Call for Contribution from members...

We would like to call for contribution from our members, researchers and international students to describe your experiences, research works or research group activities. Please write at a maximum of 1 page including pictures.

Contact: ecti.emagazine@gmail.com
Dear authors, reviewers and readers of ECTI E-Magazine,

We are delighted to welcome you to the first issue of ECTI E-Magazine 2018, for which we have served as the new team of editors. Firstly, we wish to thank our predecessor Pornchai Supnithi who has done a great service for the past two years, revolutionizing the magazine to a new level. He has always led academic community with creative thinking, bringing in new generation of young scientists and engineers to do powerful research and development, which drives the entire society towards digital transformation. He always believes that the sky is the limit, so does our new team. We wish him a wonderful success for his new role as the 2nd Vice President of ECTI association.

We are also pleased to inform you that Professor Kosin Chamnongthai is officially declared as our new President of ECTI association for 2018–2019. He is actually a co-founder of ECTI association established in 2002 and has contributed immensely in organizing many international conferences throughout his successful academic career. We are looking forward to collaborating and working under his guidance and leadership.

We are very proud to introduce Dr. Thayathip Thongtan, a professional electrical metrologist at time and frequency laboratory, electrical metrology department, NIMT, for her article entitled “Time and frequency metrology in Thailand.” This article describes the time and frequency metrology works in Thailand at NIMT, including NIMT atomic time keeping system, international time comparisons and time dissemination in Thailand.

ECTI association is organizing four major conferences this year, namely the ECTI-CON 2018 (Chiangrai), ECTI-CARD 2018 (Phitsanoulok), ITC-CSCC 2018 (Bangkok), ISCIT 2018 (Bangkok). Members are encouraged to submit technical papers for presentation and share experience among regional and global leading researchers, while taking this opportunity to meet new friends and establishing collaboration among universities and institutions. Other regional conference/workshop activities are also ongoing and will soon spread across every region, bringing academic to every corner of the society. Accepted papers in conferences with exceptionally high quality can be extended for publication in two prestigious journals of ECTI, namely the ECTI Transactions on Computer and Information Technology (ECTI-CIT) and the ECTI Transactions on Electrical Engineering, Electronics, and Communications (EEC).

Finally, we are very excited and aware of the responsibilities of the editor’s role. Therefore we wish to welcome all kinds of suggestions, discussion, and thoughts to make this E-Magazine an excellent platform for our digital generation to share their success and contribute to the world of academia and industries. Happy Songkran festival 2018.

Lunchakorn Wuttisittikulkij
ECTI E-Magazine Editor

Watid Phakphisut
ECTI E-Magazine Associate Editor

Lin M. M. Myint
ECTI E-Magazine Assistant Editor
TIME AND FREQUENCY METROLOGY IN THAILAND

Thayathip Thongtan

ABSTRACT

National Institute of Metrology Thailand (NIMT), time and frequency laboratory operates a national timescale for Thailand called Coordinated Universal Time kept at NIMT or UTC(NIMT). UTC(NIMT) is realised from four caesium atomic clocks in order to define 1 second of an International System of Units (SI) and assigned as an primary reference standard in Thailand. This in-house reference standard is internationally compared using Global Positioning System (GPS) observations to link UTC(NIMT) with UTC by observing precise timing signals from GPS navigation satellite using a GPS timing receiver. This GPS timing receiver compares 1 PPS signals defined at UTC(NIMT) and 1 PPS observations from GPS receiver output. The measurements are: the time differences between UTC(NIMT) and satellite clock onboard, and the time differences between UTC(NIMT) and GPS system time (GPST). This UTC(NIMT) is then compared with approximately 600 atomic clocks operating by around 80 national timing laboratories around the world in order to produce a globally recognised UTC timescale. This process is done by the International Bureau of weights and Measures (BIPM). The UTC(NIMT) is disseminated to users through three main channels; namely, time and frequency calibration services for high accuracy and stability frequency standards in industries and time of day through internet network by our Network Time Protocol (NTP) servers and through FM radio signals. The Hydrographics Department, Royal Thai Navy (HDRTN) timescale is linked to UTC(NIMT) to provide time of day services though a web-based clock display through HDRTN website and a speaking clock by dialling 1811. The performances and evaluations of UTC(NIMT) where the frequency accuracy of UTC(NIMT) is kept around 4.9×10-13 (Hz/Hz) per day; from 1 January 2017 to 27 December 2017 (MJD 57754 to MJD 58114), are vital to industries and many modern scientific aspects; whereas time measurement at the accuracy of a minute or few seconds are enough for our daily life activities. The time and frequency metrology in three main folds, namely, NIMT atomic time keeping, international time comparisons and time dissemination in Thailand are elaborated in this article.

