



# **STISWB 2018**

## **Abstract Book of**

### **the 10<sup>th</sup> International Conference on Science, Technology and Innovation for Sustainable Well-Being 2018**



**"Moving Towards Smart and Sustainable Technologies"**

**11<sup>th</sup> – 13<sup>th</sup> July, 2018**

**Don Chan Palace Hotel & Convention**

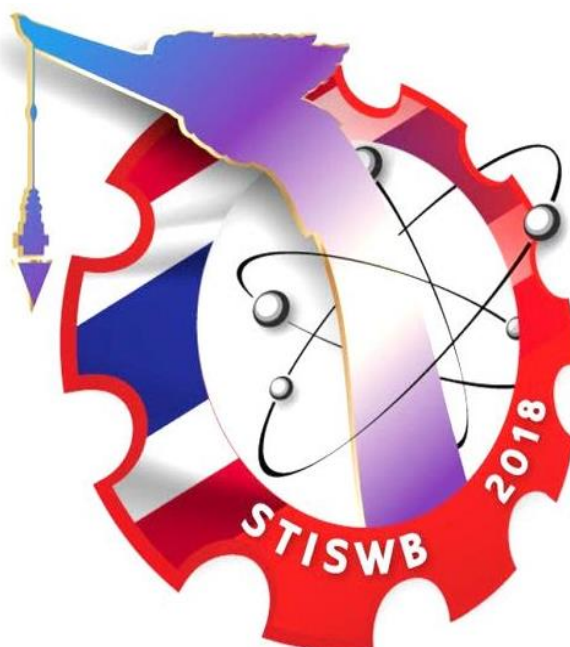
**Vientiane, Lao PDR.**

**Organized by:**

**The Faculty of Engineering,  
Rajamangala University of Technology Phra Nakhon**



## The 10<sup>th</sup> International Conference on Science, Technology and Innovation for Sustainable Well-Being 2018



**THE 10<sup>th</sup> STISWB 2018**  
**Moving Towards Smart and Sustainable Technologies**



# Abstract Book of the 10<sup>th</sup> International Conference on Science, Technology and Innovation for Sustainable Well-Being 2018 (STISWB 2018)

11<sup>th</sup> – 13<sup>th</sup> July, 2018

Don Chan Palace Hotel & Convention  
Vientiane, Lao PDR

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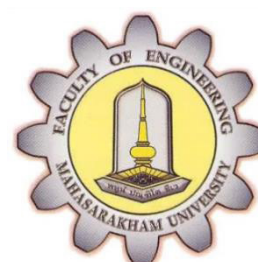




## Abstract Book of The 10<sup>th</sup> International Conference on Science, Technology and Innovation for Sustainable Well-Being 2018



### THE 10<sup>th</sup> STISWB 2018 Moving Towards Smart and Sustainable Technologies



**KMUTNB**



**11<sup>th</sup> – 13<sup>th</sup> July, 2018**  
**Don Chan Palace Hotel & Convention**  
**Vientiane, Lao PDR.**





## The 10<sup>th</sup> International Conference on Science, Technology and Innovation for Sustainable Well-Being 2018

# THE 10<sup>th</sup> STISWB 2018

### Host-Organized by:



**The Faculty of Engineering,**

**Rajamangala University of Technology Phra Nakhon, Thailand**

**“MOVING TOWARDS SMART AND SUSTAINABLE TECHNOLOGIES”**

### Co - Organized Network:

1. Faculty of Engineering, Chiang Mai University, Thailand
2. Graduated School, Mahasarakham University, Thailand
3. Faculty of Engineering, Mahasarakham University, Thailand
4. Faculty of Environment and Resource Studies, Mahasarakham University, Thailand
5. Faculty of Industrial Technology and Management,  
King Mongkut's University of Technology North Bangkok, Prachinburi Campus, Thailand
6. Faculty of Engineering and Industrial Technology, Sanam Chandra Palace Campus,  
Silpakorn University, Nakhon Pathom, Thailand
7. Faculty of Engineering and Agro-Industry, Maejo University, Thailand
8. Faculty of Engineering, Rajamangala University of Technology Lanna, Thailand
9. Faculty of Engineering, Rajamangala University of Technology Isan,  
Khonkean Campus, Thailand
10. Rambhai Bami Rajabhat University, Thailand
11. Faculty of Industrial Technology, Rajabhat Rajanagarindra University, Thailand



**Message from the President  
of  
Rajamangala University of Technology Phra Nakhon**



Welcome to the 10<sup>th</sup> International Conference on Science, Technology and Innovation for Sustainable Well-Being 2018 or STISWB 2018 held at Don Chan Palace Hotel & Convention, Laos, during 11<sup>th</sup> -13<sup>th</sup> July 2018. The conference is hosted by Rajamangala University of Technology Phra Nakhon in cooperation with 12 networks from 10 institutions.

This international conference aimed to establish networking and academic partners in all levels with both private and public sectors. It is also aimed to provide an opportunity for graduate students and interested persons to exchange and share research studies to promote the excellence in research corresponded to RMUTP Vision that is a university that inspires, develops systematic thinking skills, and creates technological excellence to serve the country and the community.

In 2018, the Thai government has announced Thailand 4.0 policy aimed at improving all industries by moving forward with the innovation and technology. Research is the key driver of innovation. With this reason, RMUTP visualizes the importance of research development. We inspire, support and promote our academic personnel and students to create new knowledge that can be applied into the community development at both national and international levels.

Again, Rajamangala University of Technology Phra Nakhon welcomes you to the 10<sup>th</sup> International Conference on Science, Technology and Innovation for Sustainable Well-Being 2018. I sincerely hope that this conference bring you all the benefits you are looking for, an opportunity to share and exchange your research ideas together, to utilize the knowledge, research, and innovation to make our countries and communities the better place for us in the future.

Assoc. Prof. Supatra Kosaiyanont

President

Rajamangala University of Technology Phra Nakhon





**Message from the Dean**  
**The Faculty of Engineering**  
**Rajamangala University of Technology Phra Nakhon**



The Northern Bangkok Engineering School is considered as a school in a field of Industrial Technology and was established in B.E. 2501 (1958). Later, it was promoted to be “The Northern Bangkok Technical Institute”. In B.E. 2531(1988), the Institute was known as Rajamangala Institute of Technology North Bangkok Campus. It was elevated to university status in B.E. 2548 (2005) until now to the Faculty of Engineering, Rajamangala University of Technology Phra Nakhon (RMUTP), totally over 60 years. Today, the Faculty of Engineering organizes the instruction in various academic fields, which including, Pre-Engineering or Vocational Certificate, Bachelor’s Degree level, Master’s Degree level, and Doctoral Degree level.

On the occasion of the faculty of engineering which will reach 60 years from the Northern Bangkok Engineering School to the Faculty of Engineering, RMUTP on 14<sup>th</sup> July, 2018. And for celebrating such occasion, the Faculty of Engineering gets an honor from the STISWB network’s committee, to be responsible as a host for organizing the STISWB conference and presenting the international researches entitled the 10<sup>th</sup> International Conference on Science Technology and Innovation for Sustainable Well-Being 2018 (STISWB 2018) under the concept of “Moving Towards Smart and Sustainable Technologies”. The conference will be held at the Don Chan Palace Hotel & Convention, Vientiane, Lao PDR, between 11<sup>th</sup> – 13<sup>th</sup> July, 2018 which will be beneficial for the instructions and researches development toward students, lecturers, educators, researcher, and interested persons. Furthermore, it will promote and publicize the research contributions to achieve the international level by presenting in the form of Oral Presentation. In addition, this will be a good opportunity for all lecturers, researchers, educators, and interested persons from various organizations to mutually discuss and have good interactions. The participants of this academic conference consist of students, researchers, lecturers, personnel from both government and private sectors, including general people both domestic and foreign countries.

On this occasion, I would like to thank you to all participants, researchers and authors from all organizations which submit papers and attend to the 10<sup>th</sup> STISWB 2018. Furthermore, I feel thankful for the research paper reviewers and all committees who have sacrificed the precious time to consider articles from every field which helps increase the quality of researches to be more valuable on the academic fields. The Faculty of Engineering will create and develop academic contributions and research works to be a part of crucial mechanisms to drive our national growth further and lead to the leading organization to construct values to the society according to the vision determined, which is,  
**“Faculty of Engineering, the First Leadership to Produce Engineers as Professional Practitioners”**

*Wirote Ritthong*

(Asst. Prof. Dr. Wirote Ritthong)  
Dean of the Faculty of Engineering  
Rajamangala University of Technology Phra Nakhon





## The 10<sup>th</sup> International Conference on Science, Technology and Innovation for Sustainable Well-Being 2018

### ABOUT THE 10<sup>th</sup> STISWB 2018

The International Conference on Science, Technology and Innovation for Sustainable Well-Being (STISWB) is one of major international conferences organized by Thai University Network. The conference brings together researchers and engineers who work in the related engineering fields.

The conference aims at providing a virtual international forum for presentation and discussion of the state-of-the-art research and development as well as to give opportunities for cooperation among participants in various sub-disciplines of engineering, science and technology, education and other related fields. The conference also aims to bring together the knowledge of different fields so as to put forward the existing science, technology and innovation into practice in order to ultimately create sustainable well-being to humankind.

On the occasion of the faculty of engineering, Rajamangala University of Technology Phra Nakhon which will reach 60 years from the Northern Bangkok Engineering School, since B.E. 2501 (1958) to the Faculty of Engineering, RMUTP on 14<sup>th</sup> July, 2018. And for celebrating such occasion, the Faculty of Engineering gets an honor from the STISWB network's committee, to be responsible as a host for organizing the STISWB conference and presenting the international researches entitled the 10<sup>th</sup> International Conference on Science Technology and Innovation for Sustainable Well-Being 2018 (STISWB 2018) under the concept of **“Moving Towards Smart and Sustainable Technologies”**.

The Faculty of Engineering, Rajamangala University of Technology Phra Nakhon, is pleased to host the 10<sup>th</sup> STISWB 2018. The conference will be held at the Don Chan Palace Hotel and Convention, Vientiane, Lao PDR, between 11<sup>th</sup> – 13<sup>th</sup> July, 2018.

**THE 10<sup>th</sup> STISWB 2018**  
**Moving Towards Smart  
and Sustainable Technologies**



## **The 10<sup>th</sup> International Conference on Science, Technology and Innovation for Sustainable Well-Being 2018**

### **STISWB 2018 TOPICS CONSIDERED**

#### **1. Education**

- Engineering Business & Management
- Engineering Education
- Industrial and Technical Education
- Sports and Exercise Science
- Education Science
- Related Topics

#### **2. Engineering**

- Agricultural, Biological and Food Engineering
- Alternative Energy and Combustion
- Agricultural Farm Machinery
- Applied Mechanics and Materials
- Biomechanics, Robotics and Controls
- Civil and Environmental Engineering
- Computational and Simulation Techniques
- Computer Engineering
- Electrical Engineering
- Electronics and Telecommunication Engineering
- Mechanical Engineering
- Mapping, GIS and Remote Sensing
- Railway and Transport Engineering
- Disaster Engineering
- Industrial Engineering
- Logistics Engineering & Management
- Related Topics

#### **3. Sciences and Technology**

- Environmental Management
- Energy Technology and Management
- Manufacturing and Process Management
- Food Science and Biotechnology
- Advanced Materials and Nanotechnology
- Related Topics.



## The 10<sup>th</sup> International Conference on Science, Technology and Innovation for Sustainable Well-Being 2018

### The History of STISWB Conferences

| STISWB             | Date                  | Venue   | Organizers   |
|--------------------|-----------------------|---|--|
| <b>STISWB I</b>    | July 23 - 24, 2009    | Pullman Raja Orchid Hotel,<br>Khon Kaen, Thailand                   | MSU, Thailand<br>KKU, Thailand<br>UBU, Thailand<br>SUT, Thailand |
| <b>STISWB II</b>   | August 12 - 15, 2010  | Quang Binh University, Vietnam                                      | MSU, Thailand<br>QBU, Vietnam                                    |
| <b>STISWB III</b>  | August 12 -15, 2011   | The University of Danang, Vietnam                                   | SU, Thailand<br>UD, Vietnam                                      |
| <b>STISWB IV</b>   | August 10-12, 2012    | The Zign Hotel, Pattaya, Thailand                                   | KMUTNB,<br>Thailand  |
| <b>STISWB V</b>    | September 4-6, 2013   | The grand Luang Prabang<br>Hotel&Resort,<br>Luangprabang, Laos      | MSU, Thailand<br>NUOL, Laos<br>Souphanouvong<br>University, Laos |
| <b>STISWB VI</b>   | August 28-30, 2014    | Apsara Ankor Resort & Conference,<br>Siem Reap, Kingdom of Cambodia | RMUTI, Khonkean<br>Campus, Thailand                              |
| <b>STISWB VII</b>  | July 30 – Aug 2, 2015 | Nakhon Pathom, Thailand   | SU, Thailand   |
| <b>STISWB VIII</b> | June 15-17, 2016      | Yangon, Myanmar   | SU, Thailand   |
| <b>STISWB IX</b>   | June 26 – 28, 2017    | Kunming University of Science and<br>Technology, Kunming, China     | RMUTL, Thailand  |
| <b>STISWB X</b>    | July 11 – 13, 2018    | The Don Chan Palace Hotel &<br>Convention, Vientiane, Lao PDR.      | RMUTP, Thailand  |





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Mahasarakham University, Thailand
11. **Asst. Prof. Dr. Pracha Yeunyongkul**  
Rajamangala University of Technology Lanna, Thailand





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Plt. Off. Dr. Ponlakit Jariyatantiwait

#### **Technical Program Chair**

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2. Asst. Prof. Kullayot Suwataroj (Education)
3. Dr. Supachai Lakkam (Science and Technology)

#### **Registration Chair**

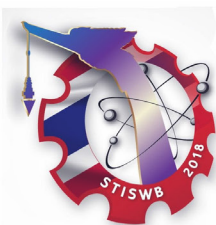
Mr. Korn Puangnak

#### **Publication Chair**

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#### **Secretariat**

Miss. Supaporn Latum



The 10<sup>th</sup> International Conference on Science, Technology and Innovation for Sustainable Well-Being 2018

**STISWB 2018**

Moving Towards

Smart & Sustainable Technologies



# The 10<sup>th</sup> International Conference on Science, Technology and Innovation for Sustainable Well-Being 2018

11<sup>th</sup> - 13<sup>th</sup> July, 2018

@Vientiane, Lao PDR.

Don Chan Palace Hotel

& Convention



**CALL FOR PAPERS**

Participants Receive 12 PDU.

of the Continuing Professional Development (CPD.)  
for engineer, certified by the Council of Engineers, Thailand



**IMPORTANT DATES**

- ✦ Full Paper Submission Deadline 4<sup>th</sup> May, 2018
- ✦ Full Paper Accepted Notification 25<sup>th</sup> May, 2018
- ✦ Revised Full Paper Deadline 15<sup>th</sup> June, 2018
- ✦ Payment Registration Deadline 22<sup>nd</sup> June, 2018
- ✦ Final Program Announcement 29<sup>th</sup> June, 2018
- ✦ Conference Dates 11<sup>th</sup> - 13<sup>th</sup> July, 2018



Prof. Dr. Kosin Chamnongthai

King Mongkut's University of Technology Thonburi

**KEYNOTE**

**SPEAKERS**



Assoc. Prof. Dr. Yodchanan Wongsawat

Mahidol University, Thailand



Prof. Dr. Prayoot Akkaraekthalin

King Mongkut's University of Technology North Bangkok



**STISWB2018 TOPICS CONSIDERED**



## 1. Engineering

- Agricultural, Biological and Food Engineering
- Alternative Energy and Combustion
- Agricultural Farm Machinery
- Applied Mechanics and Materials
- Biomechanics, Robotics and Controls
- Civil and Environmental Engineering
- Computational and Simulation Techniques
- Computer Engineering
- Disaster Engineering

- Electrical Engineering
- Electronics and Telecommunication Engineering
- Industrial Engineering
- Logistics Engineering & Management
- Mechanical Engineering
- Mapping, GIS and Remote Sensing
- Railway and Transport Engineering
- Related Topics



## 2. Education

- Engineering Education
- Engineering Business & Management
- Education Science
- Industrial and Technical Education
- Sports and Exercise Science
- Related Topics



## 3. Science and Technology

- Advanced Materials and Nanotechnology
- Environmental Management
- Energy Technology and Management
- Food Science and Biotechnology
- Manufacturing and Process Management
- Related Topics.

