



# Book of Abstracts

## Conference on Recent Trends in Algebra and Related Topics

January 19–20, 2023

Organized by  
Department of Mathematics, Faculty of Science,  
Chiang Mai University, Chiang Mai, Thailand

Conference on Recent Trends in Algebra and Related Topics  
Book of Abstracts  
Organized by Department of Mathematics, Faculty of Science,  
Chiang Mai University, Thailand.

# Table of contents

Table of contents . . . . .	iii
Program Schedule . . . . .	1

## Abstract (Invited Speakers)

Semirings and $k$ -ideals	
<i>Assoc. Prof. Dr. Bundit Pibaljomme</i> . . . . .	5
Construction of a gyrogroup from a group	
<i>Assoc. Prof. Dr. Teerapong Suksumran</i> . . . . .	6
Orthogonal decomposition for a modular Lie algebra	
<i>Asst. Prof. Dr. Songpon Sriwongsa</i> . . . . .	7
Transformation semigroups never die : Magnifying elements in transformation semigroups	
<i>Assoc. Prof. Dr. Ronnason Chinram</i> . . . . .	8
Introducing UP-modules	
<i>Assoc. Prof. Dr. Aiyared Iampan</i> . . . . .	9
The algebraic coding theory and related algebraic problems	
<i>Assoc. Prof. Dr. Chakkrid Klin-eam</i> . . . . .	10

## Abstract (Contributed Talks)

Ternary Menger algebras and their algebraic properties	
<i>A. Nongmanee and S. Leeratanavalee</i> . . . . .	12
Picture $\mathcal{N}$ -sets and applications in semigroups	
<i>A. Simuen, R. Chinram, W. Yonthanthum, and A. Iampan</i> . . . . .	13
Some representations of ordered semigroups	
<i>S. Lekkoksung, A. Iampan, P. Julatha, and N. Lekkoksung</i> . . . . .	14
Quasi-ideals on the direct product of two semigroups	
<i>T. Changphas</i> . . . . .	15
The partial algebras of completely expanded terms	
<i>T. Kumduang and K. Wattanatripop</i> . . . . .	16
Regularity of generalized hypersubstitutions for algebraic systems	
<i>P. Kunama and S. Leeratanavalee</i> . . . . .	17
Algebras of full terms constructed from transformations with fixed set	
<i>K. Wattanatripop, T. Changphas, and T. Kumduang</i> . . . . .	18

Semigroups of an inductive composition of tree languages <i>B. Lang, P. Kitpratyakul, and B. Pibaljomme</i> . . . . .	19
Regularity of the semigroup of transformations preserving a length <i>W. Sommanee</i> . . . . .	20
On the maximal subsemigroups and rank properties of certain semi- groups of partial injective contractions of a finite chain <i>M. M. Zubairu and N. M. Mangga</i> . . . . .	21
On the subsemigroups of full contraction mappings of a finite chain <i>M. M. Zubairu and A. Jibrin</i> . . . . .	22
On the combinatorial and rank properties of certain subsemigroups of full contractions of a finite chain <i>M. M. Zubairu, A. Umar, and M. J. Aliyu</i> . . . . .	23
On the relative rank of orientation-preserving or orientation-reversing transformation semigroups with restricted range <i>K. Chaikan, A. Phon-On, and K. Tinpun</i> . . . . .	24
On metric dimension of Cayley digraphs of rectangular groups <i>D. Pongpipat and N. Nupo</i> . . . . .	25
Extension of Haar's theorem <i>J. Wattanapan, W. Atiponrat, S. Tasena, and T. Suksumran</i> . . . . .	26
On $S$ - $M$ -cyclic submodules <i>S. Baupradist</i> . . . . .	27
The coincidence of bi-hyperideals and interior hyperideals <i>N. Tiprachot and S. Lekkoksung</i> . . . . .	28
Some properties of $S$ -multiplication modules and $S$ -comultiplication modules <i>K. Hukaew and S. Baupradist</i> . . . . .	29
The study on the finite dimensional Poisson modules over a Poisson algebras <i>N. Chansuriya</i> . . . . .	30
Some properties of $S$ -essential submodules <i>P. Sangchan and S. Baupradist</i> . . . . .	31

## Appendix

List of Participants . . . . .	33
Organizing committee . . . . .	39

## Program

Conference on Recent Trends in Algebra and Related Topics

January 19-20, 2023 (GMT +7)