Keywords: Time keeping; time dissemination; clock offset; timescale

I. INTRODUCTION

NIMT is a public organisation under the ministry of science and technology, the royal Thai government and is located at Techno-Thani science complex, Klong 5, Patunthani.

NIMT maintains and disseminates Thailand Standard Time realised from UTC(NIMT), whereas UTC is one of the bases of a civilian atomic time keeping scheme. UTC(NIMT) is determined from the 3-ensemble caesium frequency standard. This is daily compared by observing GPS signals with other 400 atomic clocks operating by approximately 70 national timing centres around the world in order to produce the UTC timescale.

The maintained UTC timescales at each timing laboratory around the world from their operating atomic clocks are compared using two main methods: (1) two-way time transfer using communication satellites and (2) one-way time transfer using Global Navigation Satellite Systems (GNSS). GNSS is widely used in time comparisons for those clocks that are in remote distances because of its coverage and its services. This technique is called time transfer. The result is the time synchronisation errors at each epoch.

The well-defined and determined clock characteristics together with the analysis of its performances of the maintain timescale at NIMT are distributed in three main folds; namely, calibration services, time through internet network and time through FM Radio Data System (RDS).

This paper describes the time and frequency metrology works in Thailand at NIMT in a sequence from NIMT time keeping, international time comparisons and time dissemination in Thailand.

II. NIMT ATOMIC TIME KEEPING

NIMT atomic time keeping system comprises of four caesium beam tube frequency standards; comprising of three high performance and one standard performance caesium clocks. They are all contributed to TAI sales. These clocks are steered with a micro-phase stepper for time and frequency fine tuning. This system was in operation since 1998. Typical characteristics high and standard performances of caesium frequency standards used as sources of UTC(NIMT) are displayed in Table 1.

The main activities include maintaining four ensemble caesium atomic clocks in an environmentally control room in accordance with ISO/IEC 17025 for calibration and testing laboratories; whereby, the temperature and relative humidity are controlled at (23 ± 2) °C and (50 ± 15) %RH respectively. This system has to be continuously operating 24 hours a day and 7 days a week. The fundamental
measurements from our time keeping systems are frequency, period and time interval measurements. The algorithm for timescale is also applied.

The unit of time measurement is a second. It is one of the seven SI base units. The officially announced definition of a second by the 13th meeting of the General Conference on Weights and Measures in 1967 considered to be a very precise definition is specified as “The second is the duration of 9,192,631,770 periods of the radiation corresponding to the transition between the two hyperfine levels of the ground state of the caesium-133 atom.” This definition is indispensable for science and technology. The addition on this definition, later in 1997, refers to the caesium atom at rest at a temperature of 0 K. The diagram in Fig. 1 shows the electron orbits between its energy level and this energy is absorbed or released in form of electromagnetic radiations between two levels; in case of caesium-133 atom, the frequency of the electromagnetic radiation is exactly 9.192631770 GHz (BIPM, 2014).