**WWW.STISWB2018.ORG**

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E-mail : STISWB2018@gmail.com Bangkok 10800, Thailand



www.stiswb2018.org

REGISTRATION FEES (1 USD. For 34 THB.)

| Regular Registration | Types         | THB.   | USD. |
|----------------------|---------------|--------|------|
| General              | Speaker       | 10,400 | 310  |
|                      | Non - Speaker | 7,200  | 210  |
| Staff / Student      | Speaker       | 6,500  | 190  |
|                      | Non - Speaker | 5,100  | 150  |



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12. Dr. Ponlakit Jariyatantiwait      Rajamangala University of Technology Phra Nakhon
13. Dr. Surachai Karnjanakom      Rajamangala University of Technology Phra Nakhon
14. Dr. Pakamas Choosit      Rajamangala University of Technology Phra Nakhon
15. Dr. Jittimon Wongsu      King Mongkut's University of Technology North  
Bangkok
16. Asst. Prof. Aroon Charangsut      Rajamangala University of Technology Phra Nakhon
17. Asst. Prof. Supawud Nedphokaew      Rajamangala University of Technology Phra Nakhon
18. Asst. Prof. kullayot suwantaraj      Rajamangala University of Technology Phra Nakhon
19. Asst. Prof. Sopa Cansee      Maharakham University
20. Asst. Prof. Woravith Chansuvarn      Rajamangala University of Technology Phra Nakhon
21. Asst. Prof. Udomdeja Polyium      Rajamangala University of Technology Phra Nakhon



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| No.          | Organizations   | Number of Papers  |
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| 1            | Chiang Mai University   | 4                 |
| 2            | Chiangmai Technical College Chiangmai, Thailand                             | 1                 |
| 3            | King Mongkut's University of Technology North Bangkok                       | 5                 |
| 4            | King Mongkut's Institute of Technology Ladkrabang                           | 1                 |
| 5            | King Mongkut's University of Technology North Bangkok<br>Prachinburi Campus | 1                 |
| 6            | Maejo university  | 17                |
| 7            | Maharakham University   | 8                 |
| 8            | Naresuan University   | 1                 |
| 9            | Rajamangala University of Technology Isan                                   | 2                 |
| 10           | Rajamangala University of Technology Isan Khon Kaen Campus                  | 10                |
| 11           | Rajamangala University of Technology Lanna                                  | 3                 |
| 12           | Rajamangala University of Technology Lanna Tak                              | 4                 |
| 13           | Rajamangala University of Technology Lanna, Chiang Mai                      | 1                 |
| 14           | Rajamangala University of Technology Phra Nakhon                            | 22                |
| 15           | Rajamangala University of Technology Thanyaburi                             | 1                 |
| 16           | Rennes 1 University   | 1                 |
| 17           | Silpakorn University  | 25                |
| 18           | South-East Asia University  | 1                 |
| 19           | Suranaree University of Technology  | 1                 |
| 20           | Uttaradit Technical College Uttaradit, Thailand                             | 1                 |
| <b>Total</b> |   | <b>110 papers</b> |



## List of Participating Research Topics

|  |            |
|--|------------|
| <b>Total number of research papers</b> | <b>110</b> |
|--|------------|

### 1. EDUCATION

|                                      |   |
|--------------------------------------|---|
| - Engineering Business & Management  | 4 |
| - Engineering Education              | 4 |
| - Industrial and Technical Education | 2 |
| - Related Topics.                    | 1 |

### 2. ENGINEERING

|   |   |
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| - Agricultural, Biological and Food Engineering | 5 |
| - Alternative Energy and Combustion             | 9 |
| - Applied Mechanics and Materials               | 2 |
| - Civil and Environmental Engineering           | 1 |
| - Computational and Simulation Techniques       | 4 |
| - Electrical Engineering                        | 7 |
| - Mechanical Engineering                        | 2 |
| - Industrial Engineering                        | 5 |
| - Computer Engineering                          | 9 |
| - Related Topics.                               | 1 |

### 3. SCIENCES and TECHNOLOGY

|                                    |   |
|------------------------------------|---|
| - Environmental Management         | 4 |
| - Energy Technology and Management | 1 |
| - Food Science and Biotechnology   | 3 |
| - Related Topics.                  | 7 |

|              |            |
|--------------|------------|
| <b>Total</b> | <b>110</b> |
|--------------|------------|





## CONTINUING PROFESSIONAL DEVELOPMENT (CPD)



### The Continuing Professional Development (CPD) Certified by the Council of Engineers, Thailand (COE)

There are many ways to increase quality of engineers. One of the acceptances and used in many countries is the Continuing Professional Development (CPD) activities. The Council of Engineers (COE), Thailand has provided ongoing professional development of engineers already, like in the APEC and ASEAN Engineering group, which holds as an engineering agreement.

For engineers who have graduated and are working in the field of engineering, need to develop their knowledge and skills continuously. The Continuing Professional Development is one of the ways to help engineers improve their skills, professional knowledge, quality, creation, and safety. The Council of Engineers has issued regulations governing the Continuing Professional Development in B.E. 2551(2008). The differences of unit weights are identified by activities. The conceptual for getting points is counting the Professional Development Unit (PDU) units of practical hours and participated on 8 items of CPD's activities.

The COE has determined the activities which engineers can take for their CPD. Those activities are counted as the PDU and are divided into 8 items as follows:

1. Formal learning
2. Informal learning
3. Seminar, conference and meeting
4. Participation in professional activities
5. Service activities
6. Industry involvement
7. Contribution to knowledge
8. Patents



The Faculty of Engineering, Rajamangala University of Technology Phra Nakhon is accredited as a continuing professional development organization. The code of organization is number 3023, certified by the Council of Engineers (COE) on September 11<sup>th</sup>, 2017. The organizer authorizes to offer the Professional Development Unit (PDU) for participants of the 10<sup>th</sup> International Conference on Science, Technology and Innovation for Sustainable Well-Being 2018(STISWB 2018). The members of the Council of Engineers, Thailand who are participated the 10<sup>th</sup> STISWB 2018 will receive 12 PDU. **The Activity Code is: 303-00-3023-00 / 6107-001**



## CONTINUING PROFESSIONAL DEVELOPMENT (CPD)



The details of CPD's activity on the 10<sup>th</sup> STISWB 2018. The Faculty of Engineering, Rajamangala University of Technology Phra Nakhon offers 12 PDU for participants, certified by the Council of Engineers (COE), Thailand.

| รายละเอียดกิจกรรม           |  |               |              |
|-----------------------------|--|---------------|--------------|
| รหัสกิจกรรม:                | 303-00-3023-00/6107-001  |               |              |
| ประเภทกิจกรรม:              | ประเภทที่ 3 การเข้าร่วมสัมมนาและการประชุมทางวิชาการ หรือวิชาชีพ (seminar, conference and meeting)                    |               |              |
| กิจกรรม:                    | 303. การเข้าเฝ้าฯ สัมมนาและการประชุมทางวิชาการหรือวิชาชีพ ระหว่างประเทศ  |               |              |
| ชื่อหัวข้อกิจกรรม:          | The 10th International Conference on Science, Technology and Innovation for Sustainable Well-Being 2018 (STISWB2018) |               |              |
| น้ำหนัก:                    | 1.5  |               |              |
| รายละเอียดการจัดกิจกรรม:    | The International Conference on Science, Technology and Innovation.  |               |              |
| สาขา:                       |  |               |              |
| ประเภทกิจกรรม:              | กิจกรรมทางด้านเทคนิค   |               |              |
| Keyword:                    | อื่น ๆ   |               |              |
| ลักษณะงาน:                  | Conference   |               |              |
| Website:                    | www.stiswb2018.org   |               |              |
| จำนวนวิทยากร:               | 3  |               |              |
| ลำดับที่                    | ชื่อวิทยากร  | รหัส          | จำนวนชั่วโมง |
| 1                           | ยศชนัน วงศ์สวัสดิ์   | ไม่เป็นสมาชิก | .5           |
| 2                           | ประยุทธ อัครเอกฉัตร  | 30561         | .5           |
| 3                           | โกสินทร์ ชำนาญไทย  | ไม่เป็นสมาชิก | .5           |
| วัน/เวลา/ค่าเข้าร่วมกิจกรรม |  |               |              |
| จำนวนชั่วโมง:               | 8  |               |              |
| ค่า PDU:                    | จำนวนชั่วโมง คือ จำนวนชั่วโมงที่ทำการปฏิบัติกิจกรรมพัฒนาวิชาชีพวิศวกรรมอย่างต่อเนื่อง                                |               |              |
| วันที่เริ่มรับสมัคร:        | 12   |               |              |
| วันหมดเขตรับสมัคร:          | 01 ธ.ค. 2560   |               |              |
| วันเริ่มจัดกิจกรรม:         | 22 มี.ย. 2561  |               |              |
| วันสิ้นสุดกิจกรรม:          | 11 ก.ค. 2561 เวลา 09.00  |               |              |
| สถานที่จัดกิจกรรม:          | 13 ก.ค. 2561 เวลา 17.00  |               |              |
| ค่าเข้าร่วมกิจกรรม:         | Vientiane, Lao PDR.  |               |              |
|                             | Member   | 6500 บาท      |              |
|                             | Government   | 10400 บาท     |              |
|                             | State Enterprise   | 10400 บาท     |              |
|                             | Non Member   | 10400 บาท     |              |
|                             | Student  | 6500 บาท      |              |
| เอกสารประกอบ:               | ไม่มีเอกสารประกอบ  |               |              |
| รายละเอียดผู้ติดต่อ         |  |               |              |
| ชื่อ:                       | Miss Pornpit Sirima  |               |              |
| โทรศัพท์:                   | 028363000 ext. 4181 โทรสาร: 028363000 ext. 4118  |               |              |
| Email:                      | pornpit.s@mutp.ac.th   |               |              |

Reference: <http://www.coe.or.th/CPD3/modules.php?name=OrgActivity1&mode=preview&id=5149>

**The Activity Code: 303-00-3023-00 / 6107-001**

Conference Schedule 11-13 July, 2018

The 10<sup>th</sup> International Conference on Science, Technology and Innovation for Sustainable Well-Being 2018

Hosted by Faculty of Engineering, Rajamangala University of Technology Phra Nakhon

| Wednesday, July 11 <sup>th</sup> - Pre-conference meeting   |  |                                   |                                |                      |                      |                     |                               |  |  |
|---|--|-----------------------------------|--------------------------------|----------------------|----------------------|---------------------|-------------------------------|--|--|
| 12.00 - 16.00   | Registration                                     |                                   |                                |                      |                      |                     |                               |  |  |
| 13.00 - 16.00   | Knowledge Management (KM) Program                |                                   |                                |                      |                      |                     |                               |  |  |
| 14.00 - 16.00   | STISWB Network Meeting (CEO and Representatives) |                                   |                                |                      |                      |                     |                               |  |  |
| 18.00 - 20.00   | Welcome party                                    |                                   |                                |                      |                      |                     |                               |  |  |
| Thursday, July 12 <sup>th</sup> - The conference day  |  |                                   |                                |                      |                      |                     |                               |  |  |
| 08.00 - 09.00   | Registration                                     |                                   |                                |                      |                      |                     |                               |  |  |
| 09.00 - 09.30   | Welcome speech                                   |                                   |                                |                      |                      |                     |                               |  |  |
| Opening ceremony - President of Rajamangala University of Technology Phra Nakhon                      |  |                                   |                                |                      |                      |                     |                               |  |  |
| 09.30 - 11.00   | Keynote Speakers                                 |                                   |                                |                      |                      |                     |                               |  |  |
| 1. Prof. Dr. Kosin Chamnongthai - King Mongkut's University of Technology Thonburi, Thailand          |  |                                   |                                |                      |                      |                     |                               |  |  |
| 2. Prof. Dr. Prayoot Akkarakethalin - King Mongkut's University of Technology North Bangkok, Thailand |  |                                   |                                |                      |                      |                     |                               |  |  |
| 3. Assoc.Prof. Dr. Yodchanan Wongsawat - Faculty of Engineering, Mahidol University, Thailand         |  |                                   |                                |                      |                      |                     |                               |  |  |
| Coffee Break  |  |                                   |                                |                      |                      |                     |                               |  |  |
| Parallel Sessions   |  |                                   |                                |                      |                      |                     |                               |  |  |
| Chairperson   | Room 01  | Room 02                           | Room 03                        | Room 04              | Room 05              | Room 06             | Room 07                       |  |  |
|   | Asst.Prof.Dr.Pracha Yeunpongkul                  | Dr.Chantina Rewlay-ngoen          | Assoc.Prof.Dr.Uthen Kannam     | Dr.Supachai Lakkam   | Dr.Sanya Khunkhao    | Dr.Jirasak Tharajak | Dr.Chantana Papattha          |  |  |
| Co-chairperson  | Dr.Patiwat Khomwachirakul                        | Dr.Surachai Kamjanakorn           | Dr.Chadkaew Jariyatanitwatt    | Mr.Siripol Tongom    | Dr.Auchalee Manosueb | Dr.Kanawut Inkaew   | Mr.Kreaditsak Lappanichayakul |  |  |
| 11.00 - 12.00   | ENG 01 - ENG 03                                  | ENG 17 - ENG 19                   | ENG 31 - ENG 33                | ENG 47 - ENG 49      | ENG 65 - ENG 68      | SCI 01 - SCI 03     | EDU 01 - EDU 02               |  |  |
| 12.00 - 13.00   | Lunch  |                                   |                                |                      |                      |                     |                               |  |  |
| 13.00 - 14.45   | ENG 04 - ENG 08                                  | ENG 20 - ENG 23                   | ENG 34 - ENG 37                | ENG 50 - ENG 55      | ENG 69 - ENG 74      | SCI 04 - SCI 08     | EDU 03 - EDU 05               |  |  |
| 14.45 - 15.00   | Coffee Break                                     |                                   |                                |                      |                      |                     |                               |  |  |
| Chairperson   | Asst.Prof.Dr.Padiphan Tinprabuth                 | Asst.Prof.Dr.Thibordin Sangsawang | Asst.Prof.Dr.Poramatr Arromdee | Dr.Krisada Lekdee    | Dr.Paisan Kanthang   | Dr.Jirasak Tharajak | Dr.Chantana Papattha          |  |  |
|   | Dr.Chadkaew Jariyatanitwatt                      | Ms.Vichuda Mettanant              | Dr.Ponlakit Jariyatanitwatt    | Dr.Therdpong Daengsi | Dr.Chanwit Prabpayak | Dr.Kanawut Inkaew   | Mr.Kreaditsak Lappanichayakul |  |  |
| 15.00 - 17.45   | ENG 09 - ENG 16                                  | ENG 24 - ENG 30                   | ENG 38 - ENG 46                | ENG 56 - ENG 64      | SCI 17 - SCI 25      | SCI 09 - SCI 16     | EDU 06 - EDU 11               |  |  |
| 18.30 - 21.30   | Banquet  |                                   |                                |                      |                      |                     |                               |  |  |
| Welcome speech by the conference host   |  |                                   |                                |                      |                      |                     |                               |  |  |
| Cultural shows  |  |                                   |                                |                      |                      |                     |                               |  |  |
| STISWB Talk - Prof.Dr.Pradit Terdtoon, Dean of Graduate School, Mahasarakham University, Thailand     |  |                                   |                                |                      |                      |                     |                               |  |  |
| Flag transfer ceremony for the next STISWB 11 <sup>th</sup>   |  |                                   |                                |                      |                      |                     |                               |  |  |
| Friday, July 13 <sup>th</sup> - On-Site Visiting  |  |                                   |                                |                      |                      |                     |                               |  |  |
| 08.30 - 10.00   | National University of Laos                      |                                   |                                |                      |                      |                     |                               |  |  |
| 10.00 - 12.00   | Lao National Museum                              |                                   |                                |                      |                      |                     |                               |  |  |
| 12.00 - 13.00   | Lunch  |                                   |                                |                      |                      |                     |                               |  |  |
| 13.00   | Traveling to Airport                             |                                   |                                |                      |                      |                     |                               |  |  |



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# EDUCATION

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# Knowledge and Behavioral Factors Influencing the Gas-fuel Car Owner in Making Decision to Use LPG and NGV: Case Study in Muang District, Samutprakarn Province

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*Abstract*—This research was aimed at exploring knowledge and behavioral factors for the gas car owner in making decision to use LPG and NGV. Referring to Yamane sample calculation and type of sample organizations, the research was conducted to 400 car owner in Muang district. The data was collected by questionnaire and analyzed by mean, SD, Chi-Square, t-Test, One-way ANOVA and Scheffe post hoc analysis at 0.05 level of significance.

The research findings indicated that most respondents had knowledge and understanding on gas-fuel setting car at medium level while the Chi-Square showed that the knowledge and understanding level was depended on three major elements type of car, type of fuel, and maximum capacity of gas per gallon. Referring to the comparison analysis between behavior and attitude level, it was found the major difference in type of fuel. Eventually, the result of comparison between knowledge and attitude level revealed that there were difference in two factors convenience and satisfaction at .05 significance level of statistical difference.

*Keywords*— Behavior, Decision Making, LPG and NGV





# Study of Safety Behavior for Manufacturing Employees: A Case Study of Paper Pulp Factory Cluster

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**Abstract** This research aimed to investigate the effect of individual factor on safety behavior in manufacturing workers and level of safety support from company. The data was collected from 300 employees by using a questionnaire and sample size was calculated from Taro Yamane at 95% confidence level and 5% error. The data analyzed by mean, standard deviation (SD), t-test, F-test (One-way ANOVA) and Scheffe's post hoc analysis at 0.05 level of significance.

The results of statistical analysis of the difference between individual factors and safety behavior in manufacturing workers showed that the difference was in all aspects, except for income and the difference between individual factor and level of safety support from company was found in three aspects: gender, status and education at .05 significance level of statistical difference.

**Keywords**— Behavior, Safety, Manufacturing worker, Paper and factory



# Factors Influencing Decision to Purchase the Design Engineering Software in Companies in Navanakorn Industrial Estate, Pathumthani Province

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**Abstract**—The objectives of this research were to study behavior in making decision to purchase the design engineering software and to compare the marketing mix which affects the customer in making decision to purchase the design engineering software. Referring to Yamane sample calculation and type of sample organizations, the research was conducted to 66 companies in Navanakorn Industrial Estate. The data was collected by questionnaire and analyzed by mean, SD, t-Test, F- Test (One-way ANOVA) and Scheffe's post hoc analysis at 0.05 level of significance.

According to research findings from comparison analysis on type of organizations and factors influencing decision to purchase design engineering software, it was found as follows: Product – capability and usability; Price – vendor, cash discount for long- term payment, and reasonable price; Place – on-line channel availability, on-site product demonstration by staff; Promotion – advertisement in various channels e.g. magazine, internet, etc.; Process – online-helpdesk; and People – skilled staffs, at .05 significance level of statistical difference.

**Keywords**—*Decision Making, Design Engineering Software, Industrial Real Estate*





# Performance Measurement Faculty of Engineering RMUTP for Digital University

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*Abstract*— The objective of this research work was to arrange a performance measurement for finding factors which will have influence on the capacity of Faculty of Engineering, Rajamangala University of Technology Phra Nakhon, leading it to become a digital university. The results of making a survey on the data from the personnel of the Faculty of Engineering showed that: the factor that had the most influence on the capacity of the Faculty of Engineering, Rajamangala University of Technology Phra Nakhon was the factor of knowledge and attitudes (the mean was 3.61, which stood at the level of comments "high"); regarding the level of comments, this was followed by the factor that had influence on the capacity of the Faculty of Engineering in terms of the environment in the organization (the overall mean was 3.49, which stood at the level of comments "moderate"); the factor that had influence on the capacity of the Faculty of Engineering in terms of participation came in the last place (the mean was 3.41, which stood at the level of comments "moderate"). The basics results obtained from this research work will be partly used as an approach to help improve the processes of the Faculty of Engineering. This will support stepping into becoming a digital university in the future.

*Keywords*— Performance Measurement; Digital University



# The Construction and Efficiency Finding of Instructional Package on the Topic of ASK in Digital Modulation for Application to Vocational Education

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*Abstract*—The objective of this study were construction and efficiency finding of Teaching Package on the Topic of ASK in Digital Modulation for Application to Vocational Education on diploma student. In addition, it is to compare the learning achievement of the students between both before and after teaching and learning the teaching set. This study is the Experimental Research with one group pre-test post-test design. There were 25 students in sampling group. They were the last year student in semester 2, academic year 2017, who were studying in Diploma Program in Electronics and had studied Telecommunication system, Rajamangala University of Technology Lanna Tak. The efficiency of teaching set could be found from the value analysis of E1/E2 and compared with the learning achievement of the students both before and after teaching and learning by the teaching set. There was analyzed by test t-test Value. According to the research result, it showed that teaching set constructed by the researcher reach the efficiency of 84.48/81.60, higher than the standard criteria. When comparing the difference between the values of the scores on before and after teaching and learning by the statistic of t-test, it showed statistically significant level. As a result, the new teaching set constructed by researcher had the efficiency level which increased at the statistical significance level 0.05.

