resonators, and compare themwith experimental characterization. We will discuss some open challenges in current numericalmodeling techniques.

16:50 : Invited talk
Maxwell's equations based models for large-scale simulations of interaction of ultrashort laser pulses with transparent solids
Vladimir Zhukov[1], **Nadezhda Bulgakova**[2]
[1] *Institute of Computational Technologies SB RAS (Russia),* [2] *Institute of Thermophysics SB RAS (Russia)*

In this report, we present different aspects of application of the nonlinear Maxwell equations -based models to the large-scale simulations of the processes in transparent dielectrics irradiated by ultrashort laser pulses in the regimes of volumetric modification. The problems of proper descriptions of photo- and impact ionization rates, absorbed laser energy, electron collision cross-sections, which are still debated, are discussed.This work is supported by the Russian Foundation for Basic Research (RFBR project No. 15-01-02432).

Friday 28th July, 2017

09:00 - 10:40 — Room 118

Session 3A1

Computational electrodynamics and its emerging applications I

Organized by: Zongfu Yu, Shanhui Fan and Susan Hagness

Chaired by: Zongfu Yu, Shanhui Fan and Susan Hagness

09:00 : Invited talk

Analytic derivations of the effective constitutive parameters and their electrostrictive and magnetostrictive tensors for bi-anisotropic metamaterials

Neng Wang, C. T. Chan
The Hong Kong University of Science and Technology (Hong Kong)

Based on multiple scattering theory, we derived for the first time the analytic formulas of effective constitutive parameters as well as their electrostrictive and magnetostrictive tensors for bi-anisotropic metamaterials in the long wavelength limit. The former can be regarded as an extension of the traditional Maxwell-Garnet formula to chiral metamaterials and the latter are very useful for calculating the optical force distribution inside the metamaterials.

09:20 : Invited talk

Toroidal Modes in the System of Antennas

Lixin Ge, Hong Xiang, Dezhuan Han
Chongqing University (China)

A class of resonant modes with intrinsic toroidal moment is identified in the discrete dipole systems such as the system of dipole antennas in the THz and microwave regime and plasmonic nanoparticles at optical frequencies. An eigenmode analysis are developed and this method can give a complete description for this system. In these systems, the toroidal multipoles will interfere with the conventional multipoles in the far field, leading to the non-radiating anapoles and unidirectional scattering.

09:40 : Invited talk

Topological one-way fiber of second Chern number

Ling Lu, Zhong Wang
Chinese Academy of Sciences (China)

We propose topological one-way fibers enabled by the recently discovered Weyl points in a double- gyroid (DG) photonic crystal. These single-polarization single-mode and multi-mode one-way fibers, having nearly identical group and phase velocities, are topologically-protected by the second Chern number (C2) in the 4D parame- ter space of the 3D wavevectors plus the winding angle of the helixes. This work suggests a unique way to utilize higher-dimensional topological physics without resorting to artificial dimensions.

10:00 : Invited talk

Plasmonic computing of spatial differentiation

Tengfeng Zhu[1], Yihan Zhou[1], Yijie Lou[1], Hui Ye[1], Min Qiu[1], Zhichao Ruan[1], Shanhui Fan[2]
[1] *Zhejiang University (China),* [2] *Stanford University (USA)*

In this talk, we show that the interference effects associated with surface plasmon excitations at a single metal-dielectric interface can perform spatial differentiation. And we experimentally demonstrate edge detection of an image without any Fourier lens. This work points to a simple yet powerful mechanism for optical analog computing at the nanoscale.

10:20 : Invited talk

Optical Metasurface Design Optimization Assisted by Artificial Neural Networks

Jonghwa Shin, Myungjoon Kim, Arthur Baucour, Suwan Jeon
Korea Advanced Institute of Science and Technology (Korea)

Artificial neural networks (ANNs) can predict the optical properties of metasurfaces based on their structural parameters. Once trained, ANN-based predictions require orders-of-magnitude smaller computational resources than full numerical simulations. It is shown that ANN can be incorporated into conventional numerical optimization routines to reduce the optimization time significantly. Examples of waveplate and color filter metasurfaces are presented.