Table 1 Caesium atomic clock characteristics: high and standard performances (Microsemi, 2017)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Type of atomic clock</th>
<th>Caesium</th>
<th>Caesium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturer</td>
<td>Microsemi</td>
<td>Microsemi</td>
<td></td>
</tr>
<tr>
<td>Model</td>
<td>5071A</td>
<td>5071A</td>
<td></td>
</tr>
<tr>
<td>Option</td>
<td>High performance tube</td>
<td>Standard performance tube</td>
<td></td>
</tr>
<tr>
<td>Frequency outputs</td>
<td>5 MHz, 10 MHz, 1 PPS</td>
<td>5 MHz, 10 MHz, 1 PPS</td>
<td></td>
</tr>
<tr>
<td>Frequency signals</td>
<td>Sine</td>
<td>Sine</td>
<td></td>
</tr>
<tr>
<td>Load impedance</td>
<td>50 Ω</td>
<td>50 Ω</td>
<td></td>
</tr>
<tr>
<td>Accuracy</td>
<td>±5.0×10⁻¹³</td>
<td>±1.0×10⁻¹²</td>
<td></td>
</tr>
<tr>
<td>Stability (1-second averaging time)</td>
<td>≤5.0×10⁻¹²</td>
<td>≤1.2×10⁻¹¹</td>
<td></td>
</tr>
<tr>
<td>Stability (5-day averaging time)</td>
<td>≤1.0×10⁻¹⁴</td>
<td>≤5.0×10⁻¹⁴</td>
<td></td>
</tr>
</tbody>
</table>

The BIPM is the peak body of metric systems of SI located in Paris, France. It was created in 1875 and founded by contributions from the member states of the meter treaty. The BIPM maintains an International Atomic Time (TAI) scale. TAI scale is obtained from 604 atomic clocks kept by around 80 timing institutes around the world in order to ensure that the time interval unit of TAI second is kept closed to one SI second. These 604 atomic clocks comprised of 168 Hydrogen masers, 404 caesium clocks as well as 32 other types of clocks, for instances, microwaves and optical frequency standards (TAI, 2018). BIPM also generates UTC scale which is an atomic timescale that is related to the rotation of the Earth because the Earth’s is rotating slower. This is determined from the Earth Orientation Parameters (EOP) collected by the International Earth Rotation Service (IERS). Hence, a leap second is added to The TAI scale to produce a UTC scale. This makes TAI runs at the same rate with UTC where UTC is synchronised closely; not more than 0.9 seconds, with the time determined by the Earth’s rotation (Teunissen PJG and Kleusberg A (Eds.), 1998). The leap second was inserted on
31 December 2016 at 23:59:60 UTC time. The current difference between TAI and UTC timescales is specified as Equation (1); (BIPM, 2018):

\[
\text{TAI-UTC} = 37 \text{ seconds} \quad (1)
\]

NIMT participates in both UTC and rapid UTC (UTCr) scheme by the BIPM. At the moment (as of 2018), timing laboratories participating in UTC and UTCr are 80 and 55 respectively (TAI, 2018). BIPM produces UTC at a monthly data on a document named Circular T with the solution of UTC-UTC(k); where k is the participated laboratory, at a 5-day solutions based on the MJD interval of 5 and 9. UTCr is officially published at a weekly solution on every Wednesday before 18:00 UTC time, where daily UTCr-UTC(k) is provided. This data can be used at the participated lab to steer their clocks at a shorter interval.

**III. INTERNATIONAL TIME COMPARISONS**

NIMT atomic timescale, UTC(NIMT), is traceable (or internationally compared) to the international time at the BIPM by continuously observed GPS satellites at NIMT. NIMT precise atomic timing system output source of 1 PPS and 10 MHz is connected to a GPS receiver. The time offsets between the UTC(NIMT) and GPST can be directly monitored where GPST is used as a reference time. GPST is also an atomic time system; not adjusted to the leap second, which commenced at 00:00 hrs UTC on 6 January 1980. GPST is restarted each week (Sat/Sun night). TAI is ahead of GPST by 19 seconds as specified in Equation (2).

\[
\text{TAI-GPST} = 19 \text{ seconds} \quad (2)
\]

Timescale difference between computed UTC and GPST from 1 January 2017 to 27 December 2017 (MJD 57754 to MJD 58114) is as shown in Figure 2 (TAI, 2018).