Department of Mathematic, Faculty of Science, Chiang Mai University, Thailand

January 19, 2023		
08.30 – 09.00	Participants enter the Zoom meeting in preparation	
09.00 – 09.10	Opening Ceremony <ul style="list-style-type: none"> <li>• Welcome Speech by <b>Prof. Dr.Sorasak Leeratanavalee</b> The Chair of Program Committee</li> <li>• Opening Address by <b>Assoc. Prof. Dr.Nattakorn Sukantamala</b> The Head of Department of Mathematics, Faculty of Science, Chiang Mai University</li> </ul>	
09.10 – 09.15	Group Photo	
09.15 – 10.00	Invited Speaker 1: <b>Assoc. Prof. Dr.Bundit Pibaljomme</b> <i>Semirings and k-ideals</i>	Chair: Assoc. Prof. Dr. <b>Somnuek Worawiset</b>
10.00 – 10.45	Invited Speaker 2: <b>Assoc. Prof. Dr.Teerapong Suksumran</b> <i>Construction of a gyrogroup from a group</i>	Chair: Prof. Dr. <b>Thawat Changphas</b>
10.45 – 11.00	Break	
Contributed Talks 1		
11.00 – 11.15	Anak Nongmanee <sup>†</sup> and Sorasak Leeratanavalee <i>Ternary Menger algebras and their algebraic properties</i>	Chair: Assoc. Prof. Dr. <b>Kritsada Sangkhanan</b>
11.15 – 11.30	Anusorn Simuen <sup>†</sup> , Ronnason Chinram, Winita Yonthanthum and Aiyared Iampan <i>Picture N-sets and applications in semigroups</i>	
11.30 – 11.45	Somsak Lekkoksung, Aiyared Iampan, Pongpun Julatha and Nareupanat Lekkoksung <sup>†</sup> <i>Some representations of ordered semigroups</i>	
11.45 – 12.00	Thawat Changphas <sup>†</sup> <i>Quasi-ideals on the direct product of two semigroups</i>	
12.00 – 13.00	Lunch Break	
13.00 – 13.45	Invited Speaker 3: <b>Asst. Prof. Dr.Songpon Sriwongsa</b> <i>Orthogonal decomposition for a modular Lie algebra <math>\mathfrak{sl}_n</math></i>	Chair: Prof. Dr. <b>Sorasak Leeratanavalee</b>
13.45 – 14.00	Break	
Contributed Talks 2		
14.00 – 14.15	Thodsaporn Kumduang <sup>†</sup> and Khwancheewa Wattanatripop <i>The partial algebras of completely expanded terms</i>	Chair: Asst. Prof. Dr. <b>Sarawut Phuapong</b>
14.15 – 14.30	Pornpimol Kunama <sup>†</sup> and Sorasak Leeratanavalee <i>Regularity of generalized hypersubstitutions for algebraic systems</i>	
14.30 – 14.45	Khwancheewa Wattanatripop <sup>†</sup> , Thawat Changphas and Thodsaporn Kumduang <i>Algebras of full terms constructed from transformations with fixed set</i>	
14.45 – 15.00	Bunlong Lang <sup>†</sup> , Pongsakorn Kitpratyakul and Bundit Pibaljomme <i>Semigroups of an inductive composition of tree languages</i>	
15.00 – 15.15	Break	
Contributed Talks 3		
15.15 – 15.30	Worachead Sommanee <sup>†</sup> <i>Regularity of the semigroup of transformations preserving a length</i>	Chair: Asst. Prof. Dr. <b>Kittisak Tinpun</b>

15.30 – 15.45	Muhammad Mansur Zubairu and Nasiru Mohammed Mangga <sup>†</sup> <i>On the maximal subsemigroups and rank properties of certain semigroups of partial injective contractions of a finite chain</i>	
15.45 – 16.00	Muhammad Mansur Zubairu <sup>†</sup> and Abubakar Jibrin <i>On the subsemigroups of full contraction mappings of a finite chain</i>	
16.00 – 16.15	Muhammad Mansur Zubairu <sup>†</sup> , Abdullahi Umar and Muhammad Jada Aliyu <i>On the combinatorial and rank properties of certain subsemigroups of full contractions of a finite chain</i>	
<b>January 20, 2023</b>		
09.00 – 09.15	Participants enter the Zoom meeting in preparation	
09.15 – 10.00	Invited Speaker 4: <b>Assoc. Prof. Dr. Ronnason Chinram</b> <i>Transformation semigroups never die : Magnifying elements in transformation semigroups</i>	Chair: Dr. <b>Panuwat Luangchaisri</b>
10.00 – 10.45	Invited Speaker 5: <b>Assoc. Prof. Dr. Aiyared Iampan</b> <i>Introducing UP-modules</i>	Chair: Assoc. Prof. Dr. <b>Samruam Baupradist</b>
10.45 – 11.00	Break	
<b>Contributed Talks 4</b>		
11.00 – 11.15	Krittapon Chaikan <sup>†</sup> , Aniruth Phon-On and Kittisak Tinpun <i>On the relative rank of orientation-preserving or orientation-reversing transformation semigroups with restricted range</i>	Chair: Asst. Prof. Dr. <b>Nareupanat Lekkoksung</b>
11.15 – 11.30	Denpong Pongpipat <sup>†</sup> and Nuttawoot Nupo <i>On metric dimension of Cayley digraphs of rectangular groups</i>	
11.30 – 11.45	Jaturon Wattanapan <sup>†</sup> , Watchareepan Atiponrat, Santi Tasena and Teerapong Suksumran <i>Extension of Haar's theorem</i>	
11.45 – 12.00	Samruam Baupradist <sup>†</sup> <i>On S-M-cyclic submodules</i>	
12.00 – 13.00	Lunch Break	
13.00 – 13.45	Invited Speaker 6: <b>Assoc. Prof. Dr. Chakkrid Klin-eam</b> <i>The algebraic coding theory and related algebraic problems</i>	Chair: Asst. Prof. Dr. <b>Warud Nakkhasen</b>
13.45 – 14.00	Break	
<b>Contributed Talks 5</b>		
14.00 – 14.15	Nuchanat Tiprachot <sup>†</sup> and Somsak Lekkoksung <i>The coincidence of bi-hyperideals and interior hyperideals</i>	Chair: <b>Dr. Nuttawoot Nupo</b>
14.15 – 14.30	Kanrop Hukaew <sup>†</sup> and Samruam Baupradist <i>Some properties of S-multiplication modules and S-comultiplication modules</i>	
14.30 – 14.45	Nagornchat Chansuriya <sup>†</sup> <i>The study on the finite dimensional Poisson modules over a Poisson algebras</i>	
15.45 – 15.00	Poramate Sangchan <sup>†</sup> and Samruam Baupradist <i>Some properties of S-essential submodules</i>	
15.00 – 15.15	Closing Ceremony <ul style="list-style-type: none"> <li>An invitation to The 16th International Conference of Young Algebraists in Thailand (ICYAT)</li> <li>Closing speech by <b>Prof. Dr. Sorasak Leeratanavalee</b> The Chair of Program Committee</li> </ul>	

