ISSN: 2286-7074
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ECTI President Message:

This year the ECTI committees work very hard to make all conferences organised by ECTI association very successful. I would like to express sincere appreciation to not only committees but also sponsors who provided a lot of supports for those conferences. Also, we have improved the quality of both transactions published by ECTI association and aim to bring them into the higher citation index systems in the near future. The members will see changes in all activities managed by the ECTI to give members more and more benefits for next coming year.

For this e-Magazine, the editorial team pays more attention to make it very interesting and useful for all ECTI members. I would like to express sincere appreciation to all the authors for their excellent contributions and editorial committee members for their great efforts to make this issue very successful. I also look forward to see the growing contribution for next issues.

Finally, I would like to remind all members that the datelines for submitting your papers to the ECTI-CON 2015 held in Hau-Hin and the ECTI-CARD 2015 held in Trang are coming. You all are invited to attend both conferences that bring you to the most up-to-date on all fields of electrical technology.
Merry Christmas and Happy New Year and wish you all having happiness and success for the next coming year.

Prayoot Akkaraekthalin (KMUTNB)

In this issue:

วารสารอิเล็กทรอนิกส์ ECTI
ECTI e-magazine
ISSN: 2286-7074

[Article]

Ground Penetrating Radar (GPR): Theory and Simulations

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King Mongkut's University of Technology North Bangkok

1. Introduction

Electromagnetic pulse was first used to determine the structure of buried features in 1926 by Hülsenbeck [1]. It was noted that the variation of dielectric property of material would also produce reflections and this technique had the advantages over seismic method. In 1929, the ground penetrating radar (GPR) was also first used to survey the depth of a glacier by Stern [2]. This technology was not received interest until the late 1950's. From the beginning of 1970's, there are a number of commercial applications using GPR.

The systems used in that time were exclusively impulse time domain systems. The applications were mainly found in the domain of civil engineering: location of voids, containers, tunnels and rocks, detection of cables and tubes, measuring the thickness of ice and coal layers, probing the profiles of lakes and rivers, etc. From then until today, the range of applications has been growing steadily.

Besides the use of GPR in commercial application, GPR is also applied to defense technology for landmine detection [3] Since GPR have been received considerable interest in many applications, there are a number of research which attempt to improve its performance, for example, GPR antenna [4], transmitter, receiver [5], and signal processing unit [6]. The advantage of the use of GPR over metal detector is that GPR can detect non-metal object such as plastic landmines [7].

This paper describes the basic principle of GPR systems, including its basic configuration and data collection technique. The relation between antennas and buried object is shown via the equation of propagation time. This equation reveals the hyperbolic curve resulting to GPR image. We also examine a simulation of the GPR system by using GPRmax.

ISSN: 2286-7074
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2. Ground Penetrating Radar (GPR)

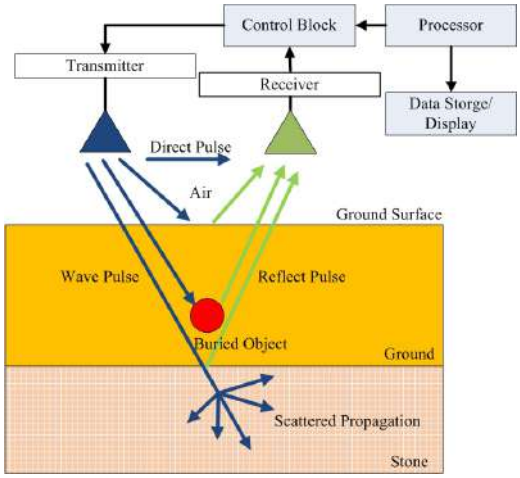
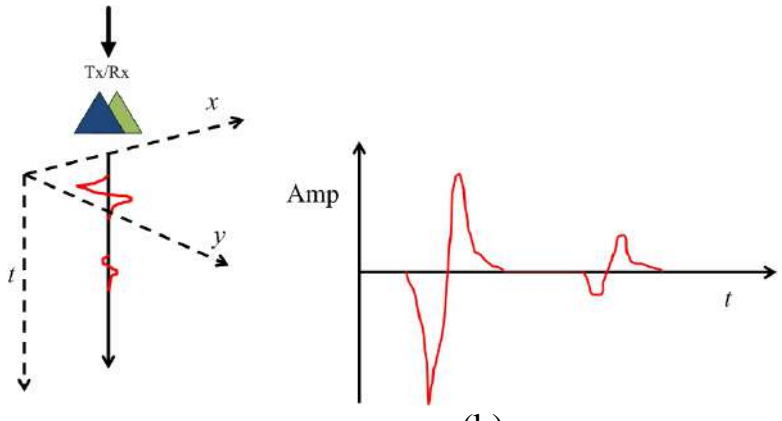