NIMT GPS receiver information is as explained in Table 2 and its measurement diagram is as display in Figure 3. BIPM computed time differences between UTC(NIMT) and both UTC and UTCr. The results GPST from 1 January 2017 to 27 December 2017 (MJD 57754 to MJD 58114) are as display in Figure 4 and Figure 5 respectively.

**IV. TIME DISSEMINATION IN THAILAND**

This precise time and frequency are disseminating to users within the country through calibration services, internet network by NTP server and radio data systems by FM radio.

<table>
<thead>
<tr>
<th>Site identification</th>
<th>4-character BIPM code</th>
<th>NIMT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data output format</td>
<td>Common GPS GLONASS Time Transfer Standard (CGGTTS)</td>
<td></td>
</tr>
<tr>
<td>Date installed</td>
<td>4 November 1997</td>
<td></td>
</tr>
<tr>
<td>Monument foundation</td>
<td>Roof of the building</td>
<td></td>
</tr>
<tr>
<td>Site location information</td>
<td></td>
<td></td>
</tr>
<tr>
<td>City or town</td>
<td>Thanyaburi</td>
<td></td>
</tr>
<tr>
<td>State or province</td>
<td>Pathumthani</td>
<td></td>
</tr>
<tr>
<td>Country</td>
<td>Thailand</td>
<td></td>
</tr>
<tr>
<td>Tectonic plate</td>
<td>Eurasian</td>
<td></td>
</tr>
<tr>
<td>Approximate position (ITRF)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X coordinate (m)</td>
<td>-1150489.200</td>
<td></td>
</tr>
<tr>
<td>Y coordinate (m)</td>
<td>6080853.999</td>
<td></td>
</tr>
<tr>
<td>Z coordinate (m)</td>
<td>1537597.843</td>
<td></td>
</tr>
<tr>
<td>Receiver information</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Receiver type</td>
<td>Topcon Euro-80</td>
<td></td>
</tr>
<tr>
<td>Antenna maker and type</td>
<td>Javad L1/L2</td>
<td></td>
</tr>
<tr>
<td>Satellite system</td>
<td>GPS</td>
<td></td>
</tr>
<tr>
<td>Elevation cut-off setting</td>
<td>15 degrees</td>
<td></td>
</tr>
<tr>
<td>Number of channels</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Antenna cable maker and type</td>
<td>LMR-400</td>
<td></td>
</tr>
<tr>
<td>Length outside the building</td>
<td>~ 30 m</td>
<td></td>
</tr>
<tr>
<td>Data collection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sampling time</td>
<td>13 seconds</td>
<td></td>
</tr>
<tr>
<td>Data access</td>
<td><a href="http://203.185.69.45/Topcon/">http://203.185.69.45/Topcon/</a></td>
<td></td>
</tr>
<tr>
<td>Delays</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internal delay</td>
<td>GPS C1: 31.2 ns (measured on 30 January 2017)</td>
<td></td>
</tr>
<tr>
<td>Antenna cable delay</td>
<td>165.4 ns</td>
<td></td>
</tr>
<tr>
<td>Internal reference offset</td>
<td>7.07 ns</td>
<td></td>
</tr>
</tbody>
</table>

Figure 3: Diagram of NIMT international time comparison set-up.
BIPM defines calibration and measurement capabilities as “the highest level of calibration or measurement normally offered to clients, expressed in terms of a confidence level of 95 %, sometimes referred to as best measurement capability”. These measurement capabilities have to be maintained by the national metrology institutes and were in acceptance by the International Committee of Weights and Measures under the mutual recognition agreement (NPL, 2018). NIMT time and frequency measurement ranges, standard measurement used as well as its corresponding measurement and calibration capabilities for each equipments published on the BIPM website are as stated in Table 3 (see https://kcdb.bipm.org/appendixc/default.asp).

The calibration services undertaken at NIMT comprises of various frequency standards such as caesium frequency standard, rubidium frequency standard, quartz oscillators and GPS disciplined oscillators that may have either rubidium clocks or quartz oscillators as its internal or external frequency reference standard for their GPS time comparisons with NIMT. The calibration services details and price list are stated on NIMT webpage.