*Keywords*— teaching package; digitalmodulation; ASK.



# The Construction and Efficiency Finding of Instructional Package on the Module of Video and Audio Analog Optical Fiber Link

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*Abstract*—The objective of this study were construction and efficiency finding of Teaching Package on the Topic of the modular instructional package of video and audio analog optical fiber link. Circuit designed to test signal performance to come out as expected. This is to introduce the knowledge gained from the creation and the efficiency of the modulation circuit. The instructional package was created to convey to the sample students are high school diploma. Enrollment in the second semester of academic year 2560, at RMUTL TAK: Rajamangala University of Technology Lanna Tak. Then take the test to measure the achievement. Then the scores were calculated for the instructional package. The results of this research show that the instruction package developed by the researcher was 80.30/80.15 and the students' satisfaction was at the high level (mean 4.48) Performance based on research hypothesis.

*Keywords*— teaching package; optical communication; optical fiber link.



# Motives to study Bachelor of Technology Program in Engineering Business, Silpakorn University

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*Abstract*— The purpose of this research was to find motives for studying a Bachelor of Technology Program in Engineering Business at the Faculty of Engineering and Industrial Technology at Silpakorn University. The population in this survey research was 639 students of the program who were asked to complete the self-administered questionnaires. The collected data were then analyzed by using statistic methods including; percentage, mean, S.D. and F-test. The results revealed that motives behind most students' enrollments in this program were the reputation and recognition of Silpakorn University while a suggestion by others was partially affect their decision. Evidently, the experiment on the hypothesis of different background of students influenced their motives to study the program was at 0.05 statistical significance.

*Keywords*— *Motives; B.Tech. (Engineering Business)*



# Lecture and test in Moodle Platform: the Teaching Innovation on Thermo-fluid Coursework

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*Abstract*—The learning platform called Moodle was applied to develop the calculation skill of thermos-fluid students. The teaching videos were added in Moodle platform to facilitate the student to access the thermos-fluid coursework at anywhere and anytime. Ten problems from exercises database were randomly selected to establish the weekly test and retest. Moodle was used to score the digital answer sheet of each student and report their score after the test was over. More than 60% of total test score was required before approving the students to access the lesson and test in next week. If students cannot meet this requirement, they were assigned to review the lecture content in video format contained in Moodle platform before retest. The weekly score of classroom was recorded and analyzed. The number of F grade point obtained student was compared between 2 sections which were applied a different coursework management. The observation found that using the Moodle platform to manage the weekly test and announce the score in real-time induced the student's stress. However, this teaching technique resulted in the increase of percentage of class average testing score and student's learning ability. In addition, the number of F grade point obtained student was significantly lower than the conventional coursework management.

*Keywords*—Moodle; Thermo-fluid; Coursework; Learning platform; teaching innovation





# Benchmark of Desired Attributes of Technology Graduates in Thailand: Basis for Improving

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**Abstract**— This study used descriptive method to create a benchmark of desired attributes of Technology graduates in Thailand which can be used as basis for improving attributes of Electronic Technology graduates. The study utilized a survey questionnaire which has been validated and pilot-tested with a Cronbach alpha value of 0.92 and conducted using two sectors in Thailand; the industry sector and the school sector. The selection of respondents utilized a purposive sampling. Graduate attributes are highly manifested as perceived by the two groups of respondents. The School is able to produce graduates who have the cognitive skills, knowledge, communication skills, leadership skills, ethical and moral skills, technical and job-related competencies in the field of electronics technology. Although there are some significant differences in the three domains, namely knowledge, communication and leadership skills, in most of the domains, there is no significant difference. This therefore is an indication that the School is able to produce graduates who are fit for the jobs available in the industry, who can be competitive and who can be assets in their respective organizations. The School needs to focus in those three areas where the university scored higher than their industry counterpart. The university can focus more on these three domains knowledge, communication and leadership skills. The curriculum can be re-designed in order to address these concerns. Deeper understanding of theories in industrial technology and how this is integrated to other related fields must be enhanced. Language deficiency can be addressed by integrating more practical activities to improve their communication skills, whether verbal, written or technical. Leadership skill can be developed by offering more curricular and co-curricular activities for the students. Having determined the desired attributes of technology graduates in Thailand, this study finds it relevant to use this benchmark as basis for recommendations for improving attributes of graduates of Electronic Technology.

**Keywords**— graduates attributes; f; benchmark of desired; technology graduates in thailand.



# The Development of the Interactive e-book on the 38 Steps Towards Enlightened Living

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**Abstract**—This research was conducted to; (1) study results of an interactive electronic book (e-book) used for teaching of the 38 Steps Towards Enlightened Living (2) study performance of the said interactive electronic book. Research samples were 30 of the bachelor degree students at the Department of Information Technology, Faculty of Industrial Technology and Management, King Mongkut's University of Technology North Bangkok (Prachinburi Campus) who were selected by Purposive Sampling method. Research tools including interactive electronic book on the 38 Steps Towards Enlightened Living, pretest- posttest of each lesson, overall test after completion of the entire studies. Hypothesis of the research was based on post-study results which were anticipated that, after using the said interactive electronic book, the posttest scores were higher than that of the pretest ones at statistical significance level with performance value of 80/80. Data was assessed by using averaged value, percentage, standard deviation and t-test. According to the results, the above mentioned interactive electronic book; (1) raised student's posttest scores higher than that of the pretest ones at statistical significance level of .05 (2) resulted in performance values of 89.50/84.60, against the expected values of 80/80.

**Keywords**—Interactive electronic book; Steps Towards Enlightened Living; Study results; Media performance



# Analyzing Graduate Production Costs of Faculty of Industrial and Technology Management, King Mongkut's University of Technology North Bangkok Prachinburi

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*Abstract*— Abstract—This study analyzed and calculation of graduate production cost in higher education, case study of Faculty of Industrial and Technology Management (FITM) King Mongkut's University of Technology North Bangkok (KMUTNB) by using data in the academic year 2013-2016. Analyze data using descriptive statistics method such as frequency, percentage, and mean to explain the information available and ration the indirect cost by using full-time equivalent student (FTES).

The analyzing graduate production costs result of FITM found that unit cost of a 4-year program is 247,787.44 Baht and from a 2-year continuing program is 114,198.20 Baht. But after included the number of dropouts and average study time the value is changed to 416,972.95 and 216,845.93 Baht respectively. That is the real graduate production costs highly relate to a number of students, number of dropouts and average study time.

*Keywords*— graduate production costs, unit cost, higher education



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# ENGINEERING

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- Agricultural, Biological and Food Engineering
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# Effect of various conditions on ultrasonic-assisted extraction of allicin from garlic (*Allium Sativum* Linn.)

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**Abstract**— Medicinal properties of garlic (*Allium Sativum* Linn.) have been studied extensively, even though it has been used as a traditional remedy. This study examined the effects of various ultrasonic frequency (28, 45 and 100 kHz), extraction temperatures (20, 30 and 40°C) and extraction time (20, 40 and 60 min) on the extraction yield of allicin content from garlic. Extraction was most efficient at 45 kHz, while the extraction temperature of 30°C and time of 40 min. Under the optimal conditions, the allicin content was  $6.282 \pm 0.010$  mg/ml. This study is important due to its ability to improve extraction of allicin content using ultrasonic-assisted extraction method.

**Keywords**—ultrasonic-assisted extraction; garlic; allicin



# Solar Drying House for Drying Herbs

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**Abstract**— This research was to investigate and designed of solar drying house for drying herbs. The solar drying house in this research was double layers, the outside layer was made from clear polycarbonate and the inner layer was made from galvanized sheet. The one side of galvanized sheet was painted by black color for absorption of solar radiation. The 2 of roof ventilators were set at the top of solar drying house. Moreover, the ten of radiator fans motors 12V DC 90 W were set at galvanized wall. The herbs for experimental were Curcuma sliced and Beijing grass from Baan Dong Bung herb group, Prachin Buri Province, Thailand. The 100 g of Curcuma (*Curcuma longa* Linn.) sliced and Beijing grass (*Murdannia loriformis*) were set up distribution in drying racks at inner drying house. The temperatures at three points of front, center and back zones and the weight of herbs were measured every one hour until the average of herbs moisture content were decreased to the standard of Baan Dong Bung herb group. It was found that the temperature of inner solar drying house by turn on fans was nearly the temperature of inner solar drying house by turn off fans (the maximum of temperature difference in case of turn on fans as 2°C). The maximum of the efficiency of solar drying house was 16.05%. The drying time by using solar drying house at turn on fans was lower than drying time of by using solar drying house at turn off fans.

**Keywords**— *Curcuma; Beijing Grass; Drying House; Solar Energy*





# Temperature Distribution Inside Biochar Kiln for Biochar Production

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**Abstract**—Biochar is a carbon-rich solid product of thermal pyrolysis of organic matter used for soil fertility improvement. The quantity and quality of biochar are mainly influenced by the pyrolysis temperature. To achieve the maximum yield and high quality of biochar, the biochar kiln was therefore designed with the optimized process parameter. The kiln with a dimension of 467 mm × 384 mm (height × diameter) was developed consisting of the core with diameter of 114.3 mm located at the kiln center. The different core puncture diameters (3.18 mm, 4.76 mm, and 6.35 mm) were investigated. The computer simulation was applied on this study aimed at determining the effect of the core puncture diameter on the temperature distribution. To validate the model, the simulation results were compared with the experimental results. From the simulation, all core puncture diameters showed the same temperature distribution, i.e., the highest temperature was respectively found at the middle, top, and base of the kiln. The temperature averagely over the radial positions at the middle part of the kiln was found to be equal to  $574.0 \pm 164.6$  °C,  $487.3 \pm 126.7$  °C, and  $463.7 \pm 114.2$  °C for the core puncture diameter of 3.18 mm, 4.76 mm, and 6.35 mm, respectively. Based on this simulation results, it can reveal the characteristic of the temperature distribution, affecting to the yield and quality of biochar.

**Keywords**—agricultural residues; biochar kiln; slow pyrolysis; temperature distribution; thermal simulation



# Disassembled Solar Greenhouse Dryer for Agricultural Products

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*Abstract*— The purpose of this research is to design, construct and testing a solar greenhouse for agricultural products drying. The housing can be easily assembled and disassembled using polyvinyl chloride (PVC) pipe and fitting as a main structure. In this study, the two cable slings were used to support the pipe for more rigid structure. The housing has a shape of a 45 degree triangular prism with a base of 7.3 m x 4 m and a height of 4.4 m. The 0.5 mm thick of transparent polyethylene sheet was used to cover and the 0.5 mm thick of dark polyethylene sheet was used as the solar absorber. The drying area was 18.24 m<sup>2</sup>. Results found that the 120 kg soybean can be dried from the initial moisture content of 53.9% wet basis down to 10% wet basis within 3 days for safe storage. In addition, the average thermal efficiency of this greenhouse was 6.5%.

*Keywords*—drying efficiency; greenhouse; solar energy; soybean



# Effects of Drying Temperatures and Pretreatment Conditions on the Drying Kinetic and Color Quality of Japanese Pumpkin Powder obtained from Hot Air Drying

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**Abstract**—The product color is one of an important factor for consumer acceptance. It can be improved by blanching or steaming before drying process. Therefore, the objective of this research is to study the effects of drying temperature and pretreatment conditions on the drying kinetic and color quality of Japanese pumpkin powder obtained from hot air (HA) drying. The Japanese pumpkin slices were blanched or steamed for 30 and 60 seconds and then the sample dried by HA drying (60-90°C). The drying kinetics and color quality of Japanese dried pumpkin were considered. The results showed that the moisture ratio of dried Japanese pumpkin slices obtained from HA90 drying was more changed than other cases and as a result in shorter drying time. However, the results showed that drying at 70 °C resulted in the best color qualities of the Japanese pumpkin powder. The lightness (L) and yellowness (+b) value were higher and the redness (+a) value was lower than those of other drying conditions. When considering the effect of pretreatment conditions on color quality of dried Japanese pumpkin, blanching process for 60 seconds shows the most effective condition for preserving the color quality of Japanese pumpkin powder. The sample had higher lightness and yellowness values but lower redness than the other pretreatment conditions. In conclusion, the most effective condition for producing Japanese pumpkin powder is a blanching the sample with hot water at a temperature of 90 °C for 60 seconds and dried by HA70 condition.

**Keywords**— color; japanese pumpkin powder; drying kinetic; pretreatment



# Thermal Efficiency Behavior of Hot Air Production from Fluidized Bed Kiln by Waste Biomass

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**Abstract**—The aim of this study is to investigate thermal efficiency behavior of hot air production from fluidized bed kiln by waste biomass. A hot air production had the main parts of a fluidized bed kiln, an air chamber, a biomass fuel feeder set, a blower motor of fluidized bed kiln, an air blower, fire burn pocket, cyclone and a control box. Hot air temperature control was to design by control waste biomass feeding and air flow of fluidized bed kiln. Experiments were performed by waste biomass types of rice husk, sawdust and minor leaf. They were test under conditions 170 °C of air temperature with flow rate of 0.0715 kg s<sup>-1</sup> during 180 minutes. It was found that average thermal efficiencies of rice husk, sawdust and minor leaf were 25.82±11.70, 25.8±11.70 and 28.03 ±13.98 %, respectively.

**Keywords**—waste biomass; hot air production; rice husk; sawdust; minor leaf



# Investigation of Fuel Delivery of Common Rail Injector using a Volumetric Injection Meter

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**Abstract**—This work investigates fuel delivery of common rail injector with different injection strategies. Injection delivery was investigated by an in-house fuel injection measurement system, which was calibrated by comparing with the commercial device. For single and double injection strategy, the experiments were operated by injection pressure and duration in the range of 250-1400 bar and 250-1400 microseconds, respectively, with different the first injection duration, second injection duration and dwell times. The typical diesel selling in Thailand's market was used for experiments. The results indicate that increasing injection pressure and injection duration increase fuel injection and return quantities for single injection strategy. At injection duration shorter than 800 microseconds, Fuel injection and returning quantities are dominated by injection duration related to the needle opening. For double injection, the first injection duration and second injection duration show the similar trend of the injected quantity and return as single injection at given conditions. Short dwell time gives higher injected fuel quantity due to incompletely closing nozzle holes.

**Keywords**—*fuel delivery, common rail; volumetric injection meter; injector*



# Improvement of Physical Properties of Heterogeneous Biomass Pellets using Fermented Cassava rhizome and Kratin-wood residue: Effect of Fermentation Time

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**Abstract**—The objective is to study effect of fermentation time on binding property of fermented cassava rhizome and physical properties of a heterogeneous biomass pellet product. Rhizome of cassava (*Manihot esculenta*) and a wood residue from kraton tree (*Leucaena leucocephala*) were collected from local agricultural areas in Ratchaburi and Phetchaburi provinces, respectively. Cassava rhizome and fermented cassava rhizome were employed as mixers for pelletizing of kraton-wood residues. Fermentation of cassava rhizomes were conducted at room temperature, allowing growth of natural microorganisms for one and three days, respectively. The fermented cassavas obtained were termed “FC1” and “FC3”, respectively. The FC1 and FC3 were mixed with kraton-wood residue (ratio 1:1) prior to be molded using a flat-die pellet mill machine. Moisture content (30% of raw material) and initial die temperature (75 °C) were controlled. Heterogeneous of mixture of kraton-wood and cassava (LNFC0) and homogeneous cassava pellets (L100) were employed as control and reference, respectively. Biomass pellet products were determined for bulk density and durability following the standard methods set by Pellet Fuels Institute Standard. Bulk density and durability of the homogeneous L100 pellet values of  $655 \pm 2.09 \text{ kg/m}^3$  and  $94.25 \pm 0.31\%$  were determined, respectively. Comparing to the L100, both bulk densities and durability of the heterogeneous pellets were increased corresponding to the increased fermentation period:  $682.13 \pm 1.13 \text{ kg/m}^3$  and  $97.03 \pm 1.86\%$ ,  $686.74 \pm 3.04 \text{ kg/m}^3$  and  $98.76 \pm 0.47\%$ , and  $691.89 \pm 3.94 \text{ kg/m}^3$  and  $98.87 \pm 0.97\%$  for the LNFC0, LFC1, and LFC3, respectively. The results suggest that cassava rhizome and fermented cassava are able to improve the physical properties of heterogeneous pellets such that they meet the standard requirement of the Pellet Fuels Institute (PFI) Program Standards.

**Keywords**— Biomass pellet fuel; Pelletizing; Fermentation time







# Tank-to-Wheel Analysis of Environmental and Economic Evaluation from Passenger Cars Transportation

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**Abstract**—Electric vehicles are considered as technology which can significantly reduce the problems related to transportation such as increasing greenhouse gas emissions, hazardous air pollution and energy import dependency. The main objective of this paper is to analyze the current environmental impact perspective on present global warming potential and economic characterization of different types of electric vehicles and fuels are compared (petro, diesel, Hybrid Electric Vehicles (HEVs), Battery Electric Vehicles (BEVs)) on their level of global warming potential impact and economic value per one hundred kilometer. Resulting indicate that in term of vehicle use (Tank-to-Wheel perspective) the electric vehicle shows a lower environmental impact and economic value. Futuremore, Emissions during fuel production should be addressed and also impacts with the production of vehicle. Moreover, the different pollutants result in different environmental damages.

**Keywords**—*Tank-to-Wheel, electric vehicles, economic, emissions,*



# Effects of Air Staging on Emission Characteristics and Combustion Efficiency in a Twin-cyclonic Swirling Fluidized-bed Combustor Firing Rubberwood Sawdust

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**Abstract**— The experimental tests were conducted in a twin- cyclonic swirling fluidized-bed combustor (TFBC) firing with rubberwood sawdust with different operating parameters, constant fuel feed rate of 20 kg/h, secondary air ratio (S/T) at 0.5 for excess air 20-80%. Silica sand of particle size range 450-550  $\mu\text{m}$  was used as the bed material at static bed height 30 cm above the annular spiral air distributor. The temperature and gas concentrations of O<sub>2</sub>, CO, and NO were measured along the axial directions of the combustor. CO and NO emissions was experimentally investigated at the stack for all tests prior using CO emission for calculating heat loss owing to incomplete combustion. Fly ash was sampling from ash collector with the aim to calculate the heat loss due to unburned carbon. The combustion efficiency was then calculated by indirect heat losses method. As revealed from the experimental results, CO emission decrease with rising of excess air but increase when secondary air ratio rising, while NO emission present inverse trends with CO. For firing rubberwood sawdust in TSFBC at EA 60-80% and S/T 0-0.1, as leading to high (~97%) combustion efficiency ( $\eta_c$ ) and acceptable levels CO and NO emission with Thailand emission standard.