Fig. 1 Block diagram of the typical GPR system.

Figure 1 depicts a block diagram of the typical GPR system. In the figure, radar signals (short pulse or step frequency) which are transmitted by using the transmitters propagate through the transmitting antenna. The signals scattered from the object buried under the ground are received by the receiving antenna. The signals are converted into digital format and then used to construct the GPR image. There is need of performing signal processing in order to eliminate some signals due to direct path and ground-air interface.



(a) (b)

Fig. 2 Data Collection of A-scan (a) measurement geometry (b) data representation

ISSN: 2286-7074
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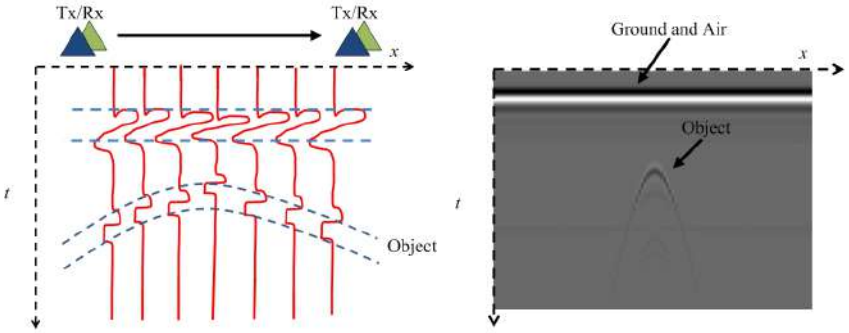
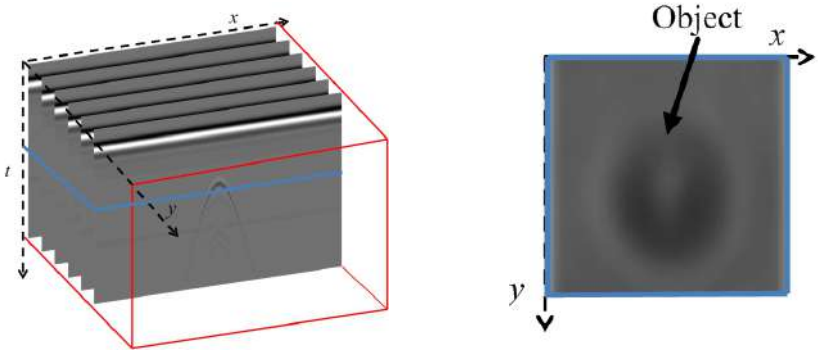
ECTI e-magazine



(a) (b)

Fig. 3 Data Collection of B-scan (a) measurement geometry (b) data representation



(a) (b)

Fig. 4 Collection of C-scan (a) measurement geometry (b) data representation

GPR data are generally collected in three types of scanning i.e. A –scan, B-scan and C-scan.

1) A-scan: The data is recorded by a single signal received from one antenna, i.e., a composite transmitting antenna and receiving antenna or one monostatic antenna, at a fixed position (x, y), as shown in Fig. 2 (a). Fig. 2(b) is the depth of the propagation velocity, which is only related to the time (t). A-scan data can be used to detect and identify buried objects, whose locations are known.