<table>
<thead>
<tr>
<th>Measurand/Equipment</th>
<th>Measurement method</th>
<th>Measurement range</th>
<th>Calibration and Measurement Capabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Frequency Source</td>
<td>Direct Frequency Measurement</td>
<td>1 Hz to 1000 Hz</td>
<td>$3.6 \times 10^{-9}$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt; 1 kHz to 10 kHz</td>
<td>$1.2 \times 10^{-10}$</td>
</tr>
<tr>
<td>Local Frequency Standard</td>
<td>Phase Measurement</td>
<td>5 MHz and 10 MHz</td>
<td>$1.0 \times 10^{-13}$</td>
</tr>
<tr>
<td>Time Interval Source</td>
<td>Direct Measurement</td>
<td>100 ns to 10000 s</td>
<td>2 ns</td>
</tr>
<tr>
<td>Remote Frequency Standard</td>
<td>GPS common-view</td>
<td>5 MHz and 10 MHz</td>
<td>$2.1 \times 10^{-13}$</td>
</tr>
</tbody>
</table>

The time of day is disseminated through an internet network using a NTP via a time server. Users synchronised their time servers to one of the NIMT time servers will obtain Thailand standard time with the traceability to UTC(NIMT) without any charges. NIMT time servers are time1.nimt.or.th, time2.nimt.or.th and time3.nimt.or.th.
Users can access this precise Thailand standard time over the internet by setting the computer time to either one of NIMT time servers. This is a free service with accuracy better than 30 ms depending on the traffic within the internet network. This service is demanding as computer systems required precisely timestamp events and occurrences.

Apart from time dissemination through the internet network, it is also disseminated through the FM/RDS radio transmission. Thailand standard time is broadcasted at the conventional FM radio broadcast station by applying the time code to the sub-carrier frequency of 57 kHz known as RDS. This RDS is a communications protocol standard for embedding small amounts of various types of digital information including Clock Time (CT). CT can be accurate to within 100 ms of UTC at the rate of 1 minute transmission. NIMT FM/RDS radio transmission for Thailand standard time services is at 95.0 MHz and 102.5 MHz with the collaboration with MCOT Public Company Limited and the Royal Thai Air Force respectively. Hence Thailand standard time could be easily accessed by tuning the radio frequency to the stated radio channels.

V. CONCLUSIONS

NIMT time and frequency laboratory is the sole organisation in Thailand who maintains and disseminates the Thailand Standard Time. NIMT time and frequency are traceable to the UTC timescale maintained by the BIPM in Paris. The timescale maintained as Thailand standard time is known as UTC(NIMT); determined by operating four caesium frequency standards at all time and in an environmentally controlled room, and is internationally linked with BIPM daily by measuring differences of each of our clocks and observing visible GPS satellites. The precise time are disseminating to users within the country over the internet network and through FM/RDS signals. NIMT also provide calibration services on various frequency standards such as caesium frequency standards, rubidium frequency standards and quartz oscillators. This is to fulfilled our nation quality infrastructure and beneficial to Thailand economic growth as a whole.

ACKNOWLEDGEMENTS

Author thanks NIMT managements, Dr Sivinee Sawatdiaree and Dr Chaiwat Jassadajin for allowing me to write this review article and also thanks NIMT time and frequency staff, Dr Piyaphat Phoonthong and Mr Thepbodin Borirak-Arawin, for their kind contribution to the time keeping and disseminations. All errors are mine.