Coffee Break and Exhibit Inspection

10:40 - 11:10

Session 3P1

Poster Session II

11:10 - 12:10

P1: Modeling of multi-pulse irradiation of transparent solids based on Maxwell's equations
Vladimir Zhukov[1], **Nadezhda Bulgakova**[2]
[1] *Institute of Computational Technologies SB RAS (Russia),* [2] *Institute of Thermophysics SB RAS (Russia)*

The nonlinear Maxwell's equations are applied for a case of multipulse irradiation regimes. It is assumed that the accumulation process influences on the subsequent pulse dynamics by facilitating ionization and by changing the refractive index. It is shown that the maximum free electron density does not increase from pulse to pulse if the refractive index change is not taken into account while the growth of the refractive index can lead to this.

P2: Analyzing quantum mechanism of frequency up-conversion
Jeong Ryeol Choi, Jinny Song
Daegu Health College (Korea)

Quantum mechanism of frequency up-conversion has been investigated. The mathematical representation of quantized electromagnetic waves associated with frequency switching in time-varying media is obtained by using the invariant operator method. The time behavior of wave packets during the conversion of frequency has been analyzed.

P3: Crosstalk reduction of optical WDM multiplexing on SOI substrates
Zhiyong Li, Huan Guan, Limin Chang, Lei Liu, Yinxin Kuang, Yude Yu
Chinese Academy of Sciences (China)

An optical wavelength (de)multiplexer is demonstrated on a silicon-on-insulator substrate. The performance of WDM add/drop multiplexing is improved, such as channel crosstalk and broad bandwidth, due to cascaded resonators with optimized coupling. For each channel, extinction at adjacent channel is below -39 dB and out-of-band rejection ratio is up to 40 dB. And the average free spectra range (FSR) of 18+/-2 nm is measured at the wavelength range from 1460 nm to 1565 nm.

P4: Far-Field Measurement of LTE Base Station-like Exposure in RF-shielded Environment
M. A. Humayun[1], **H. A. Rahim**[1], **M. AbdulMalek**[2], **P. J. Soh**[1], **M. S. Zulkefli**[1], **C. M. Nor**[1], **A. A. Al-Hadi**[1]
[1] *Universiti Malaysia Perlis (Malaysia),* [2] *University of Wollongong in Dubai (United Arab Emirates)*

In this article we demonstrate the far-field measurement with difference values of LTE exposure in RF-shielded environment. We compared the electric-field and power density results from LTE850, LTE1800 and LTE2600 field exposure that adhere to the standard guidelines issued by the ICNIRP. The results for E-field and power density are far below the safety standard value for the public recommended by ICNIRP.

P5: Adaptive Rate and Power Adaptation Techniques for Packet
Wan Norsyafizan W. Muhamad, Darmawaty Mohd Ali, Suzi Seroja Sarnin
Universiti Teknologi MARA (Malaysia)

This paper presented several energy efficient packet transmission techniques for the IEEE802.11 WLAN to

minimize energy consumption, while meeting the quality of service (QoS) performances of data traffic. The rate and power adaptation algorithms have been developed initially based on a single parameter adaptation technique which adapts the data rate according to the network packet delay.

P6: Coupling Matrix Synthesis Method for Microwave Filters using Genetic Algorithm Optimization
Abdul Rehman, M. Salman Khattak, ChangHyeong Lee, Dajung Han, Heejun Park, M. Kamran Khattak, Sungtek Kahng
Incheon National University (Korea)

This paper presents the comparison of two different approaches for the synthesis of CM for microwave filters. A proposed genetic algorithm-based optimization technique is compared with the traditional design approach of coupling matrix. The traditional design approach follows the recursive technique procedure. The Genetic algorithm-based optimization technique uses cost function having a minimum set of characteristics that can completely describe the desired filter response. Both the design methods use the (N+2)-by-(N+2) transversal coupling matrix.

P7: Wideband Adjoint Sensitivity of Anisotropic Structures Using the FDTD Method
Mohamed Bakr[1], Atef Elsherbeni[2], Veysel Demir[3]
[1] *McMaster University (Canada),* [2] *Colorado School of Mines (USA),* [3] *Northern Illinois University (USA)*

We present in this work a novel algorithm for adjoint sensitivity analysis of anisotropic structures using the finite difference time domain (FDTD) method. Using only one extra adjoint simulation, our approach estimates the sensitivities of the desired objective function or response with respect to all components of permittivity, permeability, or conductivity tensors of all anisotropic media using only one extra simulation. Our approach gives good results as compared to the accurate central difference approaches.