2) B-scan: The B-scan is A-scan when moving the antennas on a line along the x-axis using the configuration similar to that of the antenna in A-scan. Series of A-scan data are collected to form a two dimensional data set called B-scan as shown in Fig. 3 (a). The amplitude of the received signal is presented by a grey-scale or color scale 2-D image with the vertical axis being the depth of the ground (represented as the signal time t) and the horizontal axis (x) being the surface.

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ECTI e-magazine
ISSN: 2286-7074

Buried objects detected by B-scan in the resulting image are usually appear as hyperbolas as shown in Fig 3(b), which can be processed by techniques such as curve fitting, Hough transform, migration, and SAR processing. The B-scan is popular for detecting objects because it does not need to know the location of objects in the areas but can still detect objects precisely.

3) C-scan: The C-scan is B-scan moving an array of antennas in the xy-plane to form a three dimensional data by gathering multiple simultaneous parallel B-scan as shown Fig 3(a). The vertical axis is the depth of the ground (represented as the signal time t). A slice of xy-plane presents the slice of the depth as shown Fig 3(b). C-scan data can be used to detect objects by searching through these slices along time axis (t). However, the array antenna is usually expensive and running a C-scan takes much more time than A-scan and B-scan.

C-scan based GPR is an efficient system to detect the buried object. However, the cost of C-scan system is higher than that of B and A-scan systems but its cost is high. If A-scan system is used to detect the object, there is need of very complicate algorithm in detection.

In a B-scan system, parabola shape resulting from object detection depends upon two main parameters i.e. distance of each scanning and signal velocity dependent upon relative permittivity of ground.

The limitation of ability of GPR depends upon the characteristic of systems under consideration. Examples of parameters which affect the performance of GPR are

Noise: GPR is sensitive to noise due to system environment.

Soil property: The property of soil affects the ability of penetration of electromagnetic field.

Signal frequency: The used frequency of GPR affects the ability of penetration and accuracy of GPR. Generally, GPR operates in the low and high-frequency band such as 1 – 1000 MHz.

ISSN: 2286-7074
วารสารอิเล็กทรอนิกส์ ECTI
ECTI e-magazine

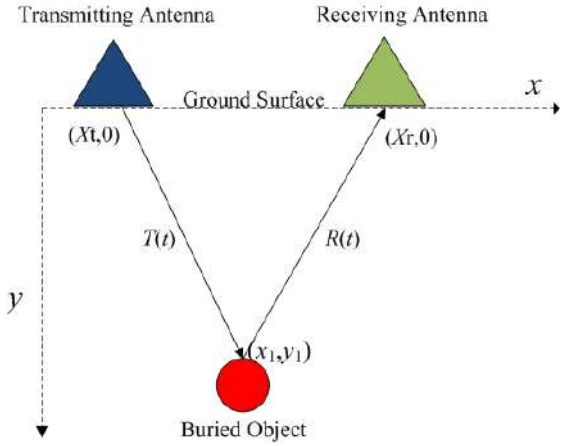

Fig. 5 Geometry relations between antennas and a buried object.

3. Basic principle of GPR and Simulations

To analyze the concept of operation of the GPR system, one can descript it by geometry relations between antenna and a buried object as shown in Fig. 5 [8]. In the figure, the antenna lines along x axis. The depth of the object is in z axis. The position of object is at (x_1,y_1). The electromagnetic field is transmitted from the antenna at (Xt,0) The signal scattered from the object (x_1,y_1) is received by the antenna at (Xr,0). The received signal can be expressed by

$$R(t) = A \cdot T(t - \Delta t) \tag{1}$$

where A the amplitude of the received signal and Δt denotes the propagation time from transmitting antenna to receiving antenna through the reflection at the buried object. The propagation time Δt can be given by

$$\Delta t = \frac{\sqrt{(Xt - x)^2 + y^2} + \sqrt{(Xr - x)^2 + y^2}}{\upsilon_r} \tag{2}$$

where υ_r denotes the propagation velocity in soil. If we assume the soil is homogeneous, the υ_r is constant and given by.