REFERENCES


BIOGRAPHY

Dr. Thayathip Thongtan is currently a professional electrical metrologist at time and frequency laboratory, electrical metrology department, NIMT. She has working experiences in time and frequency calibrations, GNSS/GPS time comparisons and GNSS reference station for positioning and timing in Thailand. She is also a master degree examiner at the department of survey engineering, faculty of engineering, Chulalongkorn University. She holds a PhD in geomatics engineering from University College London in 2008 and a master in advanced manufacturing from Brunel University, London in 2004 (Ministry of Science and Technology’s scholarship). She holds a bachelor in electrical engineering from Kasetsart University in 2002.
ECTI E-magazine Vol.12, No.1, Jan.-Mar. 2018

Paper List of ECTI Transaction

ECTI-ECC Transaction (Scopus Database)
Website: http://www.ecti-ecc.org/index.php/ecti-ecc

Two issues are available in February and October each year. The next issue will be available soon.

ECTI-CIT Transaction (In the process of Scopus Database submission)
Website: https://www.tci-thaijo.org/index.php/ecticit

Two issues are available annually. The next issue will be available soon.
ECTI Committee Meeting

Date: Jan. 20, 2018
Venue: Chulalongkorn University
Announcements/Upcoming events/Call-for-Papers

ECTI-CARD 2018

1st Call For Papers


**Announcements/Upcoming events/Call-for-Papers**

**1st Call For Papers**

**ECTI-CARD 2018**

การประชุมวิชาการ งานวิจัย และพัฒนาศิลปะนวัตกรรม ครั้งที่ 10 26 – 29 มีนาคม 2561 ณ มหาวิทยาลัยพะเยา

หลักสูตรการประชุม: ประชุมวิชาการนานาชาติ ประชุมวิชาการระดับชาติ ประชุมวิชาการระดับภูมิภาค ประชุมวิชาการระดับประเทศ

*Announcements/Upcoming events/Call-for-Papers*
Preliminary call-for-papers

ITC-CSCC 2018
The 33rd International Technical Conference on Circuits/Systems, Computers and Communications

Theme: Fostering Innovation towards Digital Transformation

July 4 – 7, 2018
Bangkok, Thailand

With the great success of the International Technical Conference on Circuits/Systems, Computers and Communications (ITC-CSCC) as the world leading conference devoted to the advancement of high technologies in Circuits/Systems, Computers and Communications, we would like to invite all the scholars and experts around the world to attend the 33rd ITC-CSCC 2018 to be held in Bangkok, the City of Angels, Thailand.

Topics
The conference is open to researchers from all regions of the world. Participation from Asia Pacific region is particularly encouraged. Proposals for special sessions are welcome. Papers with original work in all aspects of Circuits/Systems, Computers and Communications are invited. Topics include, but not limited to, the followings:

- Circuits & Systems
  - Computer Aided Design
  - Power Electronics & Circuits
  - Analog Circuits
  - RF Circuits
  - Modern Control Systems
  - Medical Electronics & Circuits
  - Semiconductor Devices & Technology
  - VLSI Design
  - Sensors & Related Circuits

- Computers
  - Artificial Intelligence
  - Image/Speech Processing
  - Internet Technology & Applications
  - Computer Systems & Applications
  - Multimedia Service & Technology
  - Computer Vision
  - Face Detection & Recognition
  - Security
  - Watermarking
  - Data Mining and Big Data Analytics
  - Cloud computing
  - Engineering Education

- Communications
  - Antenna & Wave Propagation
  - Network Management & Design
  - Optical Communications & Components
  - wireless & Components for Communications
  - IP Networks & QoS
  - Communication Signal Processing
  - Ubiquitous Networks
  - Multimedia Communications
  - Visual Communications
  - Future Internet Architectures
  - IoT
  - 5G and beyond
  - Satellite Navigation
  - Vehicular Communication

Submission of Papers
Prospective authors are invited to submit original paper(s) of either MS Word or PDF format written in English. Abstract is limited to two pages of text and figures. Abstract can be submitted on the official website. If you have any trouble in preparing papers and online submission, please contact the conference secretariat.

Proceedings and Publications
All registered participants are provided with conference proceedings. Moreover, authors of the accepted papers are encouraged to submit full-length manuscripts to IEE JSTJ (Korea), IEICE Transactions (Japan), or ECTI Transaction (Thailand). Papers passed through the standard review procedures of the IEE JSTJ and IEICE Transactions will be published in regular issues while ECTI Transactions and Engineering Journal will be published in special issues. The authors (or their institute) are requested to pay the publication charge for the IEE JSTJ or IEICE Transactions when their paper is accepted.