**Keywords**— *Fluidized bed; Silica sand; Excess air; Emission; Combustion, Efficiency*





# The Improvement of Biomass Properties by Torrefaction Rotary Kiln

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**Abstract**— This research studies the effect of torrefaction process by using rotary kiln on torrefied biomass properties. Corncob was use in this research. In this research the effect of torrefaction temperature and rotation speed of the rotary kiln on biomass properties were investigated. The torrefaction rotary kiln (6 meters length and 0.3 meters diameter) was used in this research. Liquid petroleum gas was selected as heat source. The temperature of torrefaction process were set at 230, 250 and 270 degrees Celsius. The rotation speed was at 1, 2 and 3 rpm. The temperature distribution, temperature profile, characteristic of torrefied biomass, moisture content, particle distribution, mass yield and energy yield reported. It was concluded that, the rotary kiln can used for torrefaction process. The biomass after torrefaction with torrefaction rotary kiln was uniform product. The moisture content of torrefied product was sharply decrease. The particle size after torrefaction was smaller than raw biomass. The large particle size was sharply decrease ( $>3.35$  mm) and the smaller particle was slightly increase (1.7-3.35 mm). The mass yield and energy yield were decrease when the torrefaction was increase. On the other hand, the mass yield and energy yield were increase when rotation speed was increase. It was concluded that, the optimum condition of torrefied corncob in this research was 230 °C with 3 rpm.

**Keywords**—torrefaction process; rotary kiln; mass yield; energy yield



# Ultrasound-Assisted Acetylation of Glycerol for Triacetin Production over Green Catalyst

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**Abstract**—Upgrading of crude glycerol to high value-added chemical products is an attractive process in biomass conversion and biorefinery industry. In this work, production of triacetin from direct conversion of glycerol with acetic anhydride over SO<sub>3</sub>H-glycerol-carbon catalyst assisted with ultrasound was investigated for the first time. The catalyst was also prepared from glycerol via *in-situ* carbonization and sulfonation. The triacetin selectivity (100%) was successfully achieved in mild conditions via acetylation reaction. The obtained results indicated that the contribution of catalyst acidity with ultrasonic power was responsible for determining triacetin selectivity.

**Keywords**—Triacetin; Glycerol; Carbon-based solid brønsted acid catalyst; Acetylation; Ultrasonic



# An Alternate Numerical Algorithm for Minimization of Unconstrained Non-linear Functions for Solving Combustion Equations

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*Abstract*— For a specific fuel combustion problem involving calculations of several species at the equilibrium state, it was simpler to write a general computer program and calculate the combustion concentration. Original work describes, an adaptation of Newton-Raphson method was used for solving the highly nonlinear system of equations describing the formation of equilibrium products in reacting of fuel-additive-air mixtures. This study also showed how possible of the results. It presented the efficient numerical algorithms for solving the combustion problem. Nonlinear equations based on a few alternate numerical algorithms for minimization of unconstrained non-linear functions by using the modified Adomian decomposition method, and the modified Householder's iteration method with the Taylor series to spread the equation that the new method was able to compete by Karthikeyan [17, 18]. These results illustrations were given to show the efficiency of algorithms. According to comparisons of results by the general solving method of original Newton-Raphson Method. Nitromethane-Air be used example of this case, that the result data indicated that the new Matlab routines were reliable, and typical deviations from general results were less than 1%.

*Keywords*—Non-linear equation, Newton-Raphson Method, fuel and Combustion products, Minimization, Adomian decomposition method, Householder's iteration method.



# Production of Briquette from Agricultural Residue

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*Abstract*—This study aimed to study biomass fuel from rice husk, maize cob, and rubberwood. Additionally, manufacturing, processes and proportions content in properties of moisture, density, durability, heat value, and compressive strength were investigated. The materials were prepared using a grinder and a sieve with a diameter of 5 mm. After screw extruder compressed that material at a die temperature of 300, 330 and 360 °C. The results in this study show rice husk had the highest durability at the temperature of 300°C (95%). Rice husk mixed with rubberwood had the lowest moisture content at the temperature of 360 °C (6.1%). Rice husk had the highest density at the temperature of 300 °C (520 kg/m<sup>3</sup>). Finally, Rice husk mixed with rubberwood had the highest heating value at the temperature of 360 °C (16.98 MJ/g).

*Keywords*—agricultural residue; biomass; densification; alternative fuel; green energy;





# Effect of Temperature on Change of Microstructure of Hadfield Steel

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**Abstract**—This research objective is to study effect of temperature on change of microstructure in heat treatment process of high manganese steel (Hadfield steel). Samples were heat at temperature range 1050 °C for 2 hours, then samples were immerse into water. Samples were heat for reduce residual stress by tempering process, tempering temperature at 350, 450, 550 and 650 °C for 2 hours and cool in air. Finally, Samples were examined the microstructure by OM and SEM. Hardness was measured by hardness tester and crystal structure was determined by XRD technique.

From microstructure results, it was found that after Solutionizing step at temperature range 1050 °C for 2 hours, then samples were immerse into water. Microstructure shown only austenite phase. The residual stress was measured. It was found that the residual stress increased from as-cast condition. Tempering temperature at 350, 450, 550 and 650 °C for 2 hours, microstructure results, it was found that tempering at 350 °C without manganese carbide, tempering at 450 °C occur manganese carbide at grain boundary, tempering at 550 °C and tempering at 650 °C occur manganese carbide with increasing along grain boundary.

**Keywords**—Heat treatment; Austenitic manganese steel; Hadfield



# Surface Improvement of SCM 440 by the Ball-burnishing Technique

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**Abstract**—The objective of this research was to develop a new ball-burnishing tool integrated with a CNC milling, to improve the surface roughness, hardness, and residual stress of the material used in the present study, the Low-alloy steel SCM 440. The surface burnishing parameters for the ball-burnishing tool were determined after conducting the experimental methods. Based on the experimental results, the adequate combination of the process parameters was as follows, the burnishing pressure constantly from 200 to 600 bars, when machining using a low depth of cut 0.5 and 0.6 mm/rev, the velocity of 2 m/min, fluid as lubricant hydraulic oil (HLP 68). The quality of the surface roughness was studied. The final quality was similar to grinding, even reaching  $0.349 \mu\text{m Ra}$  on average by using the adequate burnishing parameters. Corresponding to a before surface and to the same surface after being burnished with two different burnishing depth, roughness parameters improved about 75% when burnishing was applied. The burnishing surface hardness was increased to HV 586 on average.

**Keywords;** ball-burnishing; surface roughness; surface hardness; SCM440



# Using Unmanned Aerial Vehicle Photogrammetry for Surveying a Landslide

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*Abstract*— Unmanned Aerial Vehicle (UAV) technology has recently been promoted for many Civil Engineering applications such as terrain survey, quarry mining survey and landslide hazard mapping. UAV photogrammetry combines classical manned aerial photogrammetry and ground survey techniques. This paper aims to use a UAV for landslide survey because it is well known that a UAV can provide accurate data at low-cost and less time consuming than ground survey methods. The landslide site is located 28 km northeast of Lampang Province, Thailand. A photogrammetric project was carried out with images taken from a Phantom 3 ADVANCED with a 12.76 Megapixels camera. We used photogrammetry software DJI Go 4, Pix4D Capture and Agisoft PhotoScan applications to process the data. The flight was designed to cover the whole survey area. This study has successfully shown that the UAV has capability to produce a three dimensional model and imaging fissures, illustrating ground displacement on the landslide surface.

*Keywords*— *landslides; slope instability; unmanned aerial vehicle; UAV; surveying*



# A Review on Difference of Contracting for Works of Regulations on Procurement, B.E. 2535 (1992) between Government Agency and Local Government, Thailand

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*Abstract*— Operational framework and different standards resulted in problems and barriers to purchasing and contracting for works of Thai Government. This research aims to compare the differences of the Regulation on the Office of the Prime Minister's procurement B.E. 2535 (OPM Regulation 1992) and Regulation on the Ministry of Interior on the procurement of Local Administration Organization B.E. 2535 (MOI Regulation 1992). The findings revealed that the differences of the regulations on procurement, B.E. 2535 (1992) were 1) the person having in charge of these regulations 2) application 3) committee in charge of procurement (CCP) 4) plan for procurement 5) pre-qualification for purchasing and contracting for works 6) procedure on purchasing and contracting for works and 7) penalty for person excluded from procurement programs.

*Keywords*—*regulation; procurement; government agency; local government*



# Efficiency of alkaline fuel cell for produce hydrogen gas, in conjunction with electric production by using PEM membrane fuel cell

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**Abstract**— Hydrogen gas is an alternative energy that produces by the alkaline fuel cell. Hydrogen gas uses in electric production via electrochemical reaction in alkaline hydrogen fuel cell. The efficiency of hydrogen coupled with the electricity production was improved by using various types of electrodes; smooth, hole, and net stainless steel, and electrolyte chemical reagents; NaOH, Ca(OH)<sub>2</sub>, and KOH at 0.5-2M. The voltages at 1-9V were input in hydrogen production for 30 min at ambient temperature. The 0.5 M of NaOH solution showed the best electrolyte in hydrogen production. Moreover, the stainless steel 604-hole structure generated hydrogen concentration at 329 ppm and produced hydrogen volume at 75 cm<sup>3</sup>. This generated hydrogen was injected into hydrogen fuel for electricity production. The electric production system showed the high voltage at 2.828 mV, 4.64 A/m<sup>2</sup>, and 2.59 W/m<sup>2</sup> add an amp and power density. The efficiency of hydrogen production conjugated with the electricity generation was 0.225% theoretical yield.

**Keywords**—component; Hydrogen gas; Alkaline fuel cell; PEM fuel cell; electrolyte chemical; Electricity production.



# Feasibility on the Development of Power Generation using the Stainless Steel and Aluminium as Electrodes in PEM Fuel Cell Technology

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**Abstract**— The fuel cell type proton exchange membrane (PEMFC) technology represents a method for the electricity generation using the hydrogen from the reaction of water electrolysis. In this study, the two chamber fuel cell with the reassembly of membrane was operated by varying the electrodes materials; stainless steel and aluminium, and shapes; whole sheet, and whole sheet with 0.6 and 0.2 mm of hole diameter. Results indicated that the aluminium in whole sheet type is an appropriate material for anode and cathode. The hydrogen concentration in range of 200 – 300 ppm was injected into the PEMFC which operated using the 2 k $\Omega$  of suitable external resistance loading at ambient temperature. The result shows the efficiency of electricity generation at 35.29 mV of voltage output, 17.65  $\mu$ A of system currents and 50.84  $\mu$ A/cm<sup>2</sup> of power density. These results demonstrate that the hydrogen can be used for the power production by PEM fuel cell technology. The development of power generation system should be the first priority done in the future.

**Keywords**—Stainless steel; aluminium; hydrogen gas; PEM fuel cell; power generation





# Optimal Rule Curves of Small Reservoir using Wind Driven Optimization and Flower Pollination Algorithm

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*Abstract*— Reservoir operation requires optimal rule curves, for controlling amount of store water and release to downstream. This research proposes the application of the Wind Driven Optimization (WDO) and Flower Pollination Algorithm (FPA) techniques with reservoir simulation model for finding the optimal rule curves. The objective functions of search process were the minimum average water shortage and the minimum average excess spill water. This study considered information of the Huay Sabag reservoir in Yasothorn province as the case study. The historic monthly inflow data from 1996 to 2017, water demand from reservoir, hydrological data and the physical data of the reservoir were considered for the study. In addition 1,000 samples of synthetic inflow were used to evaluate the efficiency of the obtained rule curves that present in term of water shortage and excess release water. The results found that the patterns of new rule curve were different from the current rule curves. The results also present that the new rule curves from WDO can alleviate flood situations more than the current rule curves but less than rule curves from FPA both using historic inflow and synthetic inflow cases. Whereas, the situations of water shortage of the new obtained rule curve were slightly less than the current rule curves.

*Keywords*—reservoir rule curves; optimization techniques; Wind Driven Optimization; Flower Pollination Algorithm; reservoir operation



# Application of Genetic Programming and Flower Pollination Algorithm for Searching Optimal Rule Curves of small reservoir

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**Abstract**— Rule curves of small reservoir are important information for reservoir operation system. This Study presents the Genetic Programming (GP) and Flower Pollination Algorithm (FPA) techniques for searching optimal rule curves of small reservoir. The propose techniques were connected with the reservoir simulation model to search optimal rule curves of reservoir. The objective functions of search procedure were the minimal average water shortage and the minimal excess release water. Monthly rule curves and historic inflow record from 1994 to 2017 of the Huay Ling Jone reservoir, located in Yasothon province were considered for this study. The 1,000 samples of generated inflow data were used to evaluate the performance of the new obtained rule curves. The results presented situations of water shortage and excess release in terms of frequency, duration, amount of average and maximum. The results found that the patterns of these new rule curves were similar to the existing rule curves because of seasonal inflow effect and the same searching conditions. The results also present that the new obtained rule curves of GP can reduce situations of water shortage and excess release more than the existing rule curves and the FPA rule curves. Then, the obtained rule curves of the proposed models were used to evaluate with synthetic inflow of 1,000 samples. The results also found that the new rule curves from GP can alleviate the situations of water shortage and flood more than the existing rule curves and slightly than rule curve from FPA.

**Keywords**— *reservoir rule curves, reservoir operation, genetic programming, flower pollination algorithm*





# The Embodied Energy & Greenhouse Gas Emission of Residential Building in Silpakorn University, Nakhon Pathom, Thailand

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*Abstract*—The purpose of this study is to analyze the embodied energy and greenhouse gas emission from building materials in terms of MJ and kgCO<sub>2</sub>e by Life Cycle Energy. A case study in this research is the 10-storey residential building located in Silpakorn University, Nakhon Pathom, Thailand. The utility space is 17,000 m<sup>2</sup>. This study found that the embodied energy is 121,771,441.61 MJ. The embodied energy is mainly consumed by material fabrication processes. Total embodied energy in building is utilized by steel for 74.26% and concrete for 17.06% respectively and 8.68% for others materials: bricks, PVC, etc. The total greenhouse gas emission is 10,079,258.91 kgCO<sub>2</sub>e with 75.22% from steel and concrete for 19.57%.

*Keywords*—Life cycle analysis (LCA), Life cycle energy (LCE), Building, Energy, Greenhouse gas, Building material



# Application of Optimization Techniques for Searching Optimal Reservoir Rule Curves for Medium Reservoir

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**Abstract**— Many small and medium reservoirs located in Thailand. Optimal reservoir rule curves are required for operating reservoir system. This study applied the Tabu Search Algorithm (TSA) and Flower pollination algorithm (FPA) connecting with the reservoir simulation model to search the optimal reservoir rule curves. This study considered the Huay Ling Jone and Huay Sabag reservoirs located in Yasothorn Province, Thailand for the case study. Historic inflow data of both reservoirs were used in this study. The 1,000 samples of synthetic inflow of reservoirs were used to simulate the reservoir operation system for evaluating the obtained rule curves as present in term of water situation. The situations of water shortage and excess water were shown in terms of frequency magnitude and duration. The results showed that TSA and FPA connecting with the reservoir simulation model can provide the optima rule curves. The obtained rule curves from TSA and FPA can mitigate drought and flood situations more than the current rule curves.

**Keywords**—reservoir rule curves; optimization techniques; Tabu Search Algorithm; Flower pollination algorithm; Reservoir Operation



# Mechanical Properties of Pavement Concrete Containing Reclaim Asphalt Aggregate

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**Abstract**— This paper presents a study of properties of pavement concrete containing reclaim asphalt aggregate (RAC). The RAC was sieved and classified as fine aggregate (FA), medium aggregate (MA), and coarse aggregate (CA) with particle sizes ranging between 0.001-12.5 mm. The RAC were used to replace nature aggregate at 10, 20, and 30 %. The compressive strength, modulus of elasticity, flexure strength, volume of water absorption, and porosity of concrete were tested. The results showed that the pavement concretes with 28-day compressive strengths of 27-32 MPa, modulus of elasticity of 37-54 GPa, flexure strength of 4.4-5.3 MPa, and volumes of water absorption and porosity of 1.8-4.5% and 4.2-10.5 % were obtained. The results indicated that the strength of pavement concrete decreased with increasing amount of RAC. However, with the increasing amount of RAC, the water absorption and porosity decreased because asphalt coat reduced the water absorption and enhanced the corrosion resistant of concrete.

**Keywords**—*Mechanical properties; Pavement concrete; Reclaim asphalt aggregate; Modulus of elasticity*



# Consolidation Behavior of Cement and High Calcium Fly ash Stabilized Loess soil

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**Abstract**— Several areas in Northeastern Thailand used Loess as landfill. Loess soil will have a bearing capacity of over than 1000 kPa in the drought and compacted conditions. The coefficient of permeability is about  $1 \times 10^{-5}$  to  $1 \times 10^{-7}$  centimeters per second, and a shrinkage of about 1%; however in wet state or changing of moisture content increased only 5%-8%, the loess soil will have a bearing capacity of under than 50 kPa and the shrinkage rate increased by 8% -10%. Based on the above characteristics, the loess soil is not suitable for civil engineering. This research studied the consolidation behavior of loess modified with cement and fly ash to be used in the landfill and other civil engineering works. The study varies the weight of cement 1, 3 and 5% of dry soil weight and replacing cement with fly ash at the ratio of 0, 10, 20 and 30% of cement weight under standard compaction. Base on test results found that the cement and fly ash stabilized loess soil can be classified the normally consolidated soil and not the pre-consolidation 0) with void ratio (e), and compression index (cc) swelling index (cs) and coefficient of compressibility (mv) decreased with increase of the amount of cement content and curing time. However, the replacement of cement by fly ash did not change the behavior consolidation of soil samples.

**Keywords**— Loess soil, Compressibility, Permeability, Soil cement, Landfill





# Wildfire Detect and Monitoring System using Wireless Sensor Network and Mobile Application

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*Abstract*—Wildfire or forest fire problem is frequency encounter in Thailand. Effective firefighting, the firefighter must go to fire point as quickly as possible to stop the fire at the beginning. However, it is difficult to know the fire point and travel route. This paper introduces the system to alert the firefighter to locate the source of fire more quickly and more accuracy via mobile phone. The method to collect a fire data from the forest in this paper is using wireless sensor network because we can spread sensors to cover all area as needed. The data from wireless sensor network will send to the server to process the data if the forest fire is occurring the server will send a fire point and travel route to the firefighter immediately. The system works well using a test condition in KMUTNB Prachinburi campus and has been demonstrated to the officer from Prachinburi forest fire control division and get a good satisfaction.