$$\upsilon_r = \frac{c}{\sqrt{\varepsilon_r}} \tag{3}$$

ISSN: 2286-7074
วารสารอิเล็กทรอนิกส์ ECTI
ECTI e-magazine

Where ε_r is a dielectric constant of soil. According to Fig. 5, if both transmitting and receiving antenna are at the same position $Xn = X_T = X_R$. The GPR operate along x axis. Eq. (2) becomes

$$\frac{(\upsilon_r \cdot \Delta t/2)^2}{y^2} - \frac{(Xn - x)^2}{y^2} = 1 \qquad (4)$$

Clearly, this equation reveals a hyperbolic curve on the plane of depth $\upsilon_r \cdot \Delta t/2$ and the antenna position x as shown in Fig. 5.

In this paper, we also show some simulation examples of GPR systems. The simulations are conducted by using GPRmax[9]. Fig. 6 illustrates the geometry of simulation under consideration [10]. In simulations, the object created as perfect electric conductor (PEC) with radius of 3.75 cm is buried under the road. The structure of road is composited of different three layers. The top layer is Asphalt Dry with thickness of 10 cm. The object is buried in the middle layer with the thickness of 20 cm. The height of antenna from the ground is 5 cm. Fig. 7 shows the GPR image obtained from simulation. There is a hyperbolic curve in the figure. This implies that there is an object under the road. Note that the position of object is at the center of hyperbolic curve.

Besides the transmitter and receiver, one of the most important parts of the GPR system is a signal processing unit. In practical situation of operation of GPR, the GPR image is generally not clear. This is due to noise or clutter. Thus, performing signal processing such as reduction of dc offset and clutter is required to improve quality of signal of GPR image.

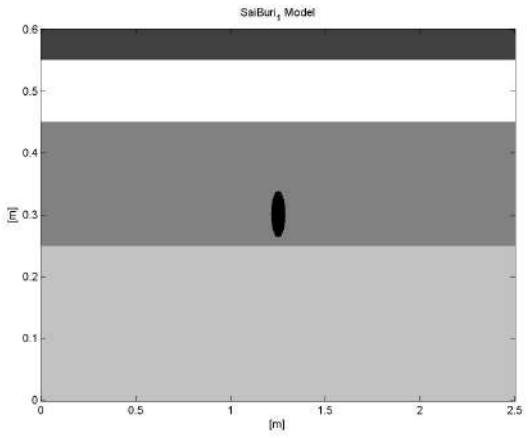

Fig. 6 configuration of simulation.

ISSN: 2286-7074
วารสารอิเล็กทรอนิกส์ ECTI
ECTI e-magazine

Fig. 7 GPR image obtained from simulation.

4. Conclusions

This paper presents the overview of GPR systems. Three types of data collections of GPR systems i.e. A-scan, B-scan and C-scan are introduced. The basic principle of GPR systems is described via the equation of propagation time of signal. The equation of a hyperbolic curve results to the GPR image. Example of simulation is conducted by using GPRmax in order to illustrate GPR systems. The hyperbolic curve occurring in the GPR image show the position of object buried under the road.

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ISSN: 2286-7074
วารสารอิเล็กทรอนิกส์ ECTI
ECTI e-magazine

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Akkarat Boonpoonga received the B.Eng. degree in Electrical Engineering from King Mongkut's Institute of Technology North Bangkok (KMITNB), Bangkok, Thailand in 2002. He received M.Eng. Degree in Telecommunications Engineering and D. Eng in Electrical Engineering from King Mongkut's Institute of Technology Ladkrabang (KMITL), Bangkok, Thailand in 2004 and 2008, respectively. He was a lecturer at Department of Computer Engineering, Faculty of Engineering, Mahanakorn University of Technology. He currently a Assistant Professor at Department of Electrical and Computer Engineering, Faculty of Engineering, King Mongkut's University of Technology North Bangkok (KMUTNB). His research interest includes signal processing for EM applications such as adaptive antenna, DOA, target classification and GPR systems.