Important Dates
- Submission of Two-Page Extended Abstract: April 1, 2018
- Notification of TA Acceptance: May 7, 2018
- Submission of Camera Ready Papers: June 4, 2018

Contact: secretary@itc-csc2018.org
http://www.itc-csc2018.org
The 15th International Conference on Electrical Engineering/Electronics, Computer, Telecommunications and Information Technology or ECTI-CON 2018 is the fifteenth annual international conference organized by Electrical Engineering/Electronics, Computer, Telecommunications and Information Technology (ECTI) Association, Thailand. The conference aims to provide an international platform to present technological advances, launch new ideas and showcase research work in the field of electrical engineering, electronics, computer, telecommunications and information technology. Accepted papers will be published in the Proceedings of ECTI-CON 2018 and will be submitted for inclusion in the IEEE Xplore. Acceptance will be based on quality, relevance and originality.

Technical Tracks
1. Devices, Circuits and Systems
2. Computers
3. Information Technology
4. Communication Systems
5. Controls, Instrumentation and Measurements
6. Electrical Power Systems
7. Power Electronics
8. Signal Processing
9. Other Related Areas
10. Special Sessions

Special Sessions
A special session can be submitted to the special session chair before the deadlines. The session topic can be varied upon one’s interest but still related to the role of Electrical/ Electronic Engineering, Computer, Telecommunications, Computer and IT.

Best Paper Awards
Papers with the highest score of a track that holds more than 10 papers will be nominated as a “Best Paper Award” paper.

Important Dates
Deadline for Special Session Proposal 15 December 2017
Deadline for Submission 15 January 2018
Notification of Acceptance 27 April 2018
Deadline for Final Manuscript Submission 25 May 2018
Deadline for Early Registration 25 May 2018
Conference Dates 18 – 21 July 2018

Paper Submissions
1) Prospective authors are invited to submit original full papers WITHOUT authors’ names and affiliations, in English, of 1-4 pages in standard IEEE two-column format only, reporting their original work and results, applications, and/or implementation in one or more of the listed areas.
2) Papers must be submitted online only through the submission system of the conference website.
3) At least one author of each accepted paper MUST register and present the paper at the conference in order that the paper is to be included in the program. The program will also be submitted for inclusion in the IEEE Xplore.

Further Publication
Potential papers are encouraged for their extension and submit to ECTI Journals (ECTI-IEC or ECTI-CIT) for further publication.

Supports and Scholarship
Post graduate student whose paper is outstanding and has applied for the scholarship will be nominated for a partially supported scholarship. The grant is not transferable nor changed in other forms.

More information is available at http://www.ecti-con.org/col-2018/
ISCIT 2018
First CALL FOR PAPERS

The 18th ISCIT 2018, Bangkok, Thailand
“Communication and IT for Smart City”
26 - 29 September 2018

The 18th International Symposium on Communications and Information Technologies (ISCIT 2018) will be held in Bangkok, city of angles. ISCIT 2018, under the technical sponsorship of IEEE, will provide a forum for researchers, engineers and industry experts to exchange and discuss new ideas, recent development, and breakthroughs in IoT, communications and information technologies. ISCIT2018 will also offer an exciting social program. Accepted and presented papers will be published in the conference proceedings and submitted to IEEE Xplore as well as other abstracting and indexing databases.