# Abstract (Invited Speakers)

## Semirings and $k$ -ideals

Bundit Pibaljomme<sup>†</sup>

Department of Mathematics, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand  
E-mail: banpib@kku.ac.th

### Abstract

As a generalization of a ring, a semiring [2] is an algebraic structure consisting of a nonempty set with two associative binary operations on the set and both operations are connected with distributive law. It is known that every ideal of a ring is a kernel of a ring homomorphism but it is not generally true in case of ideals of semirings [1]. However, this condition can be true for restricted ideals of semirings called  $k$ -ideals [1]. Later, many researchers working on semirings gave many results related to  $k$ -ideals. Nowadays, many topics related to  $k$ -ideals of  $n$ -ary semirings are interestingly investigated.

### References

- [1] M. Henriksen, Ideals in semirings with commutative addition, *Am. Math. Soc. Notices*, 6 (1958), 321.
- [2] H. Vandiver, Note on a simple type of algebra in which cancellation law of addition does not hold, *Bull. Amer. Math. Soc.*, 40 (1934), 914–920.

---

<sup>†</sup>Speaker



# Construction of a gyrogroup from a group

Teerapong Suksumran<sup>†</sup>

Department of Mathematics, Faculty of Science, Chiang Mai University, Chiang Mai 50200, Thailand  
E-mail: teerapong.suksumran@cmu.ac.th

## Abstract

A gyrogroup is a non-associative algebraic structure, which may be viewed as a suitable generalization of a group, arising from the study of the parametrization of the Lorentz transformation group by Abraham A. Ungar. In this talk, we present a few constructions of gyrogroups from generic groups and mention several related properties of groups and their corresponding gyrogroups.

---

<sup>†</sup>Speaker

## Orthogonal decomposition for a modular Lie algebra $\mathfrak{sl}_n$

Songpon Sriwongsa<sup>†</sup>

Department of Mathematics, Faculty of Science, King Mongkut's University of Technology Thonburi, Bangkok 10140, Thailand

E-mail: songpon.sri@kmutt.ac.th

### Abstract

An orthogonal decomposition problem of Lie algebras over the complex numbers has been studied since the 1980s. It has many applications and relations to other areas of Mathematics and Sciences. In this talk, we consider an orthogonal decomposition problem over a finite commutative ring with identity. We define a suitable type of orthogonal decomposition of a modular Lie algebra and construct it for Lie algebra  $\mathfrak{sl}_n$  under some sufficient conditions. A necessary condition is also discussed of this type of Lie algebra. Moreover, we analyze the problem over finite fields by using some important facts of modular Lie algebras over fields of positive characteristic.

# Transformation semigroups never die : Magnifying elements in transformation semigroups

Ronnason Chinram<sup>†</sup>

Division of Computational Science, Faculty of Science, Prince of Songkla University, Hat Yai, Songkhla 90110, Thailand

E-mail: ronnason.c@psu.ac.th

## Abstract

A transformation semigroup is a collection of transformations that is closed under function composition. Transformation semigroup theory is one of main research in semigroup theory. An element  $a$  of a semigroup  $S$  is called a *left (right) magnifying element* if there exists a proper subset  $M$  of  $S$  satisfying  $aM = S(Ma = S)$ . In this talk, we focus on research of magnifying elements of transformation semigroups.