*Keywords*—Wildfire Dectction, Wireless Sensor Network



# Adaptive Discrete Kirchhoff Quadrilateral Element for Thermal Bending Analysis of Thin Plate

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**Abstract**— An adaptive meshing technique is combined with the Discrete Kirchhoff Quadrilateral (DKQ) element to analyze plate bending due to temperature gradient through the thickness of plates. The DKQ plate bending finite element formulation with detailed finite element matrices for thermal plate bending analysis were presented herein. The adaptive meshing technique was also applied to improve the efficiency of the DKQ element. The technique is to generate small elements in the regions of high stress gradient while larger elements are generated in the other regions to reduce the problem unknowns and thus the computational time. The performance of the DKQ element and the combined method were evaluated by some thermal bending of thin plate problems of which the exact or analytical solutions are known. Results demonstrates that solutions obtained from DKQ element perform very well for analyzing thermal bending of thin plate problems, and the combined method can improve the solution accuracy and reduce the computational effort.

**Keywords**— *finite element; adaptive mesh; plate bending; DKQ element*



# Risk Assessment for Drought in Thailand Using Hidden Markov Models

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**Abstract**— The objective of this research was to propose a proper model for risk assessment for drought in Thailand. A hidden Markov model was adopted. The results indicate that the amount of rainfall depends on the hidden states, drought or non- drought state. If the state changes from drought to non-drought the amount of rain will increase. The probability of changing from drought state to non-drought state is higher than from drought state to drought state. The probability of drought occurrence in February is highest, followed by in November, March, December, January, July, April, June, October, September, August and May, respectively. When the temperature increases, the probability of drought occurrence will increase.

**Keywords**— *Hidden Markov models (HMMs), Drought in Thailand, Probability function, Bayesian estimation*



# Wurtzite-to-Rocksalt like Phase Transformations in Case of LiGaO<sub>2</sub> from First principles

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**Abstract**— A homogeneous wurtzite-to-rocksalt like phase transformation in LiGaO<sub>2</sub> is studied using first principle calculations. We found that under specific conditions, LGO can show structure of a rocksalt-like structure that have not been previously reported the body-centered tetragonal (I41/amd) occurs under hydrostatic compression. We characterize the stability of the phase transformation processes by calculating enthalpy surfaces and barriers and find that the smallest barrier correspond to the (I41/amd) structure (86.25 meV/atom) at 3.7 GPa compressive strain.

**Keywords**— Phase Transformations, LiGaO<sub>2</sub>, B4-B1 pathway



# Performance Testing of Transformers used in Distribution Systems

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*Abstract*— This research is to test the efficiency of three -phase oil immersed distribution transformer system. Routine and type tests are carried out on the topic of temperature rise test of various points and the obtained results were calculated to find the properties of transformer as defined by standards. To conduct the tested with three-phase distribution transformer 50 Hz 22000-400/230 volt power rating 50 kVA , 100 kVA , and 160 kVA according to PEA standards and TIS -384 Standard. According to the testing results of the transformer, it could be known the transformer efficiency. And can be developed into software. To use it in practice for actual operation.

*Keywords*—distribution transformer; routine test; temperature rise test



# Implementation of Load Cycle Simulation for Studies of Loss Energy and Lifetime of Oil-Immersed Transformers

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*Abstract*—This paper studies about the decrease of loss energy and the extension for the lifetime of Oil-Immersed transformers. The simulation of a load cycle when parallel connected is compared with individual connected of two transformers. Loss energy, Top oil temperature, Hottest-spot, Loss of Life and Lifeare calculated in the studies. The results of research applicable to the field work and useful for determining the limit load of transformer, The protection from overheat and an economic aspect of transformer.

*Keywords*— *Loss Energy; Hottest-spot Temperature*



# Low Cost Submarine for Under Water

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**Abstract**—In an agriculture, water is an important factor that affects both quality and quantity of agriculture products. Therefore, a quality of water needs to be evaluated. If the salinity is higher than the requirement, the quality of products is poor and/or the quantity may be lower than expected. In this paper, we propose a low-cost submarine to be used for collecting water samples from the farmer's garden. The collected water samples are used to evaluate the quality of the water which is contaminated by salts. To develop the low-cost submarine, firstly, we study the details of practical submarine architecture. To control the low-cost submarine, we implement several sensors, depth sensor, temperature sensor and pressure sensor, and microcontrollers. The results from sensors and microcontrollers are displayed on LCD monitor. Movements of the submarine are controlled by 3 motors and the water samples are collected by collecting kit. As a result, 5 meters from the surface, the low-cost submarine can collect water samples from several water depths and transmits the data from sensors efficiently. Therefore, the user can use the water efficiently.

**Keywords**— submarine; low cost; sensor





# Smart Home Control Unit via Mobile Ringtone

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**Abstract**—This paper presents a smart home control unit via mobile ringtone. The control unit comprises a switching power supply, a GSM module and a signal over DC module. The mobile ringtone with different rings (Interval time) can be used to switch on/off each lamp inside a building without the need of internet access. The rings of mobile ringtone are received and mapped with the output command by the GSM module. The output command is used to switch on/off up to 10 lamps inside the building. Finally a prototype of smart home is implemented and the experimental results show that the accuracy of the system is between 86 and 99%.

**Keywords**—*GSM, Smart Home, Mobile Phone, Signal over DC*



# Comparison of Performance of Regenerative Power for Electric Vehicles between Single and Dual DC Motor Drive Systems

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*Abstract*—This paper presents comparison of performance of regenerative power for electric vehicles between a single and a dual dc motor drive systems. Both drive systems under study had the same rated power of 10kW and speed of 1,750 rpm when the test conditions under the study were at full load, medium-low load, reduced speed and breaking conditions. The test results obtained from MATLAB Simulink program showed that both drive systems could not generate power at full load but the dual motor drive system had less inrush current by 11.98% in average than the single motor drive system. At medium-low load, the dual motor drive system could regenerate power of 1.5kW, while the single motor driver could not. At the reduced speed and breaking conditions, both drive systems could regenerate similar amount of power by 1.3kW, which was 13.0% of the rated power of the motors.

*Keywords*—Regenerative power; single motor drive; dual motor drive, efficiency, electric vehicles



# Analysis of High Performance Savonious Wind Turbines for Low Speed Wind Applications

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*Abstract*— Generating high amount of electric power from wind turbines requires high speed wind. Unfortunately, most lowlands where most people live have only low speed wind (0.5- 2.65 m/s). This paper presents analysis of high performance Savonious wind turbines that could operate efficiently at low speed wind. The analysed results showed that implementation of external wind tunnel(s) provided significantly high performance by more than double (103.7% and 148-171%max increased for a single tunnel and double tunnels, respectively). Implementation of special design of configurations or blades provided improved performance upto 40% compared to the conventional turbines; using bach-type blades, two-blade configuration, valve-aided blades, and twisted blades could provide higher power generation approximately by 39.5%, 18.7-20.0%, 5.0-19.5% and 6.9%max, respectively.

*Keywords*—Savonious wind turbines; low speed wind; high performance



# Design and Construction of a Simple Dual DC Motor Drive System for Three Wheel Electric Vehicles

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*Abstract*—This paper proposes design and construction of a simple dual DC motor drive system for a three wheel electric vehicle. The proposed system consisted of 2 separately excited DC motors, batteries, a simple speed controller with variable resistive control, magnetic contactors and protection circuits. The Global Positioning System (GPS) navigation system which could be able to control via a mobile phone was also presented. The experimental results from the system prototype showed that the designed system could drive the vehicle with passengers up to 750 kg, maximum speed of 50 km/hr, and up to 15 degree-slope climbing ability.

*Keywords*—three wheel vehicles; electric vehicles; design; dual drive system



# Application of Heat Pipes to cool down high power Light-Emitting Diode

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*Abstract*— This paper has for goal to compare and test the viability of heat pipes as cool down solution for Light-Emitting Diode. We will observe and measure the temperature of the LED in different conditions and try to determine the possible heat transfer to cool down LED with the use of heat pipes.

*Keywords*—*heat pipes; LED; Cool Down system*



# Simulation of Straight Line Trajectory Planning for a Manipulator based on Modified RMRC Method

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*Abstract*— This paper proposes a dynamic simulation of a straight line trajectory planning for a 6 DoFs manipulator. In this study, resolved motion rate control (RMRC) method is used to control the manipulator from point to point. However, the trajectory of an end-effector is not moved in a straight manner. To overcome this problem, we employ the unit vector technique to discover the series of point which represent the straight line and applied them with RMRC method. In the simulation, it was found that our proposed method can provide better results of trajectory planning compared to the original RMRC method. This study has shown that the proposed method can be used to control a manipulator with a straight line trajectory, which is beneficial to utilize in an industrial application that requires a straight line planning, such as grapping, welding, and cutting.

**Keywords**—Trajectory; Manipulator; Control; RMRC; Straight Line Planning



# A Study of the Injury Mitigation of Pedestrians Based on Head Injury Criterion Using the Lifted-up Hood Technique

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**Abstract**—Nowadays, car is one of important factors for the human life whereas critical traffic dramatically affects the risk of accident between cars and pedestrians. Therefore, the road accident is the enormous loss of human resources. Regarding this problem, this research aims to find the solution to reduce the rate of death or injury of pedestrians based on head injuries situation. The lift-up hood idea was suggested to study the trend that it is selection method to reduce the pedestrian injuries. There are 8 steps of the vertical space under the hood in this study to verify the reduction of Head Injury Criterion using headform. The Pedestrian Protection Test Procedures in EURO NCAP was referred in this study. From experimental works, the increasing gap between the bottom edge of hood and the engine valve cover tends to decrease the values of HIC. The HIC15 and HIC36 in case of the 4th test decrease 59 and 29 of percentage comparing to the 1st test. The 18 cm of the vertical space is suggested for the injury reduction of pedestrians based on head injuries situation. However, this value may be variable depending on car hood materials and also the design of each car.

**Keywords**—Injury; Head Injury Criterion; Lifted-up hood







# Simulation on Porosity of Twisted Fiber Bundle Wick

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**Abstract**— Porous wick is an important component which affect to thermal performance of heat pipe. In manufacturing of fiber bundle wick that commonly used in the miniature heat pipe for cooling compact electronic devices such as smartphone, is twisted to maintain its shape. The twisting fiber affect the pore size and the flow of working fluid in fiber bundle wick. This study presents the simulation of fiber arrangement in twisted fiber bundle wick, in order to investigate twisting effect on porosity of fiber bundle wick. The open-packing method was used to simulate cross-section of twisted fiber bundle wick to determine the porosity by cross-section area. In analysis procedure, the porosity of non-twisted fiber bundle wick was compared with porosity of twisted fiber bundle wick with pitches of 0.5, 1, 5, 10 and 20 mm. According to studies, Non-twisted fiber bundle wick had more porosity than twisted fiber bundle wick. When the pitch decreased which meanted tight twist, the porosity also increased. Because of the same bundle size, the twisted fiber bundle wick with more pitch can contain fewer fibers. Moreover, the porosity of mixing of fiber's diameter between 30 and 50  $\mu\text{m}$  had slightly higher than use only fiber's diameter 30  $\mu\text{m}$ . Because of lower number of fiber, it can save production costs.

**Keywords**—fiber bundle wick; twisted fiber; porosity; simulation; open-packing



# Effect of Flattening of Heat Pipe with Double Heat Sources on Thermal Resistance of Grooved - Fibre Heat Pipes

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**Abstract**—Effect of flattening of heat pipe with double heat sources on thermal resistance of grooved - fibre heat pipes were experimentally studied. The copper tubes with an original diameter of 6.0 mm were used as sealed container and flattened into three final thicknesses of 2.5, 3.0 and 4.0 mm. The heat pipe had distilled water as a working fluid. The heat pipe was tested in horizontal orientation. The two heaters were used to supply heat pipe at two evaporator sections. Additionally, both heat evaporator sections were supplied with combination of two heat inputs at 40W from 0 to 40 W by increment of 10 W each. The operating temperature was controlled at  $60 \pm 1$  °C. The results showed that the trends of the flattening effect depended on how evaporator section#1 and evaporator section#2 were supplied. When final thickness increased, thermal resistance of the heat pipe decreased with supplying heater#1 and heater#2 at heat source variations of 40W:0W and 30W:10W. The both cases had the least thermal resistances of 0.34 and 0.42 K/W at final thickness of 6.0 mm while flattening of heat pipe had little effects on thermal resistances at heat source variations of 20W:20W and 10W:30W with difference thermal resistance of 0.07 and 0.03 K/W respectively. For the heat source variation of 0W:40W, when heat pipe was flattened from final thickness of 6.0 mm into the critical final thickness of 4.0 mm, thermal resistances decreased from 0.34 to 0.27 K/W after that the thermal resistance increased to thermal resistance of 0.39 K/W at final thickness of 2.5 mm. Therefore, decreasing final thickness showed smaller thermal resistances until final thickness reached critical final thickness of 3 mm for heat source variations of 20W:20W and 30W:10W and of 4.0 mm for heat source variation of 30W:10W.

**Keywords**—Grooved - Fibre Composite Wick; Flattenned Heat Pipe; Double Heat Sources; Capillary Heat pipe



# Development of Remote Monitoring System of Locomotive Engine via Cloud Network for the State Railway of Thailand

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*Abstract*—Rail transport is a quantitativetype of transport. Therefore, a rail accident affects on great damage both human life and properties. One of the causes of the accident is the deterioration of the life span. The performance tests of the locomotive are always essential and unavoidable. This research aims to develop a system for testing and monitoring of diesel locomotive performance. Moreover, the database system for diagnosis of diesel locomotive was established. To achieve this, locomotive brand HITACHI number 4513 within Cummins KTA 50 engine was selected to install the Performance Curve Testing and Performance Tracking Systems. As a results, the maintenance officer of the State Railway of Thailand can monitor the performance of diesel engines, plan the maintenance and also unwanted situation during proccession of the locomotive. These systems can reduce the risk of accidents during the proccession in practical way.

*Keywords*—Locomotive; remote monitoring; cloud network



# Mathematical Model of the Optimal Closed-loop Pulsating Heat Pipe Used in an Evacuated Glass Tube Solar Water Heater

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**Abstract**—This research aims to design the optimal closed-loop pulsating heat pipe (CLPHP) for applying into an evacuated glass tube solar water heater to obtain required heat transfer rate and save initial investment. Correlation of thermal performance of CLPHP is another useful tool in design of CLPHP because it can predict heat transfer rate of CLPHP. In this study, correlation of Khandekar *et al.* [7] was used to predict the heat transfer rate of CLPHP and the optimal CLPHP was evaluated by Net Saving Method which was referred in the thermo-economics analysis [8]. The mathematical model was simulated to determine effect of various parameters on net saving. CLPHP was designed by variation of these following parameters: inner diameters of 1.0, 1.5 and 2.0 mm, evaporator length varied from 1.0 to 1.7 m, number of turns increased from 16 to 50 turns and distilled water, R123 and ethanol as working fluids. The diabatic length of 0.05 m, condenser length of 0.3 m and 50% filling ratio of total internal tube volume were controlled. According to latitude of Chiang Mai, Thailand, the solar water heater system was tilted at 18° from horizontal with 644 W/m<sup>2</sup> of average solar radiation. The results of the mathematical model found that the optimal CLPHP consisted of evaporator length of 1 m, 16 turns, inner diameter of 0.0015 m, distilled water as working fluid and 10 evacuated glass tubes with the maximum of net saving at 48,687 baht for ten years. Thus, the evacuated glass tube solar collector with CLPHP at the optimal parameters will be constructed and tested for the prototype of the system.

**Keywords**—Solar water heater; evacuated glass tube; closed-loop pulsating heat pipe; correlation; thermo-economics analysis



# Effects of Using a Solid Desiccant Dehumidifier with an Air Conditioner on Energy Consumption

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**Abstract**—Effects of using a solid desiccant dehumidifier with an air conditioner on energy consumption and thermal comfort are presented in this paper. The energy consumption of three systems which were 1) air conditioner only 2) overcool and reheat system and 3) air conditioner with a solid desiccant dehumidifier was compared. Human thermal comfort of each system was also considered. A batch type solid desiccant dehumidifier with the dimension of 0.26 m x 0.26 m x 0.50 m comprising 10 shelves (each shelf contains 1 kg of silica gel) was placed inside an air conditioned room. All experiments were carried out in two rooms of the same dimension of 1.94 m x 2.60 m x 3.53 m. There were 21 total experiments. The first system was tested three times. The second system was tested 9 times. The third system was tested 9 times where air velocity was varied at 0.2, 0.3, and 0.4 m/s and the amount of silica gel was varied at 5, 7, and 10 kg. A set of artificial load of two persons working for 4 hours a day was placed inside each room. The setpoint of each room was 25°C, 50%RH except the first system that only temperature was controlled. The experiments were done in Nakhon Pathom province, Thailand during October and November of 2017. The results showed that the average energy consumption of the case of air conditioner only system was 0.97 kWh/4hr. The average PMV and PPD were 0.11 and 5.91%. The average energy consumption of the overcool and reheat system was 5.20 kWh/4hr which was 5.36 times that of the first system. The average PMV and PPD were 0.16 and 6.55%. The average energy consumption of the case of using an air conditioner with a solid desiccant dehumidifier was 2.73 kWh/4hr which was 1.78 times that of the first case. The average PMV and PPD were -0.07 and 5.7%. It can be concluded that all three systems could achieve the thermal comfort condition. The first system consumed least energy. However, the use of an air conditioner with a solid desiccant dehumidifier gave the best thermal comfort. When comparing between the second and third systems that both temperature and relative humidity were controlled, the use of an air conditioner with a solid desiccant dehumidifier could save energy by 66.74%.