Paper List of ECTI-EEC Trans., Vol.8 , No. 2, Nov-2014 issue

http://www.ecti-thailand.org/paper/journal/ECTI-CIT

Regular papers:

1. Shahid Md. Asif Iqbal , Alok Kumar Chowdhury, Amina Akhter , "Agent Aided Routing for Faster and Efficient Spreading of Messages in Delay Tolerant Networks"
2. Masa-aki Fukase, "Design of the Optimum Execution Stage of Embedded Processors"
3. Wannida Sae-Tang, Shenchuan Liu, Masaaki Fujiyoshi, Hitoshi Kiya, "1D Frequency Transformation-Based Amplitude-Only Images for Copyright- and Privacy-Protection in Image Trading Systems"
4. Suvit Poomrittiguland Masahiro Iwahas, "Color Image Transcoding of Lossless Coder and Standard Lossy Decoder based on JP2K"
5. Santipap Sainon and Chiranut Sa-ngiamsak, "Effect of TiO2 capping layer on reset current of lateral phase change memory"

Special section on papers selected from ECTI-CON 2013:

6. Thepparit Banditwattanawong and Putchong Uthayopas, "A Client-Side Cloud Cache Replacement Policy"
7. Kenji Sawada and Seiichi Shin, "On the output feedback control of discrete-valued input systems"
8. Wataru Inujima, Kazushi Nakano, Shu Hosokawa, "Multi-Robot Coordination Using Switching of Methods for Deriving Equilibrium in Game Theory"
9. Naowarat Tephiruk and Komsan Hongesombut, "Power System Oscillation Control Using a Robust Energy Capacitor System"
10. Yuki Satake, Hiroyuki Furuya, Youhei Mochizuki, Yuji Fukaishi, Kohji Higuchi, Kosin Chamnongthai, "Robust Digital Control for Interleaved PFC Boost Converter Using Approximate 2DOF"

ISSN: 2286-7074
วารสารอิเล็กทรอนิกส์ ECTI
ECTI e-magazine

Report from Conferences and Workshops
1. Professor Roadshow

ECTI association has set up a program to encourage Thai lecturers to plan forward professor position, and started up university visit at Chiangmai University in the beginning of 2014. Prof. Monai Krairiksh, Prof. Prayoot Akkaraekthalin, and Prof. Kosin Chamnongthai organized a seminar in the project of professor roadshow at Bangkok University on Oct 14, 2014 and Prince Songkla University on Dec 18, 2014. They plan to visit Mahasarakam University for the seminar on Jan 20, 2014.

Reported by Kosin Chamnongthai (KMUTT)

วารสารอิเล็กทรอนิกส์ ECTI
ECTI e-magazine
ISSN: 2286-7074

2. **APCC 2014** (reported by Titipong Lertwiriyaprapa**)**

Report of APCC2014 at Holiday Inn Pattaya

Statistics of APCC 2014 Paper Submissions

COUNTRY	NO. PAPERS	COUNTRY	NO. PAPERS
Australia	7	Malaysia	7
China	12	Myanmar	2
France	2	New Zealand	2
Germany	1	Pakistan	2
India	12	Switzerland	1
Indonesia	2	Taiwan	1
Iran	1	Thailand	46
Japan	30	Tunisia	3
Korea	18	Vietnam	3
		Total	152

152 submitted papers from 18 countries with 101 presenting papers 6 Special Sessions and 17 Regular Sessions