**Keywords:** transformation semigroups; magnifying elements.

## Introducing UP-modules

Aiyared Iampan<sup>1,2,†</sup>, Chayanon Polhinkong<sup>1</sup>, and Kasidej Ngenkokkrud<sup>1</sup>

<sup>1</sup>Department of Mathematics, School of Science, University of Phayao, Phayao 56000, Thailand  
E-mail: aiyared.ia@up.ac.th, cyblue0519@hotmail.com, kasidej171242@gmail.com

<sup>2</sup>Fuzzy Algebras and Decision-Making Problems Research Unit, University of Phayao, Thailand

### Abstract

The goal of this study is to introduce the concept of a new type of the hybrid algebra between Abelian groups and UP-algebras: UP-modules. We introduce the concept of fuzzy UP-submodules of UP-modules and provides properties and finds the necessary and sufficient conditions for this concept. We define fuzzy sets in UP-modules of many forms, supplying their properties and their relation to fuzzy UP-submodules. We also define and study the fuzzy UP-submodule generated by a set of fuzzy sets in UP-modules, as well as provide for their properties and their relation to fuzzy UP-submodules. Finally, we apply the concept of fuzzy UP-ideals of UP-algebras while providing properties and find the results of the composition and the product between fuzzy UP-ideals and fuzzy UP-submodules.

**Keywords:** UP-algebra, UP-module, fuzzy UP-ideal, fuzzy UP-submodule.

**2020 MSC:** 03G25, 06D99, 08A72.

# The algebraic coding theory and related algebraic problems

Chakkrid Klin-eam<sup>†</sup>

Department of Mathematics, Faculty of Science, Naresuan University, Phitsanulok 65000, Thailand  
E-mail: chakkridk@nu.ac.th

## Abstract

Algebraic coding theory studies the design of error-correcting codes for the reliable transmission of information across noisy channels. In this talk, we discuss error-correcting codes. We begin with the fundamentals of coding theory, and then explore linear codes, which are subspaces of vector spaces. We then use results from abstract algebra to understand more complex codes such as cyclic codes and constacyclic codes as generalizations of cyclic codes. In addition, we will discuss current research topics related to algebraic coding theory.

---

<sup>†</sup>Speaker

# Abstract (Contributed Talks)

## Ternary Menger algebras and their algebraic properties

Anak Nongmanee<sup>1,†</sup> and Sorasak Leeratanavalee<sup>2</sup>

<sup>1</sup>Mathematics, Faculty of Education, Nakhon Sawan Rajabhat University 60000, Thailand  
E-mail:anak.n@nsru.ac.th

<sup>2</sup>Research Group in Mathematics and Applied Mathematics, Department of Mathematics, Faculty of Science, Chiang Mai University, Chiang Mai 50200, Thailand  
E-mail:sorasak.l@cmu.ac.th

### Abstract

In this talk, we start by introducing the algebraic structure of ternary Menger algebras of rank  $n$ , where  $n$  is a fixed natural number, which can be considered as a canonical generalization of arbitrary ternary semigroups. In addition, some of its interesting algebraic properties are shown. Moreover, we also introduce the notion of  $v$ -regular ternary Menger algebras of rank  $n$ , which may be regarded as a generalization of regular ternary semigroups. Based on the concept of  $n$ -place functions ( $n$ -ary operations), we constructed ternary Menger algebras of rank  $n$  of all full  $n$ -place functions. Finally, a special class of full  $n$ -place functions, the so-called left translations, is studied.

**Keywords:** Ternary Menger algebras;  $v$ -Regular ternary Menger algebras; Left translations.

**2020 MSC:** 20M10, 20M17.

## Picture $\mathcal{N}$ -sets and applications in semigroups

Anusorn Simuen<sup>1,†</sup>, Ronnason Chinram<sup>1</sup> Winita Yonthanthum<sup>1</sup> and Aiyared Iampan<sup>2</sup>

<sup>1</sup>Division of Computational Science, Faculty of Science, Prince of Songkla University, Hat Yai, Songkhla 90110, Thailand

E-mail: asimuen96@gmail.com, ronnason.c@psu.ac.th, winita.m@psu.ac.th

<sup>2</sup>Department of Mathematics, School of Science, University of Phayao, Mae Ka, Mueang, Phayao 56000, Thailand

E-mail: aiyared.ia@up.ac.th

### Abstract

In this conference, we study picture  $\mathcal{N}$ -structures and apply it to semigroups. Moreover, we define picture  $\mathcal{N}$ -ideals in semigroups and investigate several properties of these ideals in semigroups.

**Keywords:**  $\mathcal{N}$ -sets, picture  $\mathcal{N}$ -structures, picture  $\mathcal{N}$ -ideals.

**2020 MSC:** 03E72.

---

†Speaker



## Some representations of ordered semigroups

Somsak Lekkoksung<sup>1</sup>, Aiyared Iampan<sup>2</sup>, Pongpun Julatha<sup>3</sup>, and Nareupanat Lekkoksung<sup>1,†</sup>

<sup>1</sup>Division of Mathematics, Faculty of Engineering, Rajamangala University of Technology Isan, Khon Kaen Campus, Khon Kaen 40000, Thailand

E-mail: lekkoksung.somsak@hotmail.com and nareupanat.le@rmuti.ac.th

<sup>2</sup>Fuzzy Algebras and Decision-Making Problems Research Unit, Department of Mathematics, School of Science, University of Phayao, Phayao 56000, Thailand

E-mail: aiyared.ia@up.ac.th

<sup>3</sup>Department of Mathematics, Faculty of Science and Technology, Pibulsongkram Rajabhat University, Phitsanulok 65000, Thailand

E-mail: pongpun.j@psru.ac.th

### Abstract

The concept of fuzzy ideals in ordered semigroups has been studied since 2002 by Kehayopulu and Tsingelis. After their studies, several generalized notions of fuzzy ideals in ordered semigroups have been widely investigated nowadays. The idea of  $(\alpha, \beta)$ -fuzzy ideals is one of them. This talk addresses why such a generalization of fuzzy ideals in ordered semigroups is significant.