**Keywords**—solid desiccant dehumidifier; comparison of energy consumption; thermal comfort



# Thermal Comfort of People in Textile Factories

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**Abstract**— This research aims to investigate the thermal comfort of employees who worked in seven textile and garment factories located in Bangkok and Nakhon Pathom, Samut Sakhon, and Samut Prakan provinces of Thailand. In order to get a 95% confidence interval with a  $\pm 5\%$  uncertainty, 843 subjects were randomly selected from the total population of 872. This study was conducted using a questionnaire and measuring the related parameters including air temperature ( $T_a$ ), relative humidity (%RH), air speed ( $v$ ), mean radiant temperature ( $T_r$ ), clothing insulation ( $I_{clo}$ ), metabolic rate ( $M$ ), and the immediate thermal sensation of the samples. In this study, the thermal comfort was assessed via two evaluation methods: the ASHRAE model using PMV (predicted mean vote) value which was computed from the related parameters and the Adaptive Comfort model using CV (comfort vote) value which reflected the employees' actual sensation. The assessment also took other factors affecting thermal comfort into consideration including gender, age, body mass index, and the work environment (air-conditioned or non-air-conditioned). Neutral (or comfort) temperature ( $T_n$ ) in terms of dry-bulb temperature ( $T_a$ ) and operative temperature ( $T_o$ ) were calculated for the thermal comfort assessment. It was discovered that  $T_n$  from the ASHRAE evaluation in terms of  $T_a$  and  $T_o$  were  $25.18^\circ\text{C}$  and  $25.33^\circ\text{C}$  whereas those figures in the Adaptive Comfort model were  $26.25^\circ\text{C}$  and  $26.44^\circ\text{C}$ . This illustrated that  $T_a$  and  $T_o$  using the ASHRAE model were about  $1.07^\circ\text{C}$  and  $1.11^\circ\text{C}$  lower than those of the Adaptive Comfort model, and these results indicated that  $T_a$  and  $T_o$  can be used interchangeably as an indicator to assess the thermal comfort. The study also found that the factors that affected the thermal comfort were gender, age, body mass index, and air-conditioned or non-air-conditioned workplaces.

**Keywords**— thermal comfort; textile factory; adaptive comfort; predicted mean vote (PMV)



# Effect of Drying Temperature on Colour and Anthocyanin Contents in Purple Corn Kernel

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**Abstract:** The objective of this research were to study the effect of drying temperature on colour and anthocyanin contents in purple corn kernel. By using tunnel dryer experimental, corn kernels were dried. The drying temperature was at 40, 60 and 80°C. The initial moisture content was 56.45%, 49.38% and 49.60% (Wet Basis) respectively, velocity of 1.5 m/s. Drying was continued until the final moisture content of approximately 13% (Wet Basis). Experimental results of drying temperatures 40, 60 and 80 °C showed that the average drying time was 480, 360 and 300 minutes, respectively. It also showed that, increasing drying temperature reduced the drying duration. The results of statistical colour value analysis showed that, previous drying of corn kernels with colour values L \*, a \* and b \* more than dried corn kernels. The increase in temperature causes the color values L \*, a \* and b \* to decrease. The results of total anthocyanin content analysis showed that, at temperature of 40, 60 and 80°C previous drying of corn kernels had the total anthocyanin content of 3662.46, 4335.11 and 4834.52 mg/100g, respectively. The dried corn kernels had the total anthocyanin content of 3680.31, 4431 and 3190.05 mg/100g, respectively. The results showed that the dried corn kernels at temperature of 40 and 60°C resulted in slight increases in total anthocyanin contents. At temperature of 80 °C the total anthocyanin content decreased. It was concluded that the increase in temperature had a significant effect on both color values and total anthocyanin content.

**Keywords:** Drying; Purple corn; Anthocyanin.





# Performance Limit of Closed-Loop Pulsating Heat Pipe Filled with Water-Ethanol Blended Working Fluid

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**Abstract**—This research aims to experimentally investigate the thermal characteristics of a closed-loop pulsating heat pipe (CLPHP) charged with water-ethanol blended working fluids at critical state. Moreover, this research can be compared with pure working fluid. The volume mixing ratio (MR) of blended working fluid is 1:1 with volume filling ratio of 50%. This inclination of this study is 5 ° from horizontal axis. The CLPHP is made of a copper capillary tube with the internal diameter of 2 mm and turn of 16. The evaporator section length is 50 mm. The adiabatic and condenser lengths are equaled to the evaporator section. A low-voltage and high-current power transformer is used as the heat source which supplies from the top to bottom of copper bus bar. Furthermore, the condenser section is placed in the cooling jacket. A solution of water and ethylene glycol with 1:1 by volume is set as coolant. This coolant is circulated to transfer heat from condenser section to heat sink or cooling bath. The adiabatic temperature is controlled at 50±5°C. It is concluded that, when the working fluid changed from ethanol to the blended working fluid of water and ethanol, the maximum heat flux increased from 10.2 to 20 kW/m<sup>2</sup> because of the ability of dry-out prevention on the evaporator surface. Moreover, the blended working fluid was high oscillating amplitude and frequency due to the thermo-physical properties of water.

**Keywords**— Performance Limit; Pulsating Heat Pipe; Blended Working Fluid



# A Study of Geo-polymer Concrete by Using Waste Powder Coating

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**Abstract**— This research was conducted to study a possibility of producing geo-polymer concrete by using waste powder coating. This study tested and investigated a mixing ratio in order to compare among various factors, such as physical characteristics, mechanical properties, economic value, and actual availability. In particular, the research tested different ratios between waste powder coating and metakaolin, as well as concentration of dissolved substances influencing strength of the concrete geo-polymer. Three sets of metakaolin and waste powder coating were tested with the ratio of 90:10, 80:20, 70:30 and 60:40, respectively. Results showed that maximum strength occurred at the metakaolin and waste powder coating ratio of 60:40 and mixture with NaOH :Na<sub>2</sub>SiO<sub>3</sub> of 1:2.5. When NaOH of 10 molar was concentrated, the maximum strength reached 87.28 kg/cm<sup>2</sup>. Results of this study confirmed that waste powder coating can be used and mixed to produce cement replacement materials like geo-polymer concrete.

**Keywords**—geo-polymer concrete; compressive strength; waste powder coating; kaolin



# Simulation of Molasses Cooling Using Carbon Steel Thermosyphon Heat Pipe Heat Exchanger

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**Abstract**— The objectives of this research were to study the heat transfer characteristic and fabricate, carbon steel thermosyphon heat pipe heat exchanger (HPHE) to reduce the temperature of molasses in a storage tank with natural convection under steady-state condition. Our computational program was applied to simulate the optimum HPHE for transfer heat amount 224.24 kW including consideration of the net savings and limitations of installation. The simulation results show that the maximum net saving of approximately 43.375 million-baht was obtained in the case of the HPHE with outside diameter of 0.0488 m, area of heat transfer approximately 18,397m<sup>2</sup> and using R-123 as working fluid. The molasses storage tank was constructed to compare the simulation with the experimental results, using a scale of 1:40. The simulation results show that the maximum net saving of approximately 875 baht was obtained in the case of the HPHE with outside diameter of 0.0488 m, the area of transfer heat of 4.596 m<sup>2</sup> and R-134a was used as working fluid. It was found that at the molasses temperatures of 40, 45, 50, 55 and 60°C, the heat transfer rate was equal to 32.6, 56.2, 92.1, 120.1 and 144.9 watt, respectively. The standard deviation between the experimental and simulation results was equal to 15.69 %.

**Keywords**— simulation, molasses, carbon steel thermosyphon, heat pipe, heat exchanger



# Review on Heat Transfer and Pressure Drop in Circular Tube with Twisted Tape

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**Abstract**—The objective of this article is to review the previous research on the flow and heat transfer in circular tube with twisted tape. The parameters used in the experiment include the designing and constructing wind tunnel, testing and measurement, flow analysis and heat transfer, and the types of twisted tape. The conclusion of previous research could lead to further studying on the appropriate designing and constructing wind tunnel, the most efficient type of twisted tape for heat transfer, and then the improvement of heat exchanger.

**Keywords**—twisted tape; heat transfer; pressure drop; heat exchanger



# Experimental Determination of Discharge Coefficient of Through Rectangle Trapezoid Shape and Triangle Weir

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**Abstract**—This research objective to study the effect of weir model on the flow characteristics of water and discharge coefficient of flowing through rectangular trapezoidal and triangular weir. The study was conducted three format in to open-water tunnels. During the experiment, this will measured the discharge of water  $Q$ , the height of the water overflow weir  $h$ , the point of water fall after weir  $x$ , compression angle of water  $\theta$ , the Calculate discharge of water  $Q$  from experiment and theoretical to induct calculate the discharge coefficient. The study indicated that through rectangular trapezoidal and triangles. At the through rectangular weir  $bL = 0.17$   $0.19$  and  $0.21$  m trapezoidal weir  $A = 5$   $10$   $15$  and  $20$  degree and the triangular weir  $WH = 0.05$   $0.075$  and  $0.105$  m. The weir ratio with water level above weir  $h/p$  increased. Effect on discharge coefficient  $C_d$  decreases. this is rectangular and triangular weir, and then it will increased, this is trapezoidal weir. The weir ratio with water level above weir  $h/p$  increased. Effect on discharge of water  $Q$  increased, this is rectangular and trapezoidal weir. Then it will decreases, this is triangular weir. Effect to discharge coefficient of each weir pattern that open water of flow at 100% as  $0.7714$   $0.7635$  and  $0.5052$ , respectively. at the had a high slit width  $WH = 0.105$  m. the discharge coefficient the flowing of triangular weir with an average  $0.5052$  and at the width of the weir  $bL = 0.21$  m, the discharge coefficients the flowing of through rectangular weir with an average  $0.7714$ . Experimental determination of discharge coefficient of through rectangular weir is the best. But it must be developing formulae for the better of thick-crested weir to discharge coefficient.

**Keywords**—discharge coefficient Rectangular dam Trapezoid Triangle Cross-sectional area thick-crested



# Effect of Blade Radius to Characteristics of Undershot Water Wheel

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**Abstract**— Undershot water wheel is a hydro turbine that has been the current interest. Because it has the advantage of being cheaper and simpler to build. The objective this research was to study effect of blade radius to characteristics of undershot water. The water wheel was test in the open flow water tunnel at water-submerge level of 100% with blade high and 5 water flow rate of 0.0048, 0.0044, 0.0039, 0.0034, and 0.0028 sq-m/s. The water wheel with the blade radius of 50%, 75%, 100%, 125% and 150% with blade length. Each blade had the area length of 30 cm, height of 6 cm, thickness of 3 mm and blade numbers of 12 blades. From the results of the study at each blade radius and each water flow rate, it was found that the decreased rotation speed and torque occurred when the higher blade radius, but in the case of torque decreases trend at blade radius of 50% with blade length. The maximum rotation speed about 11.98 rpm at blade radius of 50% with blade length and the maximum torque about 0.0108 N-m at blade radius of 75% with blade length. The maximum power coefficient and torque coefficient at blade radius of 50% with blade length about 47.9% and 41.97% respectively.

**Keywords**—blade radius; characteristics; undershot water wheel



# Computational Simulation on Hydrodynamics Behaviour of Air-Sand Bed in Twin Cyclonic Fluidized-bed Combustor

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**Abstract**—This research aimed to study on the hydrodynamics behavior of air-sand bed in a Twin Cyclonic Fluidized-bed Combustor (TFBC). The experiments were conducted by using silica sand bed particle size range of 300–500  $\mu\text{m}$ , while ranging excess air from 20 to 80%, and the proportion of secondary air to primary air from 0 to 0.5 at the height of 0.45 m above the air distributor. The experimental results were used for computer simulation to predict the radial solid holdup profiles in TFBC. The results from computational simulation are agreed well with the experimental results. From the analysis of both experimental and computational simulation results, excess air has higher impact on the bed expansion of the fluidized bed compared to secondary air to primary air ratio.

**Keywords**—component; Swirling Fluidized Bed; Secondary Air; Computational Fluid Dynamics (CFD)





# Energy Consumption Evaluated of Compact Solar Drying Chamber

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**Abstract**— This research study about solar drying chamber design. In this design, it contains flat plate solar collector which used to heat air temperature, and use DC fan with damper to control air temperature by using microcontroller. Microcontroller consist with software to control fan speed and damper angle to control ratio of mixing air lead to target temperature. In the experiment with target temperature at 42 °Celsius. The first experiment with fix mixing ratio and vary air flow rate. We founded that the system required average power 1.39 W at control temperature 50 °Celsius, average power 1.95 W at 45 °Celsius and average power 8.46 W at 42 °Celsius. The second experiment with varying missing ratio and fix air flow rate. We founded that in every control temperature, required average power 1.89 W. And the last experiment with varying both of mixing ratio and air flow rate. We founded that the system required average power 1.81 W at 50 °Celsius, required average power 2.01 W at 45 °Celsius and average power 3.20 W at 42 °Celsius.

**Keywords**— *Solar Drying Chamber; Temperature Control; Microcontroller*



# Study of Cooling of Compressors in Underground Wells

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**Abstract**— The aim of this study is to investigate the cooling of oil compressor of the wellhead drilling rig. The Simulation model was established by using Computational Fluid Dynamics (CFD) and compared with the experimental results by collecting actual data from actual testing while drilling underground wells. Parameters, oil and air temperatures, oil and air flow rates were collected from actual testing and then the parameters were inputted into the simulation model. Flow behavior, heat transfer rate and effectiveness of cooling unit were determined by the simulation model and compared with the experimental results. The experiment was divided to three depth range: 40, 80 and 120 m, respectively. Each depth range was obtained air mass flow rate of 1.41, 1.59 and 1.77 kg/s, respectively. The experimental result showed that heat transfer rate with the depth range of 40, 80 and 120 m were 49.1, 60.4 and 65.2 kW, respectively. While the effectiveness of the cooling unit with the depth range of 40, 80 and 120 m were 0.53, 0.55 and 0.57, respectively. Moreover, it was found that maximum of heat transfer rate and effective ness occurred with the depth range of 120 m.

**Keywords**— *underground Wells, depth range ,oil cooler, Navier-Stokes Equations*



# Numerical Study of High-Moisture Parboiled Paddy Drying in an Impinging Stream Dryer

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*Abstract*—In this study, a numerical method for high-moisture parboiled paddy drying in an impinging stream dryer was proposed. Computational fluid dynamics (CFD) was used to predict the effects of operating parameters of the dryer, i.e., parboiled paddy mass flow rate, inlet air temperature and inlet air velocity on the overall performance, in term of the volumetric water evaporation rate. The results showed that the model gave predictions that were in good agreement with the experimental mean parboiled paddy moisture content data. In addition, an increase in the particle feed flow rate, inlet air temperature and inlet air velocity led to an increase in the volumetric water evaporation rate.

*Keywords*—CFD; drying; impinging stream dryer; moisture content; paddy



# Braking Performance Comparison between Hole Profiles on Brake Rotors under Various Operating Temperatures

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**Abstract**—The main objective of this research is to find appropriate criteria of drilling pattern for both of quantity and direction of hole under the various operating temperatures of brake. By using the brake under specified below in accordance with JASO C406 standard. The drilling patterns was selected as the normal brake disc, two-hole brake drilling, three-hole brake drilling in both of straight and radial holes. This paper presents the starting speed before braking of 50 km/hr and 80 km/hr under the pressure 4 MPa by comparing the working temperature range 50 °C to 250 °C. The results revealed that the normal brake disc was reasonable for low temperature working in both of temperature range. In case of speed before braking of 50 km/hr, the straight hole that was the reasonable in high temperature whether the three-hole brake drilling in radial is more effective. For speed before braking of 80 km/hr, drilling patterns were reasonable for low temperature working.

**Keywords**—braking performance; hole profiles and operating temperatures



# A Study Performance of Split Type Air-Condition System using 5 Plus Technology

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**Abstract**— This project was to aims study split type air-condition system by using 5 Plus technology. The original systems air-condition system modular size of 12,000 BTU/h and inside refrigerant was R-407c. This project used 5 Plus technology used pressure control mechanic devices for balance system to refrigeration pressure system in a time start and stop to compressor and compare the Energy Efficiency Ratio (EER) and Electrical power per Ton of Refrigeration (kW/TR). In study we have 2 cases were Case (1) Split Type air-condition system and Case (2) Split type air-condition system with 5 Plus technology. The testing with the result that the test temperature of the room in split-type air-condition system at steady state were 23°C, 25°C and 27°C with the result of EER and kW/TR to the best condition at 27°C in two cases with conclusions was follow. In decrease of used energy of EER and kW/TR with the best condition at Part Load of steady state of split-type air-condition system. So that we see case (2) EER = 23.34 more than case (1) approximately 25.01% and in case (2) kW/TR = 0.51 less than case (1) approximately 20.31%

**Keywords**— 5 Plus technology (5 Plus), Energy Efficiency Ratio (EER), kW/TR



# A Study on the Mechanical Properties of Polypropylene at Different Mixing Ratios by Molding Test Pieces According to ASTM D638-10 and D256-10

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**Abstract**— The mechanical properties of polypropylene changed from different composite ratios by plastic Injection forming test specimens in accordance with ASTM D638-10 and D256-10. Measurement of the properties of materials with force acting in different methods such as Tensile strength testing Impact Strength testing Because it is applied to any product. Those products will have to be done more or less. Designers know the mechanical properties. It helps to design the product properly and appropriately. All types of materials will decrease mechanical property. It is not popular to forming again. It will be mixed with new materials to reduce production costs or to improve mechanical properties to proper the application. From the 4 test pieces of new PP and used PP 100:0, 80:20, 70:30 and 60:40 meet the results of Tensile Strength 37.5, 40.3, 40.9, 41.5 MPa and Impact Strength 30.4, 29.5, 29.5 and 27.6 J / m respectively. The rate of change in the material changes. The lowest value ingredients are 70:30.

**Keywords**— *plastic injection; mechanical properties*



# GEE and LMM with Spatial Effects for Cassava and Rubber Yields in Thailand

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**Abstract**—The objectives of this research were to propose an efficient and proper model for cassava and rubber yields in Thailand. A generalized estimating equation (GEE) and a linear mixed model (LMM) with spatial effects assumed to be the conditional autoregressive model (CAR) were applied. The dependent variables were the cassava and rubber yields collected from each month in every province of Thailand and the factors were rainfall, averaged temperatures, and regions. The results from GEE and LMM revealed that the factors influencing on the cassava and rubber yields were rainfall, averaged temperature, and region. Both GEE and LMM fitted the correlated data very well. The GEE is used to explain the factor influence for all provinces while the LMM is used to explain the factor influence for each province.