Keynote Speakers

1. Prof. Dr.-Ing Dirk Heberling

   Director, Institute of High Frequency Technology, RWTH Aachen University, Germany

   Topic: Antenna measurement research @ RWTH Aachen University

2. Prof. Ying-Cheng Liang

   Principle Scientist, Institute for Infocomm Research, Singapore

   Topic: Spectrum Sharing for 5G Networks

3. Prof. Jun-ichi TAKADA

   Department of International Development Engineering, Tokyo Institute of Technology, Japan

   Topic: Study of Microwave Wideband Channel toward 5G Mobile System

Special Sessions

1. Advanced Communication Technology for Smart Grid
2. Challenge of 5G Technology
3. Advanced Antennas and Microwave Devices
4. Emerging Technologies for Next Generation Ambient Intelligence and Sensor Networks I
5. Emerging Technologies for Next Generation Ambient Intelligence and Sensor Networks II

วารสารอิเล็กทรอนิกส์ ECTI
ECTI e-magazine
ISSN: 2286-7074

6. Space Technology Development Trends in Asia-Pacific Region

ISSN: 2286-7074
วารสารอิเล็กทรอนิกส์ ECTI
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ISSN: 2286-7074
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2. APSIPA-ASC 2014 (reported by Werapon Chiracharit)

The 2014 Annual Summit and Conference organized by Asia-Pacific Signal and Information Processing Association (APSIPA ASC 2014) was held in Sokha Angkor Resort, Siem Reap, Cambodia, from December 9-12, 2014. It was the sixth APSIPA annual conference, while the previous conferences were held in Japan (2009), Singapore (2010), China (2011), USA (2012) and Taiwan (2013). Although the venue was moved from Chiang Mai due to a political situation in Thailand, APSIPA ASC 2014 had a high record of 318 accepted papers from 24 countries. The conference had high turnouts, which were over 350 attendees.

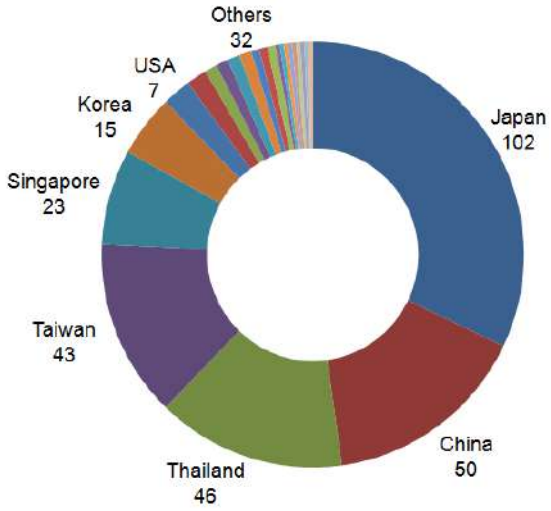

Fig. 1 Number of accepted papers by countries

ISSN: 2286-7074
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The field of interest of APSIPA concerns all aspects of signals and information including processing, recognition, classification, communications, networking, computing, system design, security, implementation, and technology with applications to scientific, engineering, and social areas. Paper submission and presentation were organized in 6 separate tracks corresponding to the technical areas covered by 6 APSIPA technical committees, as follows

- Biomedical Signal Processing and Systems (BioSiPS)
- Signal Processing Systems: Design and Implementation (SPS)
- Image, Video, and Multimedia (IVM)
- Speech, Language, and Audio (SLA)
- Signal and Information Processing Theory and Methods (SIPTM)
- Wireless Communications and Networking (WCN)

Fig. 2 Opening ceremony by Prof. C.-C. Jay Kuo

APSIPA ASC 2014's General Co-chairs are Prof. Kosin Chamnongthai (King Mongkut's University of Technology Thonburi, Thailand), Prof. C.-C. Jay Kuo (University of South California, USA) and Prof. Hitoshi Kiya (Tokyo Metropolitan University, Japan). The conference was technical co-supported by the IEEE Signal Processing Society, Electrical Engineering/Electronics, Computer, Telecommunications and Information

ISSN: 2286-7074
วารสารอิเล็กทรอนิกส์ ECTI
ECTI e-magazine

Technology Association of Thailand (ECTI), Institute of Electronics, Information and Communication Engineers (IEICE), and Royal University of Phnom Penh (RUPP). The technical program included 7 tutorial sessions, 3 keynote speeches, 2 plenary overview sessions, 1 forum discussion session, together with 53 oral sessions and 7 poster sessions.

