# ECTI e-magazine

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# 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



# *Message from* Editor

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 The performances and evaluations of dialling 1811. UTC(NIMT) where the frequency accuracy of UTC(NIMT) is kept around 4.9×10-13 (Hz/Hz) with respect to GPST, and its frequency stability is maintained at around 3.3×10-14 (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, Pathunthani.

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) oneway 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  $(23 \pm 2)$  °C and  $(50 \pm 15)$  %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)

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



Figure 1: Electron transitions between two energy levels

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



Figure 3: Diagram of NIMT international time comparison setup.

5 MHz

31 December 2016 at 23:59:60 UTC time. The current difference between TAI and UTC timescales is specified as Equation (1); (BIPM, 2018):

$$TAI-UTC = 37 seconds$$
(1)

1 PPS

Cs 5071A-001 BIPM code 1351511

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). A synchronisation error between the satellite clock and a reference timescale is provided in the navigation message.

Table 2	: NIMT	GPS	station	informatio	วท
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Site identification	
4-character BIPM code	NIMT
Data output format	Common GPS GLONASS Time
	Transfer Standard (CGGTTS)
Date installed	4 November 1997
Monument foundation	Roof of the building
Site location information	
City or town	Thanyaburi
State or province	Pathumthani
Country	Thailand
Tectonic plate	Eurasian
Approximate position	
(ITRF)	
X coordinate (m)	-1150489.200
Y coordinate (m)	6080853.999
Z coordinate (m)	1537597.843
Receiver information	
Receiver type	Topcon Euro-80
Antenna maker and type	Javad L1/L2
Satellite system	GPS
Elevation cut-off setting	15 degrees
Number of channels	12
Antenna cable maker	LMR-400
and type	
Length outside the	~ 30 m
building	
Data collection	
Sampling time	13 seconds
Data access	http://203.185.69.45/Topcon/
Delays	
Internal delay	GPS C1: 31.2 ns (measured on 30
internal delay	January 2017)
Antenna cable delay	165.4 ns
Internal reference offset	7.07 ns

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.



Figure 4: Timescale differences between UTC and UTC(NIMT)



Figure 5: Timescale differences between UTCr and UTC(NIMT)

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 <u>https://kcdb.bipm.org/appendixc/</u> 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 3 NIMT measurement capabilities			
Measurand/ Equipment	Measuremen t method	Measurem ent range	Calibration and Measurement Capabilities
General	Direct	1 Hz to 1000 Hz	3.6×10 <sup>-9</sup>
Source	Measurement	> 1 kHz to 10 kHz	1.2×10 <sup>-10</sup>
Local Frequency Standard	Phase Measurement	5 MHz and 10 MHz	1.0×10 <sup>-13</sup>
Time Interval Source	Direct Measurement	100 ns to 10000 s	2 ns
Remote Frequency Standard	GPS common- view	5 MHz and 10 MHz	2.1×10 <sup>-13</sup>

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 guartz oscillators. This is to fulfilled our nation quality infrastructure and beneficial to Thailand economic growth as a whole.

## ACKNOWLEDGEMENTS

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### 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.

# Paper List of ECTI Transaction

# ECTI-EEC Transaction (Scopus Database)

Website: http://www.ecti-eec.org/index.php/ecti-eec

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.