**Keywords:** ordered semigroup, fuzzy ordered semigroup, representation.

**2020 MSC:** 06F05, 08A72, 20M12.

## Quasi-ideals on the direct product of two semigroups

Thawhat Changphas<sup>†</sup>

Department of Mathematics, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand  
E-mail: thacha@kku.ac.th

### Abstract

Let  $a$  and  $b$  be two elements in semigroups  $S_1$  and  $S_2$ , respectively. The purpose of this talk is to give necessary and sufficient conditions when  $Q((a, b)) = Q(a) \times Q(b)$  and  $Q_{(a,b)} = Q_a \times Q_b$ .

---

<sup>†</sup>Speaker

## The partial algebras of completely expanded terms

Thodsaporn Kumduang<sup>1,†</sup>, Khwancheewa Wattanatripop<sup>2</sup>

<sup>1</sup>Department of Mathematics, Faculty of Science and Technology,  
Rajamangala University of Technology Rattanakosin, Nakhon Pathom 73170, Thailand  
E-mail: thodsaporn.kum@rmutr.ac.th

<sup>2</sup>Department of Mathematics, Faculty of Science and Agricultural Technology,  
Rajamangala University of Technology Lanna, Chiang Mai 50200, Thailand  
E-mail: khwancheewa.wat@rmutl.ac.th

### Abstract

A term which is a formal expression defined by variables and operation symbols can be described by tree diagram. The class of terms under which the longest distance from the root to each vertex is equal is called completely expanded. In this work, we consider the partial many-sorted operation defined on the family of all completely expanded terms of type  $\tau$  and construct the partial system satisfying the clone axioms.

**Keywords:** partial system, term, operation, clone, weak homomorphism .

**2020 MSC:** 08A05, 08A60, 08B20, 20N15.

# Regularity of generalized hypersubstitutions for algebraic systems

Pornpimol Kunama<sup>1,†</sup> and Sorasak Leeratanavalee<sup>2</sup>

<sup>1</sup> Faculty of Science and Agricultural Technology, Rajamangala University of Technology Lanna, Chiang Rai 57120, Thailand

E-mail: pornpimol@rmutl.ac.th

<sup>2</sup> Research Group in Mathematics and Applied Mathematics, Department of Mathematics, Faculty of Science, Chiang Mai University, Chiang Mai 50200, Thailand

E-mail: sorasak.l@cmu.ac.th

## Abstract

The concept of a generalized hypersubstitution for algebraic systems of type  $(\tau, \tau')$  is an extension of the concept of a generalized hypersubstitution for universal algebra of type  $\tau$ . The set of all generalized hypersubstitutions for algebraic systems of type  $(\tau, \tau')$  together with a binary operation defined on the set and its identity forms a monoid. The properties of this structure are expressed by terms and formulas. In this paper, we study the semigroup properties of the monoid of type  $((n), (m))$  for arbitrary natural numbers  $n, m \geq 2$ . In particular, we characterized the idempotent as well as regular elements in this monoid.

**Keywords:** Hypersubstitutions, generalized hypersubstitutions, algebraic systems, regular elements.

**2020 MSC:** 20M07, 08B15, 08B25.

# Algebras of Full Terms Constructed from Transformations with Fixed Set

Khwancheewa Wattanatirpop<sup>1,†</sup>, Thawat Changphas<sup>2</sup>, and Thodsaporn Kumduang<sup>3</sup>

<sup>1</sup>Department of Mathematics, Faculty of Science and Agricultural Technology, Rajamangala University of Technology Lanna, Chiang Mai 50300, Thailand

E-mail: khwancheewa.wat@rmucl.ac.th

<sup>2</sup>Department of Mathematics, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

E-mail: thacha@kku.ac.th

<sup>3</sup>Department of Mathematics, Faculty of Science and Technology, Rajamangala University of Technology Rattanakosin, Nakhon Pathom 73170, Thailand

E-mail: thodsaporn.kum@rmutr.ac.th

## Abstract

Based on the notion of full transformations with fixed set, in this paper, we present a novel concept of  $n$ -ary  $Fix(I_n, Y)$ -full terms. This term can be considered as a generalization of strongly full terms, permutational full terms and full terms. Together with the superposition operation, one can form a Menger algebra of rank  $n$ . The freeness of such algebra with respect to a variety of algebras of the same types is discussed. Furthermore, we apply hypersubstitution theory to define a  $Fix(I_n, Y)$ -full closed identity, a  $Fix(I_n, Y)$ -full closed variety and present some concrete examples.

**Keywords:** transformations with fixed set, full term, strongly full term, permutational full term, Menger algebra, hypersubstitution.