Technical Program	
Day 0: December 9, 2014 • Tutorial Session 1-7 • Welcome Reception	Day 2: December 11, 2014 • Keynote Speech 2 • Technical Session 19 - 33 • Poster Session 3-4 • Forum Session • Plenary Session 1 • Banquet
Day 1: December 10, 2014 • Opening Ceremony • Keynote Speech 1 • Technical Session 1-18 • Poster Session 1-2	Day 3: December 12, 2014 • Keynote Speech 3 • Technical Session 34 - 53 • Poster Session 5-7 • Plenary Session 2 • Closing Ceremony

Fig. 3 Keynote speeches by Prof. P. P. Vaidyanathan (California Institute of Technology, USA),
Dr. Wei-Ying Ma (Microsoft Research Asia, China) and
Prof. Helen Meng (Chinese University of Hong Kong, Hong Kong)

ISSN: 2286-7074
วารสารอิเล็กทรอนิกส์ ECTI
ECTI e-magazine

Four best awards were granted in the conference banquet. They are:

- Hsin-Hung Liu, Shih-Chung Hsu and Chung-Lin Huang
  "Single-sample-per-person-based Face Recognition Using Fast Discriminative Multi-Manifold Analysis"
- Shinnosuke Takamichi, Tomoki Toda, Alan W. Black and Satoshi Nakamura
  "Modulation Spectrum-Based Post-Filter for GMM-Based Voice Conversion"
- Hiroshi Higashi, Toshihisa Tanaka and Yuichi Tanaka
  "Smoothing of Spatial Filter by Graph Fourier Transform for EEG Signals"
- Yuya Kaneko, Takeshi Higashino and Minoru Okada
  "Interference Suppression Schemes for Radio over Fiber Simultaneously Transmitted with 10 Gbps On-Off Keying"

Fig. 4 Best paper awards

The social program included a welcome reception and a conference banquet. Siem Reap, city of Angkor Wat, is the capital city in northwestern of Cambodia, and a popular resort town as the gateway to Angkor temples region. Attendees had great experiences in the wonderful world heritage, colonial and Chinese-style architecture in the old French quarter, museums, traditional Apsara dance performances, silk farms, fishing villages and a bird sanctuary near the Tonle Sap lake.

ISSN: 2286-7074
วารสารอิเล็กทรอนิกส์ ECTI
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Fig. 5 The banquet

APSIPA ASC 2014 was a great success. The proceedings are all accessible online and can be downloaded at APSIPA website (http://apsipa.org/proceedings.htm). Moreover, all accepted papers are accessible via IEEE Xplore as well as other Abstracting and Indexing (A&I) databases. We welcome your contributions to ASIPA ASC 2015, which will be held in Hong Kong, from December 16-19, 2015. Look forward to seeing old as well as new friends there.

ECTI Transactions on Communication Engineering, Vol. 8, No. 4, Oct-Dec 2014

วารสารอิเล็กทรอนิกส์ ECTI
ECTI e-magazine
ISSN: 2286-7074

Call-for-Papers of International Conferences

2015 – 7th International Conference on Knowledge and Smart Technology (*KST*)

January 28-31, 2015. Faculty of Informatics, Burapha University, Chon Buri, THAILAND.