**Keywords**—Linear Mixed Model (LMM); Cassava and rubber yields; Conditional autoregressive model (CAR) spatial effects; spatial analysis





# Comparative Eco-efficiency of Ferrous and Non-Ferrous Parts Manufacturer : a Case Study of Part Manufacturing Industry in Thailand

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**Abstract**— Various organizations have responded to the policy by encouraging their own organization to become more environmentally friendly. The calculation of corporate greenhouse gas (GHG) emissions, so called carbon footprint for organization, and eco-efficiency are common tools that businesses in Thailand pay very much attention. This paper conducts a study to calculate eco-efficiency base on amount of greenhouse gas emissions analysis of ferrous and non-ferrous parts using data from part manufacturing industry in Thailand. The study have started by calculating carbon footprint for organization in order to determine direct and indirect greenhouse gas emissions. The result indicate that greenhouse gas emissions from ferrous parts manufacturer is equal to 212,011.72 TonCO<sub>2</sub>e. Considering each source of the greenhouse gas emissions, the most significant contribution come from electricity consumption in the organization, and stationary combustion GHG emissions by a percentage equal to 71.13 and 21.63 respectively. While Non-ferrous parts manufacturer have greenhouse gas emissions of 79,703.72 TonCO<sub>2</sub>e. The major emissions are process emission and electricity consumption in the organization with a ratio of 89.72 and 7.20 percentage respectively. The study provides environmental impact of greenhouse gas emissions assessed with the volume of products in the year of collection. The results also show that the non-ferrous industry case had an eco-efficiency of 2.51 units / TonCO<sub>2</sub>e compared to the ferrous industry case of 1.08 units / TonCO<sub>2</sub>e. The benefits of Eco-efficiency in the commercial business, marketing can bring the results of the evaluation to improve their own products for better performance. Can reduce the cost of production. In terms of energy use and resource use. Can improve productivity.

**Keywords**— Eco-efficiency, Carbon footprint for organization, Emission, Ferrous, Non-Ferrous



# An Ergonomic Risk Improvement in a Hard Disk Drive Production Process

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**Abstract**— This research aims to reduce an ergonomic risk in a Hard Disk Drive production process by developing a new innovative pallet to help operators work easier and more comfortable and to increase an efficiency of the process. A NIOSH lifting index is used to assess risk levels. The present situation has a NIOSH lifting index more than 3, that means this work situation is not safe with a high ergonomic risk. At this score, the NIOSH lifting theory recommends that this working method must be improved immediately. The new automatic pallet can help operators to work at the best position by using spring power to adjust a height of working position. Working without bending down is easier and more comfortable, thus the NIOSH lifting index is reduced to 2.87 in every height levels, which is in a range of acceptable score for safe work. The unpacking time is reduced from 425 seconds to 393 seconds per pallet and most operators are satisfied to use the new pallet.

**Keywords**— *ergonomic risk; NIOSH lifting index; fatigue*



# Designing Fixture to Reduce Loss During Stopper Ring Assembly: A Case Study of Automotive Parts Factory

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*Abstract*— This research studies the designing of fixture for assembling stopper ring with stabilizer bar of a car, in accordance with given standard from the customer, in order to reduce loss and customer's complaint. Studying of the current problem reveals that 89 percents of loss from stopper ring assembly comes from skewness of stopper ring outside of the given standard from the customer. This research hence intends to design fixture that prevents stopper ring from skewing during the assembly. The developed fixture was tested in a trial assembly with 3 products, 120 pieces each. The result reveals that the developed fixture can reduce the loss from stopper ring assembly at 100 percents.

*Keywords*— stopper ring; stabilizer bar; fixture



# Postal Alert And Security System Via Line Application

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*Abstract*—This paper aims to develop an automatic mailbox that can send a notification through a mobile phone via a Line<sup>TM</sup> application. The proposed system will alert automatically when a letter is dropped into the mailbox or when the human enter the mailbox security zone. Two photoelectric sensors which are interface to the main controller are used to detect both a letter and humans. The ESP 8266 board is connected to android mobile phone, and UNO R3 board is also connected to the main controller to control and auto-lock system using Bluetooth HC-05 module. Humans can control their mailboxes to be open and close for fetching documents or letters by Bluetooth linked to their mobile phone.

*Keywords*— *Arduino Uno23; home's mailbox; MCU ESP8266; module Bluetooth HC-05*



# A Talking Device of Weight and Height for the Visually Impaired Students

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**Abstract**— This research is intended to facilitate the measurement of weight and height with the body mass index detail for the visually impaired students by creating a digital measuring instrument that supports digital voice. We focused on reducing the cost and the material required in prototyping while maintaining the quality and accuracy of the device. To achieve this, we used Arduino microprocessors and ultrasonic sensors to measure the height and load cells to measure weight, and used digital screen to display measurement results. The users can press buttons, labelled in Braille, to listen to the measured values of height, weight, and BMI in Thai language. There are buttons, labelled in Braille, for listening to the measurement result. The proposed device has been evaluated by 30 sighted and 15 visually impaired volunteers who extensively used the device and provided scores in six aspects: ease of use, speed to work, ease of move, easy installation, reasonable weight of device, and introduction sound. The device received overall satisfactory scores, and due to its relatively low cost, is well-suited for individuals with low income.

**Keywords**— weight; height; strain gauges; ultrasonic



# The Realization of Four-mode First-order Allpass Filter Based-on CCCCTAs

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*Abstract*— The realization of four-mode first-order allpass filter is presented in this paper. The proposed four-mode first-order allpass filter provides two current controlled current conveyor transconductance amplifiers and single grounded capacitor. It can be operated in voltage-mode, current-mode, trans-impedance-mode and trans-admittance-mode without changing the circuit configurations. The gain and phase response of proposed circuit can be adjusted electronically/independently by DC bias current. The Pspice simulation results are agreed with the theoretical analysis.

*Keywords*— Allpass filter; Four-mode; CCCCTA.



# Electrochromic Properties of WO<sub>3</sub> Thin Film

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**Abstract**— This research investigated the behavior of electrochromic thin films of tungsten oxide (WO<sub>3</sub>) by vaporization with electrolyte. As a result of applied bias, the change in color intensity increases and decreases as well as the color retention when no bias voltage is applied. By measuring the electrical properties of the direct current and pulse signal, there are factors that affect the exchange of electrons and ions on thin films with tungsten oxide and the concentration of the electrolyte solution. This is the result of the oxidation and reduction effects of the switching time on the sensitivity.

**Keywords**—electrochromic; switching time; thin film; WO<sub>3</sub>



# Load Sharing and Fault Tolerant Systems over Multiple Inter-Domain Paths

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*Abstract*—This research is purposed to understand the efficiency of load sharing to solve the problem of large networks having high traffic load to network sharing. How much will it solve the traffic on the network in wide area network? This trial uses the Border Gateway Protocol (BGP), a popular routing protocol used in wide area networks, and examines the functionality of BGP protocols such as Route map, Prefix-list. Moreover, the error detection system has been implemented to analyze the data exchanged within the network. The results showed that this method resulted in improved efficiency of 70 percent. Bandwidth is 20 Mbps. The maximum upload rate is 5.08 Mb / s and the maximum download rate is 12.05 Mb / s. The average upload rate is 578.99 kb / s and download at 1.42 Mb / s, which is not a problem that occurs because the graph value is still active without the system down or the graph is stagnant.

*Keywords*—Load Sharing; Fault Tolerant; Load Balancing; Multiple Inter-Domain Paths; MPLS





# Voltage Controlled Sinusoidal Oscillator Based-on Commercially Available VDGA's

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**Abstract**— The sinusoidal oscillator based on voltage differencing gain amplifiers (VDGA) has been used for this research. The proposed oscillator is easily constructed with only two VDGA's without external passive capacitors. The condition and frequency of oscillation are adjusted to give simultaneous and equal transconductance gains. Furthermore, the external voltage signals can easily be adjusted according to the frequency and amplitude of the sinusoidal signal that can be conveniently used in communication systems or for training in education. The output-impedance is low which is directed to connect or drive load. The simulation results obtained by the use of commercially available active devices are satisfactory a theoretical analysis.

**Keywords**— Sinusoidal oscillator; voltage differencing gain amplifier; external passive capacitor.



# Electrical Power Consumption Monitoring and Control of Appliances with IoT

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*Abstract*—Nowadays, we use the Internet widely, in our office, home and others. Also, we use with wireless via wifi system. Internet of things is developed to connect everything to the internet. With the cloud technology, we can share information with smart devices, desktop computers, smartphones anywhere, by connecting to the Internet. This paper is to design a smart system with the internet of things technology and embedded systems technology, small and cheap, which employ the integration of wifi. This system is embedded with the outlet. We monitor and control the use of electric devices through the Internet. With cloud technology, we can monitor and check the status of devices, on or off, power consumption. We can control the devices to turn on or off and control demand of power consumption by the limit value of current. If it is greater than the set value, it will be turned off. Overload power consumption may be due to defective of devices or short circuit problem. So we can control the devices turn on or off, power consumption monitoring and overload or short circuit protection.

*Keywords*—internet of things (IoT); ESP8266.



# A Circularly Polarized Loop Antenna with Reflector for RFID Handheld Reader

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**Abstract**— This paper presents a circularly polarized loop antenna with reflector for UHF RFID handheld reader. A circularly polarized loop antenna with reflector is achieved by using a phase difference excitation of two port probe feeds. It is found that the return loss at port 1 and 2 of antenna design are less than -10 dB and the axial ratio is less than 3 dB along operating frequency. It can be operated in UHF RFID system for Thailand from 920-925 MHz. The radiation gain along operating frequency is better than 6 dBic. The axial ratio at center frequency (922.5 MHz) is about 1.2 dB. The overall size of the proposed antenna is  $90 \times 100 \times 25 \text{ mm}^3$ . Therefore, the proposed circularly polarized loop antenna with reflector can be used for a handheld UHF RFID readers.

**Keywords**—Circular polarization(CP); UHF RFID; Loop antenna



# MISO Current-mode Universal Biquadratic Filter Using VDCC

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*Abstract*— This paper presents a Multiple Input Single Output (MISO) Current-mode Universal Biquadratic Filter, based on Voltage Differencing Current Conveyor (VDCC). The proposed circuit consists of VDCCs, two grounded capacitors and one grounded resistor which can be controlled to operate as a low-pass (LP), high-pass (HP), band-pass (BP), band-reject (BR) and all-pass (AP) filters, the output signal is controlled by defining input signals. Theoretical analysis of the proposed circuit is verified by PSPICE simulation results.

*Keywords*—VDCC; current-mode; universal biquadratic filters;



# Development of School Bus Passenger Notification System Using RFID and Arduino Module

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**Abstract**—This paper presents the system and application to notify about taking a school bus of primary school students. This system aims to prevent the students from being left on the bus as well as increasing the trust from their parents. The system uses Arduino module and Radio Frequency Identification (RFID) tag to record data. The students will have student cards that identify themselves when getting on and off the bus, while the school bus will have card reader to record the data from student cards. Then, the recorded data will be sent to the server via Internet as well as through the application in almost real-time. The updated status about students will show on mobile phones of teachers and parents via the Android based application. For the performance of this system, the accuracy of the part of card reader is about 93%, while the accuracy of the mobile application is 100 %.

**Keywords**—*Arduino; Android; RFIP; IoT;*



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# SCIENCES AND TECHNOLOGY

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- Environmental Management
- Energy Technology and Management
- Manufacturing and Process Management
- Food Science and Biotechnology
- Advanced Materials and Nanotechnology
- Related Topics.





# Study of Greenhouse Gases Emission and Storage of Suranaree University of Technology, Thailand

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**Abstract**—This paper presented a study of the greenhouse gas emission and storage of Suranaree University of Technology for academic year 2016, using the guidelines of the Thailand Greenhouse Gas Management Organization (Public Organization). The study classified sources of emissions and storages into 4 scopes as follow: 1) direct emission 2) indirect emission 3) other indirect emission and 4) storage from green area. The results show that the total greenhouse gas emission of Suranaree University of Technology for academic year 2016 was 13,251 tCO<sub>2</sub>eq, and 0.73 tCO<sub>2</sub>eq per person. Scope 2, indirect emission, was the major source that generated 8,809 tCO<sub>2</sub>eq or 66% of the overall emission. Emission from scope 1 and 3 were 2,864 tCO<sub>2</sub>eq or 21%, and 1,634 tCO<sub>2</sub>eq or 12%, respectively. On the other hand, carbon dioxide storage of trees in the university area was 53,905 tCO<sub>2</sub>eq.

**Keywords**—Greenhouse gas; University; Emission; Carbon footprint; Climate change



# Investigating the Role of Factors Determining Drainage System Performance for Water-Efficient Toilet

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**Abstract**— This research focused on the saving of flush volume through drainage system design. Factors influencing drainage system performance (water-flow velocity) and flush volume were investigated including drain-pipe diameter, draining slope, draining distance, and vertical drop height. The research conducted its experiment under setting conditions to examine the ability of water-efficient toilet. The transport waste through the draining line and the drainage efficiency of the toilet were investigated. Results reveal that for the no-slope setting, installing with 150 mm. vertical drop height and the distance of 8 meters shows the best efficiency in water saving in both 2 and 3 inch- diameter pipes. The draining efficiency of all pipe sizes for the longer distance can be improved by increasing drop height. For the sloping setting, the higher the slopes, the more the draining efficiencies. The draining slope 1:50 shows the best performance in terms of water-flow velocity with the condition of 150-mm drop height and 2-3 inch-pipe sizes. For the longer draining distance, slope shows the significant impact on water efficiency and draining performance.

**Keywords**—*Drainage System; Flush Volume; Water-Efficient*





# Health risks due to radon in groundwater at Amphoe Muang Maha Sarakham

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*Abstract*— Research aims to identify a possible cause of cancer in 59 ground water samples at Amphoe Muang Mahasarakham. This was determined by measuring Radon concentration in Ground water using RAD H2O. The Radon concentrations of all samples were in the range of 0 to 2.21 Bq/l with the average of 0.69 Bq/l. The risks of Annual Equivalent Dose were found to be in the range of 0 to 0.016 mSv/y with the average of 0.005 mSv/y. The results were then compared to the standard value of the US Environmental Protection Agency (Radon concentration should be less than 11 Bq/l for drinking water and less than 150 Bq/l for using water and Annual Equivalent Dose should be less than 0.1 mSv/y). It was found that both radon concentrations and annual equivalent doses of all ground water samples were lower than the standard values. Therefore, ground water at Amphoe Muang Mahasarakham is safe for consumption without the worry of carcinogens in Ground water (Radon)

*Keywords*— Radon, Cancer, Ground Water, Maha Sarakham



# Estimation of Attenuation Coefficient of Solar Radiation in the Atmosphere of Thailand

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*Abstract*— The estimation of the attenuation coefficient of solar radiation in the atmosphere were used solar radiation data on a cloudless day. The data were collected from four measuring stations located in Chiang Mai, Ubon Ratchathani, Bangkok, and Songkhla during the years 2011-2015. Then, the relationship between the attenuation coefficient from solar radiation data and the surface data (air temperature, relative humidity and visibility data) in a mathematical model was investigated in this paper. The result showed that the relationship had a relatively high level of reliability. The attenuation coefficient was nearly equal to the value from the model. The attenuation coefficient from 85 meteorological stations across the country was calculated from the model. The result showed that seasonal change of the attenuation coefficient was high in the dry season and low in the rainy season.

*Keywords*— *attenuation coefficient; visibility data; cloudless sky; solar radiation*

I.



# Feasibility on the Utilization of Agricultural Unused Banana Trees as the Feedstock for the Ethanol Fermentation

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**Abstract**— Unused banana trees are the agricultural wastes that have a potential feedstock for the bioethanol production. Because of the ethanol is friendly energy which does not release the toxic pollutants to the environment, thus, the ethanol is used in various applications especially in the car transportation or even in the electricity generation by fuel cell technology. The research was to improve the efficiency of ethanol production by using unused banana trees as material. The unused banana trees were physically treated by chopping and grinding, then followed by the 2 steps of acid/base chemical pretreatment at 100°C for 3 hours and finally hydrolyzed by cellulase from *Trichoderma reesei* at pH 4.8 and 42°C. The HCl and H<sub>2</sub>SO<sub>4</sub> were added into the pretreatment mixture reach the concentration of 2-4%(v/v) as final concentration. The HCl treatment produces the highest total sugar at 16.89 g/ g plant including with amounts of xylose and glucose at 2.37g/g plant and 2.29 g/g plant. Remarkably, the HCl is strong acid same property as the NaOH is strong base consequently release the highest amount of total sugar at 6.01 g/g plant. The 2 steps of chemical pretreatment dramatically increase the proportion of cellulose from original content at 26.96% to 66.9%. In the other hand, the hemicellulose contents were reduced from 24.69% to 0.5%. The ethanol fermentation using the separated hydrolysis and fermentation (SHF) technology was done after the cellulase digestion by the ethanol yeast *Saccharomyces cerevisiae* at 37°C under anaerobic condition. The maximum of ethanol concentration in only glucose control condition was at 9.33% (v/v) whereas in the hydrolyzed sugar with the addition of glucose showed the highest ethanol concentration at 8% (v/v). In finally, the results establish the pretreatment technology for unused banana trees that can be applied for other lignocellulosic materials in the future.

**Keywords**—Unused banana trees; Lignocellulosic materials; Chemical pretreatment; Cellulase digestion; Bioethanol



# Enhancement of Hydrogen Production under Alkaline Condition using Various Electrode Materials and Shape Types

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**Abstract**—Hydrogen is source of green energy that can be generated by the electrolysis of water. Hydrogen can be used in various applications because it is friendly to the environment. In this study, the hydrogen system was connected with the hydrogen fuel cell to obtain the performance of hydrogen production system. The efficiency of hydrogen production under the 0.5 molar solution of sodium hydroxide as alkaline electrolyte was developed by using the different electrode materials and shapes. Both stainless steel and aluminium in whole sheet type with/without small holes were applied in hydrogen production. The highest of efficiency of hydrogen production was found by using the stainless steel 304 code 2.3S as electrode. The system generated the voltage output at 40.22 milliVolts, the current density at 0.396 microampere per square centimetre, and the power density at 15.96 microwatt per square centimetre. These results indicated that the performances of electrode are important for the development of hydrogen production in the future.

**Keywords**—Aluminium; Stainless steel; Alkaline electrolyte; Hydrogen gas;



# Evaluation of Acid and Alkaline Pretreatments, to Enhance Enzymatic Hydrolysis and Fermentation Ethanol by Agricultural Corn Cob.