**2020 MSC:** 08B15, 08A62.

# Semigroups of an Inductive Composition of Tree Languages

Bunlong Lang<sup>†</sup>, Pongsakorn Kitpratyakul, and Bundit Pibaljommee

Department of Mathematics, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand  
E-mail: bunlong.l@kkumail.com; pongsakorn.k@kkumail.com; banpib@kku.ac.th

## Abstract

Let  $W_\tau(X_n)$  denote the set of all  $n$ -ary terms of type  $\tau$ . Each element of  $\mathcal{P}(W_\tau(X_n))$  is called a tree language. Let  $W_\tau^r(X_n)$  be a subset of  $W_\tau(X_n)$  which contains all  $n$ -ary terms of type  $\tau$  except all proper subterms of a fixed term  $r$ . With an  $r$ -inductive product,  $W_\tau^r(X_n)$  forms a semigroup of an inductive composition of term. The generalization of such operation on tree languages is called an  $r$ -inductive product of tree languages. This operation is not associative on  $\mathcal{P}(W_\tau(X_n))$ , but on its subset  $\mathcal{P}(W_\tau^r(X_n))$ . In this work, we define a new semigroup of languages with an inductive composition operation and study its the algebraic structures including idempotent elements and regular elements.

**Keywords:** tree languages, inductive composition of tree languages, inductive product of tree languages, idempotent elements, regular elements

**2020 MSC:** 08A70, 08A40, 20M10.

---

<sup>†</sup>Speaker

# Regularity of the Semigroup of Transformations Preserving a Length

Worachead Sommanee<sup>1,†</sup>

<sup>1</sup>Department of Mathematics and Statistics, Faculty of Science and Technology, Chiang Mai Rajabhat University, Chiang Mai 50300, Thailand;  
E-mail: worachead\_som@cmru.ac.th

## Abstract

Let  $X_n = \{1, 2, \dots, n\}$  be a finite set ( $n \geq 2$ ) and  $T_n$  the full transformation semigroup on  $X_n$ . For  $l \in \{1, 2, \dots, n-1\}$ , we introduce the new transformation subsemigroups of  $T_n$  defined by

$$T_n(l) = \{\alpha \in T_n : \forall x, y \in X_n, |x - y| = l \Rightarrow |x\alpha - y\alpha| = l\}$$

and

$$T_n^*(l) = \{\alpha \in T_n : \forall x, y \in X_n, |x - y| = l \Leftrightarrow |x\alpha - y\alpha| = l\}.$$

Of course,  $T_n^*(l)$  is a subsemigroup of  $T_n(l)$ . In this talk, we give a necessary and sufficient condition for  $T_n(l)$  to be regular. Moreover, we prove that  $T_n^*(l)$  is a regular semigroup.

**Keywords:** regularity, transformations, preserve a length

**2020 MSC:** 20M20.

## On the maximal subsemigroups and rank properties of certain semigroups of partial injective contractions of a finite chain

Muhammad Mansur Zubairu<sup>1</sup> and Nasiru Mohammed Mangga<sup>2,†</sup>

<sup>1</sup>Department of Mathematical Sciences, Bayero University Kano, P. M. B. 3011, Kano, Nigeria  
E-mail: mmzubairu.mth@buk.edu.ng

<sup>2</sup>Department of Mathematics and Computer Science, Borno State University, P. M. B. 1122, Njimitilo Maiduguri, Nigeria  
E-mail: nasirumangga@bosu.edu.ng

### Abstract

Let  $[n] = \{1, 2, \dots, n\}$  be a finite chain and let  $\mathcal{CI}_n$  be the semigroup of partial injective contractions on  $[n]$ . Denote  $\mathcal{ODDP}_n$ ,  $\mathcal{ODCI}_n$  and  $\mathcal{OCI}_n$  to be the semigroups of "order-preserving order-decreasing partial isometries, order-preserving order-decreasing and order-preserving injective partial contractions", respectively. In this paper, we characterize all the maximal subsemigroups of  $\mathcal{ODDP}_n$ ,  $\mathcal{ODCI}_n$  and  $\mathcal{OCI}_n$  respectively, we also characterise the Green's relations and the Starred analogues in  $\mathcal{ODCI}_n$  and further investigate its rank properties.

**Keywords:** patial injectice contraction on a finite chain, maximal subsemigroups, rank of a semigroup.

---

†Speaker



## On the subsemigroups of full contraction mappings of a finite chain

Muhammad Mansur Zubairu<sup>1</sup> and Abubakar Jibrin<sup>2,†</sup>

<sup>1</sup>Department of Mathematical Sciences, Bayero University Kano, P.M.B. 3011, Kano, Nigeria  
E-mail:mmzubairu.mth@buk.edu.ng

<sup>2</sup>Department of Mathematical Sciences, Bayero University Kano, P.M.B. 3011, Kano, Nigeria  
E-mail:sadiqjibril170@gmail.com

### Abstract

Let  $[n] = \{1, 2, \dots, n\}$  be a finite chain and  $CT_n$  be the semigroup of full contraction mappings on  $[n]$ . Denote  $DCT_n, OCT_n, ORCT_n$  and  $ODCT_n$  be the subsemigroups of order-decreasing, order-preserving, order-preserving or order-reversing and order-decreasing order-preserving full contraction mappings, respectively. In this paper, we characterize the generalized Green's relations for the semigroups  $CT_n, DCT_n, OCT_n, ORCT_n$  and  $ODCT_n$ . Moreover we further investigate that  $OCT_n$  and  $ORCT_n$  are weakly abundant semigroups..