"Entertainment Technology for Life"

Call for papers

KST international conference has been established with the aim in mind that a sustainable community will be achieved through continuous studies and share resources. The conference will be held annually in Burapha University which located in the Eastern part of Thailand. It provides a central forum for experts and developers to promote, share, and discuss various issues and developments in the broad field of Computational Intelligence, Intelligent Application, Intelligent Computer Networks and Systems, and Emerging Intelligent Technologies. KST international conference will provide an opportunity for young researchers to demonstrate their talent and interesting research ideas. The conference will benefit people who are actively involved in research related to computational intelligence and its applications. Accepted papers will be published in the KST-2015 Conference Proceedings. Presented and selected papers will be included in IEEEXplore®. Selected papers will be proposed for further extension before publishing in ECTI-Transaction on Computer and Information Technology (ECTI-CIT).

The list of topics of interest includes (but not limited to)

Computational Intelligence

- Artificial Immune Systems
- Bayesian Networks
- Cognitive Systems
- Computational neuroscience
- Data Analysis and Pattern Recognition
- DNA Computing
- Expert Systems
- Fuzzy Techniques and Systems
- Genetic Algorithms and Evolutionary Computing
- Knowledge-Based Systems (Knowledge Acquisition, Knowledge Discovery and Data Mining, Knowledge Representation and Management)
- Machine Learning
- Microarray Data Analysis
- Neural Networks
- Ubiquitous Computing

Intelligent Applications

- Bioinformatics using Intelligent & Machine Learning Techniques
- Fault Diagnosis
- Financial & Stock Market Monitoring and Prediction
- Geographical Information System
- Image & Signal and Time Series Processing
- Intelligent Disaster Warning System
- Intelligent Web-based Systems
- Machine & Computer Vision
- Medical & Diagnostic Systems
- Natural Language Processing
- Speech Processing and Synthesis

Intelligent Computer Networks and Systems

- Ad Hoc Networks
- Cloud and Grid Computing
- Computer Architecture
- Computer Simulation and Modeling
- Computer and Network Security
- Computer and Network Applications
- Computer Network and Communication
- Embedded Systems
- Network Management and Analysis
- Network Protocol and Architecture
- Mobile Computing and Systems
- Future Internet
- Parallel and Distributed Computing
- Pervasive and Mobile Computing
- Wireless Sensor Networks
- Wireless Networks and Communications

Emerging Intelligent Technologies

- Artificial Intelligence and Information Agents on the Internet
- Artificial Life
- Blind Source Separation
- Business Intelligence Systems
- Cognitive Interfaces
- Context-aware and Affective (Emotional) Computing
- Human-centered Computing
- Intelligent Operating Systems
- Intelligent Agents and Multi-Agent Systems
- Intelligent Tutoring Systems
- Intelligent User Interfaces
- Intelligent Web Mining & Applications
- Intelligent Web Personalization
- Semantic Web
- Multi- Media Intelligent Information Systems

Important Dates

Call for Special Session Proposal	July 15, 2014
Notification of Special Session	September 1, 2014
Full paper submission	October 1, 2014
Notification of acceptance	November 30, 2014
Registration	December 15, 2014
Camera-ready submission	December 15, 2014

Paper Submission

Full paper submission in English is expected. All manuscripts must be prepared in the standard IEEE Conference Proceedings format and limited to the maximum of 6 pages of A4 form in PDF format. Please use 10 points and Time New Roman font. The authors' names and affiliations, postal addresses, telephones, fax numbers and e-mail addresses must be omitted from the submitted manuscripts. Each manuscript must contain an abstract of about 100 words.

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วารสารอิเล็กทรอนิกส์ ECTI
ECTI e-magazine
ISSN: 2286-7074

ECTI-CON 2015

Hua Hin, Thailand June 24 – 26, 2015

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Important dates:

- Full paper submission: Jan 31, 2015
- Notification of acceptance: Apr 30, 2015
- Camera-ready paper submission: May 15, 2015
- Authors and Early-bird registration: May 15, 2015

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ISSN: 2286-7074

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