P8: Shielding Effectiveness Measurement for Conductive Textile-based RF-shielded Environment
M. A. Humayun[1], H. A. Rahim[1], M. AbdulMalek[2], P. J. Soh[1], M. S. Zulkefli[1], C. M. Nor[1], A. A. Al-Hadi[1]
[1] *Universiti Malaysia Perlis (Malaysia),* [2] *University of Wollongong in Dubai (United Arab Emirates)*

The electromagnetic noise free environment is important to investigating possible adverse health effect caused by the exposure of the RF-EMF due to its sensitivity to the Electromagnetic Interference (EMI) noise. Thus, an experimental investigation of an EMI shielded, noise free environment has been performed. The shielding effectiveness of the proposed EMI shielded environment was studied in the frequency range of 1800-3200 MHz where it falls under the most widely used frequency by mobile phones, WBAN devices, and wireless communication systems.

P9: Electromagnetic effects and detection on Integrated Circuits
David Michel El-Baze[1], Jean-Baptiste Rigaud[1], Philippe Maurine[2]
[1] *Institut Mines-Telecom Mines Saint-Etienne (France),* [2] *LIRMM (France)*

Radiation and ElectroMagnetic Emissions can cause errors in the operation of digital systems. These kinds of effects must be alleviated as far as possible in critical systems so as nuclear plants, spatial activities and systems dedicated to security purposes. They can be used to inject controlled signals into any integrated circuits to obtain a certain benefit. This paper takes advantage of recent results provides a digital sensor allowing to detect Electromagnetic pulses and which could be integrated into ICs.

P10: Substrate Integrated Waveguide Circular Cavity Resonators for Planar Diplexer Design
N. H. Baba[1], A. H. Awang[1], M. T. Ali[1], H. M. Hizan[2]
[1] *Universiti Teknologi MARA (Malaysia),* [2] *Advanced Physical Technologies Lab (Malaysia)*

This paper presents a new design of planar diplexer based on SIW single mode circular cavity filters. The simulation return losses for the lower and upper channels are greater than 20.94 dB and 30.92 dB respectively. The minimum insertion losses obtained are 0.87 dB and 0.74 dB at each band. The proposed SIW diplexer has a promising application for the uplink/downlink RF front end subsystem for wireless communications systems.

P11: Wireless Power Transfer by Voltage Multiplication on a Trapped Surface Wave
LWY Liu, A. Kandwal, Q. Zhang
Southern University of Science and Technology (China)

In this work, power is wirelessly harvested by direct voltage multiplication on trapped surface waves. We have proven by complex analysis that a suspended layer of lossy dielectric can support propagation of trapped

surface waves. Armed with this knowledge, we have realized a new class of open-ended voltage multipliers to harvest energy on the surface of a suspended layer of high-loss dielectric with a power at the receiving end being proportional to inverse square root of the range.

P12: Dynamic Subject-Specificity On-Body Communications Channel Models for WBAN
Hasliza A. Rahim[1], P. J. Soh[1], M. Abdulmalek[2], M. Jusoh[1], G. A. E. Vandenbosch[3]
[1] *Universiti Malaysia Perlis (UniMAP) (Malaysia),* [2] *University of Wollongong in Dubai (United Arab Emirates),* [3] *Katholieke Universiteit Leuven (Belgium)*

This paper presents a small-scale fading channel derivation of the dynamic and subject-specific on-body communications channel characteristics at 2.45 GHz. A slotted planar inverted F-antenna (PIFA) fixed on the right upper arm is used as the transmitting antenna is in this investigation. Results showed that the lognormal distribution provides the best fit to model the small-scale fading for on-body communication channel in a dynamic and subject-specific environment compared to Normal, Nakagami-m, Weibull and Rician distributions.

Lunch and Exhibit Inspection

12:10 - 14:00

14:00 - 14:55 — Room 118

Session 3A2

RFID Antennas, Technologies and Applications

Organized by: Youchung Chung

Chaired by: Youchung Chung

14:00 : Invited talk
Evolution-Strategy Optimized Dual-Band Antenna for UHF-band RFID/IoE Applications
Muhammad Salman Khattak, Abdul Rehman, Changhyeong Lee, Dajung Han, Hejun Park, Sungtek Kahng, Muhammad Kamran Khattak
Incheon National University (Korea)

This paper presents an optimization-based design method for a multi-band antenna. From various optimization techniques, evolution strategy is adopted to find the proper initial geometry for creating the resonance at two frequencies with a limited physical size. The antenna structure is finalized by adjusting the geometrical parameters to meet the specifications of the UHF-band RFID/IoE services.