**Keywords:** Full Contractions maps on chain, weakly abundant semigroup, contractive refinement, contractive convex refinement.

## On the combinatorial and rank properties of certain subsemigroups of full contractions of a finite chain

Muhammad Mansur Zubairu<sup>1,†</sup>, Abdullahi Umar<sup>2,3</sup>, and Muhammad Jada Aliyu<sup>3</sup>

<sup>1</sup>Department of Mathematics, Faculty of Physical Science, Bayero University Kano, Nigeria  
E-mail:mmzubairu.mth@buk.edu.ng

<sup>2</sup>Department of Mathematics and Computer Science, Khalifa University, P. O. Box 127788, Sas al Nakhl, Abu Dhabi, UAE

E-mail:abdullahi.umar@ku.ac.ae

<sup>3</sup>Department of Mathematics, and Computer Sciences, Sule Lamido University, Kafin Hausa, Nigeria  
E-mail:muhammadaliyu2@nda.edu.ng

### Abstract

Let  $[n] = \{1, 2, \dots, n\}$  be a finite chain and let  $\mathcal{CT}_n$  be the semigroup of full contractions on  $[n]$ . Denote  $\mathcal{ORCT}_n$  and  $\mathcal{OCT}_n$  to be the subsemigroup of order preserving or reversing and the subsemigroup of order preserving full contractions, respectively. It was shown in [?] that the collection of all regular elements (denoted by  $\text{Reg}(\mathcal{ORCT}_n)$  and  $\text{Reg}(\mathcal{OCT}_n)$ , respectively) and the collection of all idempotent elements (denoted by  $\text{E}(\mathcal{ORCT}_n)$  and  $\text{E}(\mathcal{OCT}_n)$ , respectively) of the subsemigroups  $\mathcal{ORCT}_n$  and  $\mathcal{OCT}_n$ , respectively are subsemigroups. In this paper, we study some combinatorial and rank properties of these subsemigroups.

**Keywords:** ull Contractions maps on chain, regular element, idempotents, rank properties.

**2020 MSC:** 20M20.

# On The Relative Rank of Orientation-preserving or Orientation-reversing Transformation Semigroups with Restricted Range

Krittapon Chaikan<sup>1,†</sup>, Aniruth Phon-On<sup>1</sup>, and Kittisak Tinpun<sup>1</sup>

<sup>1</sup>Department of Mathematics and Computer Science, Faculty of Science and Technology, Prince of Songkla University, Pattani Campus, Pattani 94000, Thailand

E-mail: prabchaikan@gmail.com, aniruth.p@psu.ac.th, and kittisak.ti@psu.ac.th

## Abstract

The relative rank of a semigroup  $S$  modulo a non-empty set  $A$  is the minimal size (cardinality) of a non-empty set  $B$  such that  $A \cup B$  generates  $S$  where  $A$  and  $B$  are subsets of  $S$ . It is denoted by  $rank(S : A) := \min\{|B| \mid \langle A \cup B \rangle = S \text{ and } A, B \subseteq S\}$ . Let  $X$  be a finite chain and  $Y$  be a subchain of  $X$ . In this talk, we mention about  $\mathcal{T}(X, Y)$  the semigroup of all full transformation with restricted range. In addition, we study all subsemigroups of  $\mathcal{T}(X, Y)$  and find the relative rank of the semigroup  $\mathcal{OPR}(X, Y)$  of all orientation-preserving or orientation-reversing transformations modulo the semigroup  $\mathcal{OD}(X, Y)$  of all order-preserving or order-reversing transformations.

**Keywords:** relative rank, orientation-preserving, orientation-reversing, order-reversing.

**2020 MSC:** 20M20, 20M15.

# On Metric Dimension of Cayley Digraphs of Rectangular Groups

Denpong Pongpipat<sup>1,†</sup>, Nuttawoot Nupo<sup>2</sup>

<sup>1</sup>Department of Mathematics, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand  
E-mail: denpong\_p@kkumail.com

<sup>2</sup>Department of Mathematics, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand  
E-mail: nuttanu@kku.ac.th

## Abstract

A vertex  $x$  in a digraph  $\Gamma$  is said to resolve a pair  $u, v$  of vertices of  $\Gamma$  if the distance from  $u$  to  $x$  does not equal the distance from  $v$  to  $x$ . A set  $W$  of vertices of  $\Gamma$  is a resolving set for  $\Gamma$ , if every pair of vertices of  $\Gamma$  is resolved by a vertex of  $W$ . The smallest cardinality of a resolving set for  $\Gamma$ , denoted by  $\dim(\Gamma)$ , is called the metric dimension for  $\Gamma$ . In this research, we investigate the metric dimension  $\dim(\text{Cay}(S, A))$  of the Cayley digraphs of rectangular groups  $S$  with various connection sets  $A$ .