Important Dates

29 April 2018  Proposal for workshops, Tutorials and Special Sessions
27 May 2018   Paper submission deadline
01 July 2018   Paper acceptance notification
29 July 2018   Author registration Camera-ready paper submission

Topics

- Circuit and Systems
- Coding and Systems for Communications
- Embedded Communications Systems
- IoT, wearable Devices
- Analogue and Mixed Signal Processing
- Numerical Methods and Circuit Simulation
- Low Power Design & VLSI Physical Synthesis
- Model ing, Simulation and CAD Tools
- VLSI Architecture for Signal Processing

Wireless Communications

- OFDM and multi-carrier options
- MIMO, multi-user MIMO, and massive MIMO
- Interference alignment and cancellation
- Heterogeneous and small-cell networks
- Channel modeling and propagation
- Distributed and cooperative communications
- Smart antennas and space-time processing
- Communication security

Wireless Networking and Internet of Things

- Cellular systems, 4G/LTE and beyond
- WLAN, mesh, and vehicular networks
- Spectrum sharing and management
- IoT computing and networking
- Energy efficient design for the IoT
- IoT Security, Trust, Privacy
- IoT Data management, Mining, and Fusion
- New IoT services and applications

Computational Intelligence & Data Science

- Fuzzy Logic
- Neural Networks
- Evolvable Computation
- Learning Theory
- Machine Learning
- Swarm & Population Methods
- Data Mining
- Classification
- Clustering
- Association Analysis
- Regression Analysis
- Knowledge-based Engineering
- Time Series Analysis
- Big Data Analysis
- Deep Learning
- Image Processing

Next-Generation Networking

- Software Defined Networking (SDN)
- Network Function Virtualization (NFV)
- Data center and cloud-based networking
- Self-organising networks
- Network provisioning, monitoring, and management
- Emerging Internet applications
- Energy-efficient protocol design and green communication
- Network security, privacy, intrusion detection and prevention
ECTI Who’s Who

ECTI President
Kosin Chamnongthai (KMUTT)

ECTI Vice President
Sinchai Kamolphiwong (PSU)
Pornchai Supnithi (KMITL)

Advisory Board
Sawasd Tantaratana
Wanlop Surakampontor
Booncharoen Sirinaovakul
Monai Krairiksh (KMITL)
Prabhas Chongstitvatana (CU)
Prayoot Akkaraekthalin (KMUTNB)

Board Committee
Chaiwat Jassadajin (NIMT)
Kerk Piromsopa (CU)
David Banjerdpongchai (CU)
Sakda Panwai (EXAT)
Roungsan Chaisricharoen (MFU)
Theekapun Charoenpong (SWU)
Kanjana Pattanaworapan (BU)

Technical Chair (TC)
TC (Electrical Engineering)
Issarachai Ngamroo (KMITL)
TC (Electronics)
Pipat Prommee (KMITL)
TC (Computers)
Ekkarat Boonchieng (CMU)
TC (Telecommunications)
Chanon Warisarn (KMITL)
TC (Information Technology)
Anan Phonphoem (KU)
TC (System Control)
Itthisek Nilkhamhang (SIIT)
TC (Signal Processing)
Pornchai Phukpattaranont (PSU)
TC (Electromagnetics)
Panuwat Janpugdee (CU)

Regional Committee
Thailand: North: Roungsan Chaisricharoen (MFU)
Thailand: South: Kanadit chetpattananondh (PSU)
Thailand: Northeast: Surajate On-rit (UBRU)
Myanmar: Saya Oo
Myanmar: Win Zaw
Cambodia: Des Phal
Laos: Somsanouk Phatumvanh
Japan: Yoshikazu Miyanaga
Malaysia: Phooi-Yee Lau

ECTI Journal Editor
EEC: Apisak Worapishet (MUT)
Sarawuth Chaimool
CIT: Prabhas Chongstitvatana (CU)
Chiranut Sa-ngiamsak (KKU)

ECTI E-Magazine Editorial Team
Editor: Lunchakorn Wuttisittikulkij (CU)
Associate Editor: Watid Phakphisut (KMITL)
Assistant Editor: Lin M. M. Myint (SIU)

Secretary
Pairin Kaewkuay

Contact Us
ECTI Association
Sirindhorn International Institute of Technology
131 Moo 5 Tiwanon Rd., Bangkadi
Pathumthani 12000, Thailand
Tel: 02-5012578
E-mail: ecti.secretary@gmail.com
Website: http://www.ecti-thailand.org/
Facebook: https://www.facebook.com/ecti.thailand