# Report from Conferences/Workshops/Seminars/Events

# **ECTI Committee Meeting**

Date: Jan. 20, 2018 Venue: Chulalongkorn University



# Announcements/Upcoming events/Call-for-Papers

การ ประชุมวิชาการ งานวิจัย และพัฒนาเชิงประยุกต์ ครั้งที่ 10



# ECTI-CARD 2018 ารประยุกต์ใช้งานเทคโนโลยีเพื่อตอบสนองนโยบายประเทศไทย 4.0

26 - 29 มิถนายน พ.ศ. 2561

ณ จังหวัดพิษณุโลก

# 1<sup>st</sup> Call For Papers

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Secretary เศรษฐา ตั้งค้าวานิช (มน.) งานประชุมวิชาการ ECTI-CARD 2018 ครั้งที่ 10 "การประยุกต์ใช้เทคโนโลยีเพื่อตอบสนองนโยบาย ประเทศไทย 4.0" จัดโดย คณะวิศวกรรมศาสตร์ มหาวิทยาลัยนเรศวร และสมาคมวิชาการไฟฟ้า อิเล็กทรอนิกส์ โทรคมนาคมและสารสนเทศประเทศไทย ระหว่างวันที่ 26 - 29 มิถนายน พ.ศ. 2561 จังหวัดพิษณุโลก มีจุดมุ่งหมายหลักของการจัดงานเพื่อรวบรวบผลงานวิจัย งานนวัตกรรม ณ สิ่งประดิษฐ์ และการพัฒนาเชิงประยุกต์ รวมถึงเพื่อเปิดโอกาสให้นักวิจัย ผู้พัฒนา ผู้ใช้งาน และ หน่วยงานต่างๆ ได้มีโอกาสแลกเปลี่ยนเรียนรู้ทางวิชาการร่วมกัน อีกทั้งสามารถนำผลงานที่ตีพิมพ์ไป พัฒนาต่อยอดในระดับท้องถิ่น ระดับสากล และพัฒนาสุ่ผลิตภัณฑ์ในเชิงพาณิชย์ได้ ซึ่งบทความที่ส่ง มานั้นจะได้รับการพิจารณาคุณภาพและความสมบูรณ์ของงานโดยผู้ทรงคุณวุฒิ บทความที่ได้รับการ คัดเลือกและได้นำเสนอในที่ประชุม ECTI-CARD 2018 จะได้รับการตีพิมพ์ในรายงานสืบเนื่อง ECTI-CARD (ECTI-CARD Proceedings) ซึ่งสามารถสืบค้นได้จากฐานข้อมูลของสมาคม ECTI

# หัวข้อบทความที่เกี่ยวข้อง

- กลุ่มที่ 1: การเกษตรอัจฉริยะ อตสาหกรรมการเกษตร กลุ่มที่ 7: การขนส่ง การควบคมจราจร การจัดการ กลุ่มที่ 2: เทคโนโลยีชีวภาพ การแพทย์ วิทยาศาสตร์
  - กายภาพ วิทยาศาสตร์การกีฬา
- กลุ่มที่ 3: การประหยัดพลังงาน การจัดการพลังงาน บ้านอัตโนมัติ
- กลุ่มที่ 4: การเรียนการสอนทางไกล การศึกษาบันติง กลุ่มที่ 10: มาตรวิทยา การวัดและควบคุม คอมพิวเตอร์เอนิเมชัน
- กลุ่มที่ 5: การกู้ภัย ระบบเตือนภัย และพยากรณ์
- กลุ่มที่ 6: การสื่อสาร การสนับสนุนผู้ใช้ตามบ้าน เครือข่ายสังคม เครือข่ายไร้สาย
- อตสาหกรรม
- กลุ่มที่ 8: ธุรกิจการธนาคาร การท่องเที่ยว และการโรงแรม กลุ่มที่ 9: ระบบความปลอดภัย การควบคนการเข้าถึงการ
  - ยืนยัน ตัวตน ระบบตรวจจับ
- กลุ่มที่ 11: วิศวกรรมและเทคโมโลยีอุตสาหกรรม
- กลุ่มที่ 12: STEM เทคโนโลยีการศึกษา
- กลุ่มที่ 13: หัวข้ออื่นๆ ที่เกี่ยวข้อง

# การส่งบทความ (2 รูปแบบ)

 รูปแบบ บทความวิจัย เป็นบทความเต็มรูปแบบภาษาไทย หรือ ภาษาอังกฤษไม่เกิน 2 หรือ 4 หน้ากระดาษ A4 ในรูปแบบมาตรฐาน 2 คอล้มน์ของ IEEE โดยต้องกล่าวถึงที่มาและผลที่ได้รับ รายละเอียดและ/ หรือการนำไปใช้งาน ซึ่งเกี่ยวข้องกับหัวข้อใดหัวข้อหนึ่งหรือมากกว่า จาก กลุ่มต่างๆที่ได้กำหนดไว้

 รูปแบบ สิ่งประดิษฐ์และนวัตกรรม เป็นบทความเต็มรูปแบบ ภาษาไทย หรือภาษาอังกฤษ ไม่เกิน 2 หน้ากระดาษ A4 ใน รูปแบบมาตรฐาน 2 คอลัมน์ของ IEEE โดยผู้เขียนบทความ อาจนำผลงานหรือสิ่งประดิษฐ์ มาร่วมจัดแสดงในงานประชุมได้

# ติดต่อประสานงาน

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# กำหนดการ

ส่งบทความฉบับสมบรณ์ วันที่ 5 กมภาพันธ์ 2561 ประกาศผลการพิจารณาบทความ วันที่ 1 เมษายน 2561 ส่งบทความต้นฉบับเพื่อตีพิมพ์ วันที่ 1 พถษภาคม 2561 วันจัดประชุมวิชาการ วันที่ 26 - 29 มิถนายน 2561



# Preliminary call-for-papers ITC-CSCO The 33rd International Technical Conference on Circuits/Systems, Computers and Communications

With the gre at 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 hosted in Bangkok, the City of Angels, Thailand.