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**Abstract**— Corn cob is a promising as feedstock because of high yields and low costs, which does not compete with food prices. Dilute acid pretreatment for hydrolysis hemicellulose under different type of acid (HCl and H<sub>2</sub>SO<sub>4</sub>) and level dilute acid concentration 1-4% (v/v), effective to obtain high concentration xylose and glucose of 10.53 and 16.58 g/l under condition 4% (v/v) HCl at 100 °C for 3 hr. An ethanol concentration of 11.28 g/l after 12 hr. by using the yeast *S. cerevisiae*. An additional alkaline pretreatment applied to the solid fraction remaining from the diluted acid pretreatment (APSD), improved the lignin and hemicellulose removal and increase cellulose under level dilute NaOH concentration 1-4% (v/v). The highest increase 20.69% to 42.49% (w/w) of cellulose and decreased 39.20% to 4.35% (w/w) of hemicellulose under condition 4% (w/w) NaOH at 100 °C for 3 hr. The enzymatic hydrolysis obtained the sugar concentration at 32.2 g/l of addition Tween 80 from solid residual the diluted acid and alkaline pretreatment (AAPSD). The fermentation of the sugar solution from cellulosic fraction with *S. cerevisiae*, showed the highest ethanol concentration 22.25 g/l. Thus, corn cob is an interesting as feedstock conversion to produce ethanol as good as the fermentation. Show than fig. 1 the strategy of ethanol production from Corn cob

**Keywords**— Corn cob, Acid pretreatment, Alkaline pretreatment, Enzymatic hydrolysis, Fermentation ethanol.



# Simple PV-Slat Window Control Method for Net-Zero Buildings

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*Abstract*—To meet the target of net-zero buildings and plus energy buildings, lighting and cooling power savings as well as power generation by Photovoltaic panels become critical. Across variable sun angles, dynamic PV integrated shading devices have the possibility to achieve maximum diffuse daylight and electricity production when direct solar radiation is no longer present. This research investigates slat angles for horizontal PV- slat windows on north and south facades of buildings in Bangkok, Thailand. The calculations were performed for hourly sun positions over a year by using the location of Bangkok, Thailand. The simple control schemes for horizontal PV-slat windows are presented. For south facades, the slats should be tilted downward during 7:00-9:00 and 16:00-18:00 in 1<sup>st</sup> January-9<sup>th</sup> March and 13<sup>th</sup> October-31<sup>st</sup> December. For north facades, the slats should be tilted downward from 6:00-7:00 and 18:00 from 11<sup>th</sup> April to 2<sup>nd</sup> September. For the rest of the time, the slats should be set at fully open.

*Keywords*—PV-slat window; daylighting; critical angle



# The Study of Knowledge, Understanding, and Behavior on Electric Power in Household in Muang District, Nakhon Pathom Province

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**Abstract—** The objectives of this research was to identify the difference between personal data and information perception on electric power at individual level which affects behavior on electric power saving in household as well as to study the relationship between knowledge and understanding and frequency of information perception on electric power saving in household. The sample of this study was the people who live in Muang district, Nakhon Pathom province. The research findings indicated that most respondents held Bachelor Degree, had monthly income at medium level (quite low), lived in single family (3-4 family members), lived in single house, and paid the medium to low amount of electricity price. As for the knowledge and understanding on electric power saving, it was found that most respondents were at the medium level and received information 1-2 times per month. Referring to the hypothesis testing, it could be found that the personal information, knowledge and understanding, and frequency of information perception on electric power had statistically significant relationship to the behavior in selecting and maintaining home appliances.

**Keywords—** energy saving; knowledge, understanding, and behavior; household



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# Fuzzy Logic Concepts for Investment Decision Making: A review

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*Abstract* – As fuzzy logic is widely accepted and implemented in several fields to compensate for the lack of precision in our daily life, therefore this work presents the applications of fuzzy logic concepts, particularly, for the investment decision making through the reviewing of recently articles that were published in the past five years. As a result, the essential contents of each work have been reviewed, along with our opinions for the utilizations of fuzzy logic, namely, as the single and multiple fuzzy approaches. In conclusion, we have suggested that fuzzy logic concepts are suitable for the investment decision making by clarifying the previously obscure criteria to provide objective and decisive results.

*Keywords*—Fuzzy logic concepts; investment decision making; multi-criteria decision making model; business planning





# Development of a Capital Investment Decision Function via a Spreadsheet Program: A Case Study of LED T8 Production in Thailand Industry

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**Abstract**— This paper presents the development of a capital investment decision function via a spreadsheet program for a case study of LED T8 production in Thailand industry. The financial data such as revenue, labor costs, raw material costs, packaging and freight costs were used as input variables for investigating the results of Net Present Value (*NPV*), Internal Rate of Return (*IRR*), Benefit-Cost Ratio (*BCR*), and also Payback period (*PB*) for investment analysis. The calculation was done by using a financial calculator, and also the developed function via spreadsheet program. The results of *NPV*, *IRR*, *BCR* and *PB* value were reported of 620,067.30, 17.57%, 1.02 and 3.16, respectively. Consequently, the analyzed results from the program were similar to the calculations and without any errors. Moreover, we found that using the developed function is more compatible and simpler than the calculator in several ways such as data entering, data editing, and data analyzing, etc. This implies that proposed function is especially suitable in the utility of entrepreneurs for making a decision on investment.

**Keywords**—*investment; feasibility analysis; financial calculator; economic tools; spreadsheet program*



# Biogas Production from Wastewater of Yeast Fermentation with Microorganism under Mesophilic Condition

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**Abstract**—This paper was to investigate the biogas production from the wastewater of yeast fermentation. The main raw material was wastewater of yeast fermentation co-digestion with microorganisms in ratio of 1:1 (8 liters of wastewater of yeast fermentation and 8 liters of microorganism). The digester was made from the 20 liters PVC tank for hydraulic retention time (HRT) 45 days. We measured the volume of biogas produced by water displacement method once per day. The composition of biogas such as methane (CH<sub>4</sub>), carbon dioxide (CO<sub>2</sub>) and oxygen (O<sub>2</sub>) was used to analyze the specific methane yield (SMY). The results showed that the wastewater of yeast fermentation with microorganisms gave highest biogas production with 73% CH<sub>4</sub>, 19.7% CO<sub>2</sub> and 1% O<sub>2</sub> and 6.3% of other gases. The specific methane yield was 0.028 m<sup>3</sup>CH<sub>4</sub>/kgCOD<sub>removed</sub> and the biochemical methane potential was 7.89%.

**Keywords**—biogas; wastewater of yeast fermentation; potential methane production.



# Using closed loop oscillating heat pipe for cooling battery in charging process

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**Abstract**—This research is the application of closed-loop oscillating heat pipe (CLOHP) for cooling the battery while charging. The CLOHP made of copper tube with diameter of 0.055 inch (1.397 mm) and fill R-134a at filling ratio of 50% by volume. The evaporator section of CLOHP was attached to outer side of battery and condenser section was cooled by air. Rechargeable Lead-acid Battery size of 12 V 24 Ah with dimensions of 75 x 180 x 170 mm was used in the experiment. The experiment for cooling of battery while charging were 2 cases as follow: 1 without heat pipe with natural convection and 2 heat pipe with natural convection. The results of battery charging efficiency were 55.44% and 69.69%, respectively. The results of battery temperature were 36.42 °C and 33.44 °C. The conclusion of this research was using closed-loop oscillating heat pipe for cooling the battery while charging can reduce the temperature and increase the charging efficiency of the battery.

**Keywords**—closed loop oscillating heat pipe, CLOHP, battery, cooling, charging



# Biogas Production from Water Hyacinth Leaf and Petiole co-digestion with Microorganism under Mesophilic Condition

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**Abstract**— This paper was to investigate the biogas production from the water of water hyacinth leaf and petiole (WWH) by using the Biochemical Methane Potential Test (BMP). The main raw material used was WWH co-digestion with microorganism in ratio of 1: 1 (8 liters of WWH / 8 liters of microorganism), 1:0 (only WWH) and also 0:1 (only microorganism), respectively. The digester was made from the 20 liters of the PVC tank for hydraulic retention time (HRT) 60 days. We measured the volume of biogas produced by water displacement method once per day. The composition of biogas such as Methane (CH<sub>4</sub>), Carbon dioxide (CO<sub>2</sub>) and Oxygen (O<sub>2</sub>) was used to analyze the specific methane yield (SMY) and the potential for biodegradation into methane. The results showed that the WWH with microorganisms gave highest biogas production with 74.5% CH<sub>4</sub>, 17.85% CO<sub>2</sub> and 7.65% of other gases. The specific methane yield and the potential to biodegrade methane were 0.13233 m<sup>3</sup> CH<sub>4</sub> / kg VS<sub>added</sub> and 50.51%, respectively.

**Keywords**— Biogas; water of water hyacinth; potential methane production.



# *A review of thermochemical heat storage*

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**Abstract**— Heat storage technologies are used to improve energy efficiency of power plants and recovery of process heat. Chemical heat storage has been proved to be a feasible and promising method to store thermal energy. As compared to other thermal energy storage methods, chemical heat storage exhibits high energy storage density as well as feasibility for long-duration energy storage. In this paper, the basic principle of the chemical heat storage is firstly elaborated. Then the selection criteria of the chemical reaction are given. The aim of this review is to provide an insight into the promising candidate reactions for chemical heat storage application. The associated reversible chemical reactions available for thermal energy storage systems are summarized. Ongoing research and development studies illustrate that chemical heat storage is a very favorable option for the different application when diverse promising candidate reactions are selected. As working temperature is one of the key parameters for thermal energy storage systems, emphasis is given to the judgment of application temperature range for chemical heat storage. The determination of applicative temperature range of reversible chemical reactions is discussed. Besides, the challenge and prospect of the chemical heat storage technology are analyzed in the paper.

**Keywords**—*Thermal energy storage; Chemical heat storage; Chemical reaction heat storage; Chemical sorption heat storage*



# Microbial Production of Syrup from Broken Organic Jasmine Rice Grain

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**Abstract**—Organic jasmine rice generally has a high production cost but milling could partially break a full-length grain, resulting in a low market price. This research was thus aimed to increase a price of broken organic jasmine rice grain via syrup production. Five molds and two yeasts were selected for starch hydrolysis aerobically or anaerobically for a week. Microbial count, starch, reducing sugar, dextrose equivalent (DE), total sugar, and total acid were daily analyzed. Results indicated that *Rhizopus oryzae* was suitable for syrup production from broken organic jasmine rice grain aerobically as reducing sugar, DE, and total sugar were present at a higher content than other six fungi, which were *Aspergillus awamori*, *Aspergillus niger*, *Aspergillus oryzae*, *Rhizopus oligosporus*, *Candida tropicalis*, and *Saccharomycopsis fibuligera*. Using 1% *Rhizopus oryzae* spore, instead of 10%, was enough for hydrolysis of starch into syrup within six days. Syrup production from broken organic jasmine rice grain by microbial activity was economically feasible and could raise a market price of broken organic jasmine rice grain.

**Keywords**—organic jasmine rice; *Rhizopus oryzae*; starch hydrolysis; syrup production



# Production of Yanang Leaves (*Tiliacora triandra*) Powder by Drying Techniques

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**Abstract**— Yanang (*Tiliacora triandra*) a type of native climbing plant, is used as traditional medicine and as an ingredient in many recipes of northeast Thailand and Lao PDR. Due to its nutritional value and antioxidant properties, Yanang leaves are commonly used to make herbal tea and cooking ingredient powder. Three drying methods; shade drying, hot air drying and vacuum drying were comparatively studied in order to evaluate physicochemical and antioxidant properties of Yanang powder including moisture content, color, pH, TSS and DPPH assay. Shade drying method resulted in higher moisture content ( $6.81 \pm 0.10$ ) compared with the other two methods ( $p \leq 0.05$ ). The vacuum drying technique showed better color characteristics. There was no significant difference in pH and TSS between samples treated with shade and hot air drying techniques. The maximal DPPH antioxidant activity was recorded from leaves that were dried by the vacuum drying technique. The Yanang leaves powder provided 50% inhibition (IC<sub>50</sub>) of 2,2- diphenyl-1-picrylhydrazyl which varies within the range between  $120.23 \pm 2.11$  and  $130.36 \pm 3.08$   $\mu\text{g/mL}$ .

**Keywords**—Yanang powder; shade drying; hot air dring;vacuum drying; antioxidant



# Development of local Thai traditional cough drop

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**Abstract**—A cough drop was developed from a selected local Thai traditional cough remedy in Chiang Mai. Firstly, sucrose and glucose syrup ratio was varied to make candy and it was found that the ratio at 70:30 gave the highest yield. Secondly, the quantity of local Thai traditional cough remedy was varied at 10 – 40 g per 100 g of candy mixture. It was found that the ratio of sucrose had to be increased for increasing the quantity of cough remedy in the candy mixture and the best result was at 90:10 of sucrose and glucose syrup ratio and 30g of cough remedy per 100 g of candy mixture. This developed cough drop could prolong its herbal flavor to 10 min compared to 3 min of the powder form and it had lower microbial loads. There was no visible change and still low in moisture content and water activity when keeping in sealed polypropylene bag for 10 weeks.

**Keywords**—*cough drop; Thai traditional cough remedy; local Thai cough powder*





# Surface Modification of Perlite by Using Silane for the Enhancement of Heat Aging Resistance of Natural Rubber Vulcanisates

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**Abstract**—Our previous work reported that surface modifications of perlite with optimum silane content (2–4 wt%) gave optimal properties of natural rubber vulcanisates. The objective of the present study is to investigate the heat aging resistance properties in terms of stress at 100% elongation, tensile strength, and percentage elongation at break after surface modification. Furthermore, the rebound resilience and abrasion resistance of perlite treated with silane filled in NR vulcanisates will be investigated. In a comparison, the properties of clay-filled NR vulcanisates will be determined. From the experiments, it was found that surface modifications using silane gave better perlite- NR interactions before and after aging. The better heat resistance properties of perlite-filled NR vulcanisates than those of clay- filled vulcanisates can be detected from relative property data. Nevertheless, a lower percentage of rebound resilience and abrasion resistance of perlite-filled vulcanisates before and after surface modification than those of clay-filled vulcanisates can be observed. This is owing to the large particle size, low surface area, poor dispersion, and agglomeration of perlite in NR vulcanisates. Perlite particles with high silica content are potentially used as odor-adsorbing filler in natural rubber (NR) vulcanisates but not as reinforcement filler.

**Keywords**—perlite; surface modification; heat resistance; mechanical properties; natural rubber vulcanisates



# Green Natural Rubber Foam filled with Spent Coffee Grounds

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**Abstract**— The present study is focused on developing green natural rubber (NR) foam from spent coffee grounds (SCG). The SCG particles were initially characterized by various techniques prior to being added into the rubber compound. Results revealed that SCG particles had irregular shape and highly porous structure with relatively low specific surface area. It is composed of inorganic substances such as oxides of potassium, silicon, magnesium, calcium, and phosphorous. The presence of these metal oxides in SCG particles increased the rate of crosslinking (i.e. lower cure time) of the compound. The incorporation of SCG particles into NR foam gave relatively low reinforcement in terms of hardness and tensile strength, and also reduced the elastic behavior. The water absorption and relative density of the rubber foams tended to increase with SCG loading. However, SCG particles encouraged the cell formation by producing larger cell porosity and a narrower distribution in the matrix.

**Keywords**— *natural rubber; foam; spent coffee grounds*



# A Spacecraft Trajectory Optimization and Modified Local Search Algorithm

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**Abstract**—An optimization problem formulated from a trajectory design of a spacecraft named Cassini2, is introduced with some solutions by a modified local search algorithm. The optimization problem and the proposed solver are coded and also executable in MATLAB platform. Experiments has been conducted under CEC2011's evaluation criteria limited at maximum 150,000 function evaluations and due to each iteration of the modified local search evaluates five objective function values, thus the maximum iteration is set at 30,000 for each trial. There are 20 independent trials elaborated in this study. Computational results showed that the proposed local search can handle the spacecraft trajectory optimization problem and satisfy convergence property for all trials.

**Keywords**—*spacecraft trajectory; gravity assist; local search; cassini2*



# Natural Rubber Latex Foam for Seedling

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**Abstract**— Latex foam from natural rubber latex with various types of fillers such as defatted rice bran (DRB), longan shell (LS)/DRB (1/1 by weight) and organic fertilizer (OF) were prepared for seedling. The properties of latex foam from natural rubber latex and polyurethane foam were compared. The results indicated that latex foam filled with LS/DRB showed the highest density and lowest compression set value. Latex foam from natural rubber latex and polyurethane foam gave an opened cell. The latex foam filled with organic fertilizer showed the highest pore size. The morning glory seed was selected for seed germination test. The results showed that latex foam filled with LS/DRB was the highest germination. Polyurethane foam gave the highest height of seedlings. However, the latex foam filled with organic fertilizer gave the second height of seedlings. Therefore, the properties of foam for seedling were low compression set, low density and high porous.

**Keywords**— rubber foam; longan shell; defatted rice bran; organic fertilizer



# A Solution of Tsunami Wave by Using the Modified Adomian Decomposition Method

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**Abstract**— In this paper, the shallow Water model of tsunami wave is proposed. The nonlinear derivative equation system is derived and used for explain the velocity and wave height of tsunami. The model Adomian decomposition method is applied to find the solution as local analytical solutions which use to explain the phenomena of tsunami in short duration and distance. In short duration and distance, the slope of coastal is essential factor which make high velocity and wave height and affect to the damage of tsunami attack.

**Keywords**—*tsunami modeling; nonlinear partial differential equation; modified Adomian decomposition method*



# Dynamic Capability Assessment

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*Abstract*—This paper developed items for assessing dynamic capability based on House of Dynamic Capability model. Dynamic capability consists of four components including sensing, seizing, reconfiguring, and integrating capabilities. We collected empirical data from 506 manufacturing firms in high and medium-high technological industries by quantitative survey. Data was analyzed with partial least square structural equation modelling technique. The results indicated acceptable reliability and validity of items in our questionnaire. Items significantly loaded to their latent variables, and all latent variables respectively loaded to dynamic capability.

*Keywords*—dynamic capability; assessment; house of dynamic capability; structural equation modelling



# Building a Crack Processing Toolkit

Software tools for measuring building cracks

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*Abstract*—The geometry and propagation of cracks in concrete or brick walls can give us advance warning of a potential building collapse. This is particularly important after earthquakes, when many building need to be assessed rapidly under difficult situations, so the ability to take and process images of problems is a key to saving lives from collapse of unsafe buildings. Cameras allow remote and safe access to possible dangers. However, cracks take many forms and have many different environments, so, in this project we built a library of tools for handing different environments allowing the full geometry and time evolution of a crack to be determined rapidly. Most of our test images were obtained in our civil testing laboratory, where a variety of beams were marked up in many different ways by successive groups of students. We also show how to collect and register sequences of images collected from a drone, possibly over long periods of time.

*Keywords*—Crack; Detection; Geometry; Processing; Software library



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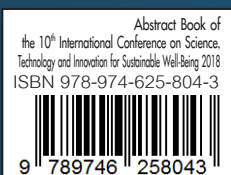
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