14:20 : Invited talk
Small UHF RFID Tag Antenna for Vehicle License Plate
Berhe Hintsa Teklebrhan, Byondi Franck Kimetya, Chang Hwan Suel, Youchung Chung
Daegu University (Korea)

This paper presents designing of passive UHF RFID Tag Antenna which is applicable in the vehicular license plate and attached to the vehicle bumper. The main goal is, to increase the reading distance range of the vehicular plate by readers installed on the road side. Since every vehicle have a license plate, the available plate structure is used to design the antenna.

14:40 : UHF RFID Automobile Plate Tag Antenna Controlling the Radiation Beam Pattern with T-Matching Structure
Berhe Hintsa Teklebrhan, Byondi Franck Kimetya, Chang Hwan Suel, Youchung Chung
Daegu University (Korea)

This paper presents Designing of RFID Tag Antenna in the UHF range, which is applicable in the vehicular license plate and attached to the vehicle bumper. The main goal is, first to increase the reading distance range, second to improved identification ratio by controlling the radiation beam pattern. The shape of the antenna is rectangular and has a dimension of 520mm x 110mm, which is a typical size of the standard plate

used in Korea.

14:55 - 15:55 — Room 118

Session 3A3

Antennas and Propagation in Complex media

Chaired by: Zhirun Hu

14:55 : Investigation on various structural compositions of textile-inegrated antenna
A. A. Sharatol Ahmad Shah, N. H. Abd Rahman, Mohd Tarmizi Ali, Muhammad Shakir Amin Nordin
Universiti Teknologi MARA (Malaysia)

Flexible wearable antennas are desired in the advancement of wireless sensor development especially for healthcare, biomedical and security applications. Common parameters such as substrate thickness and dielectric permittivity were used in designing a conventional antenna while in this paper, analysis of the effects of the textile properties on the antenna's performance is performed in detail. The parametric study focused on the thickness of the textile composition used in the antenna structure which are essential for antenna optimization.

15:10 : Amalgamation of Rectangular Microstrip Antenna with Light Emitting Diode (LED)
Suhaila Binti Subahir, Mohd Tarmizi Ali, Hamizan Yon, Siti Norhidayah Kamarudin, A. H Awang
University Teknologi MARA (Malaysia)

This paper presents the design of amalgamation of rectangular patch antenna with SMD LED operating in the S-band region. The CST was used to optimize the position of LED within the radiating patch. The antenna was fabricated on RO6002 substrate and the performances was compared and analyzed through simulation and measurement. The present results provide an important concept for further investigations. Good agreements have been achieved for both the simulation and experimental results.

15:25 : Planar microwave resonator for bio-sensing and material characterisation
Ayodunni Ayodele Oloyo, Zhirun Hu
University of Manchester (United Kingdom)

The use of planar microwave resonator for bio-sensing and material characterisatiom of biological materials in a non-invasive method is presented. The resonator was used to measure the scattering parameters values of the biological phantom of human tissues including skin, blood, fat, muscle and bone.

15:40 : Multiple Frequency Microstrip Five-Port Ring Junction Circuit for Six-Port Reflectometer (SPR)
Siti Aishah Baharuddin[1], Cheng Ee Meng[1], Hasliza Rahim[1], Kim Yee Lee[2], Zulkifly Abbas[3], Nashrul Fazli Mohd Nasir[1], Yeng Seng Lee[1]
[1] *Universiti Malaysia Perlis (Malaysia),* [2] *Universiti Tunku Abdul Rahman (Malaysia),* [3] *Universiti Putra Malaysia (Malaysia)*

The interest of the portable microwave instrument system has grown rapidly in recent years. Thus, Six-Port Reflectometer (SPR) is proposed. SPR provides a simple and inexpensive solution to industrial need of network analyzer. This paper presents the design of the multiple frequencies microstrip Five-Port ring junction which has operating frequencies of 0.37 GHz, 1.40 GHz, 2.10 GHz, 3.10 GHz and 3.80 GHz. The simulation result exhibit optimum specifications and less mismatch error.

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