#### Topics

Pisit Vanichchanun Charnchai Pluempitiwiriyawej

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Warakorn Srichavengsup Local Arrangement Chair

Special/Tutorial Session Chair Pornchai Supnithi Poompat Saengudomlert

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Sinchai Kamolphiwong Krek Piromsopa

Watid Phakphisut

Suphattharachai Chomphan

Widhyakorn Asdornwised

Nitthita Chirdchoo

Sathaporn Pron

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**

- Committee Members President Kosin Chamnongthai General Chair Lunchakorn Wuttisittikulkij Modern Control Systems Organizing Chair Plya Kovintavewat General Secretary Datchakorn Tancharoen Technical Program Chair Pisit Vanichehenunt

- Computers Artificial Intelligence
- Artificial interligence 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
- Chanon Warisarn hair Wannaree Wongtrairat - Cloud computing - Engineering Education

#### Communications

- Antenna & Wave Propagation Network Management & Design
- Optical Communications & Components Circuits & Components for Communications IP Networks & QoS Communication Signal Processing

- Ubiquitous Networks
   Multimedia Communications
   Visual Communications
- Future Internet Architectures
- 5G and beyond

Satellite Navigation Vehicular Communication



July 4 - 7

Bangkok

Thailand

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 conterence proceedings. Moreover, dumors of the accepted papers are encouraged to submit full-length manuscripts to IEIE JSTS (Korea), IEICE Transactions (Japan), or ECTI Transaction (Thailand). Papers passed through the standard review procedures of the IEIE JSTS 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 IEIE JSTS or IEICE Transactions when their paper is accepted.

#### Important Dates

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

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Contact: secretary@itc-cscc2018.org \* http://www.itc-cscc2018.org

ITC-CSCC 2018

# July 4-7, 2018 Bangkok, Thailand



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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.

6. Electrical Power Systems

7. Power Electronics

8. Signal Processing

10. Special Sessions

15 December 2017

15 January 2018

27 April 2018

25 May 2018

25 May 2018

18 - 21 July 2018

9. Other Related Areas

#### Technical Tracks

- 1. Devices, Circuits and Systems
- 2. Computers
- 3. Information Technology 4. Communication Systems
- 5. Controls, Instrumentation and Measurements

#### Special Sessions

A proposal for 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 relate to the role of Electrical / Electronic Engineering, Computer, Telecommunication, Computer and IT.

#### Best Paper Awards

Paper 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 Deadline for Submission Notification of Acceptance Deadline for Final Manuscript Submission Deadline for Early Registration Conference Dates

#### Paper Submissions

 Prospective authors are invited to submit original full papers WITHOUT authors' names and affiliations, in English, of 2-4 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-EEC 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 neither transferrable nor claimed in other forms.

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More information is available at http://www.ecti-con.org/con-2018/







# **ISCIT 2018 First CALL FOR PAPERS**

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

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

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# **Important Dates**

29 April 2018	Proposals for workshops. Tutorials and Special Sessions
27 May 2018	Paper submission deadline
1 July 2018	Paper acceptance notification
29 July 2018	Author registration

# Topics

**Circuit and Systems** Circuits and Systems for Communications Embedded Communications Systems IoT, wearable Devices Analogue and Mixed Signal Processing Numerical Methods and Crouit Simulation Low Power Design & VLSI Physical Synthesis Modelling, Simulation and CAD Tools

VLSI Architecture for Signal Processing

#### Wireless Communications

OFDM and multi-carrier systems MIMO, mult-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: 46/56 and beyond WLAN, mesh, and vehicular networks Spectrum sharing and management loT computing and networking Energy efficient designs for the loT IoT Security, Trust, Privacy, IoT Data management, Mining, and Fusion New lot services and applications

> IEEE THAILAND SECTION

#### Computational Intelligence & Data Science

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Fuzzy Logia Neural Networks Evolutionary Computation Learning Theory Machine Learning Statistic & Probabilistic Methods Data Mining Classification Clustering Association Analysis Regression Analysis Knowledge-based Engineering ine 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



C 2018

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