**Keywords:** Metric dimensions, Cayley digraphs, Rectangular groups.

**2020 MSC:** 05C25, 05C35, 05C50.

## Extension of Haar's theorem

Jaturon Wattanapan<sup>1,†</sup>, Watchareepan Atiponrat<sup>2</sup>, Santi Tasena<sup>2</sup>, and Teerapong Suksumran<sup>2</sup>

<sup>1</sup>Doctoral Program in Mathematics, Graduate School, Chiang Mai University, Chiang Mai 50200, Thailand  
E-mail: jaturon\_watt@cmu.ac.th

<sup>2</sup>Department of Mathematics, Research Group in Mathematics and Applied Mathematics, Faculty of Science, Chiang Mai University, Chiang Mai 50200, Thailand

E-mail: watchareepan.a@cmu.ac.th

E-mail: santi.tasena@cmu.ac.th

E-mail: teerapong.suksumran@cmu.ac.th

### Abstract

Haar's theorem ensures a unique nontrivial regular Borel measure on a locally compact Hausdorff topological group, up to multiplication by a positive constant. In this work, we extend Haar's theorem to the case of locally compact Hausdorff strongly topological gyrogroups. We simultaneously prove the existence and uniqueness of a Haar measure on a locally compact Hausdorff strongly topological gyrogroup, using the method of Steinlage. As an application of this result, we study some properties of a convolution-like operation on the space of Haar integrable functions defined on a locally compact Hausdorff strongly topological gyrogroup.

**Keywords:** Haar measure, topological gyrogroup, uniformizable space, Haar integral, convolution.

**2010 MSC:** 28C10, 20N05, 54E15, 43A05.

## On $S$ - $M$ -cyclic submodules

Samruam Baupradist<sup>†</sup>

Department of Mathematics and Computer Science, Faculty of Science, Chulalongkorn University, Bangkok 10330, Thailand  
E-mail: samruam.b@chula.ac.th

### Abstract

In this paper, we introduce  $S$ - $M$ -cyclic submodules which are a generalization of  $M$ -cyclic submodules. Let  $M, N$  be right  $R$ -modules and  $S$  a multiplicatively closed subset of a ring  $R$ . A submodule  $A$  of  $N$  is said to be an  $S$ - $M$ -cyclic submodule if there exist  $s \in S$  and  $f \in \text{Hom}_R(M, N)$  such that  $As \subseteq f(M) \subseteq A$ . Besides giving many properties of  $S$ - $M$ -cyclic submodules, we generalize some results on  $M$ -cyclic submodules to  $S$ - $M$ -cyclic submodules. Furthermore, we characterize  $M$ -cyclic submodules in terms of  $S$ - $M$ -cyclic submodules.

**Keywords:**  $M$ -cyclic submodules,  $S$ - $M$ -cyclic submodules.

**2020 MSC:** 16D10, 16D80, 16D90.

---

<sup>†</sup>Speaker

## The coincidence of bi-hyperideals and interior hyperideals

Nuchanat Tiprachot<sup>1,†</sup> and Somsak Lekkoksung<sup>2</sup>

<sup>1,2</sup>Division of Mathematics, Faculty of Engineering, Rajamangala University of Technology Isan, Khon Kaen Campus, Khon Kaen 40000, Thailand

E-mail: <sup>1</sup>tiprachotn@gmail.com and <sup>2</sup>lekkoksung\_lekkoksung@hotmail.com

### Abstract

This talk explores the concept of ordered hypersemigroups, a generalization of ordered semigroups. Specifically, we focus on regular duo ordered hypersemigroups. Our aim is to demonstrate that hyperideals, quasi-hyperideals, bi-hyperideals, and interior hyperideals in regular duo ordered hypersemigroups all coincide.

**Keywords:** Ordered hypersemigroup, regular ordered hypersemigroup, duo ordered hypersemigroup, left (right, two-sided, quasi-, bi-, interior) hyperideal.

**2020 MSC:** 20M12, 20M17, 06F05.

## Some properties of $S$ -multiplication modules and $S$ -comultiplication modules

Kanrop Hukaew<sup>†</sup> and Samruam Baupradist

Department of Mathematics and Computer Science, Faculty of Science, Chulalongkorn University, Bangkok  
10330, Thailand  
E-mail: fairbwn@gmail.com, samruam.b@chula.ac.th

### Abstract

In this talk, we would like to study a special class of modules called  $S$ -multiplication modules introduced by D. D. Anderson et al., which is generalization of multiplication modules. In this presentation, we would like to give a counterexample of  $S$ -multiplication module which is not a multiplication module. Moreover, we will give some result concerning  $S$ -multiplication modules.

**Keywords:** multiplication modules,  $S$ -multiplication modules, comultiplication modules,  $S$ -comultiplication modules

**2020 MSC:** 13A15, 16P40



# The study on the finite dimensional Poisson modules over a Poisson algebras

Nagornchat Chansuriya<sup>1,†</sup>

<sup>1</sup>Faculty of Science, Energy and Environment, King Mongkut's University of Technology North Bangkok (Rayong Campus), Rayong 21120, Thailand  
E-mail: nagornchat.c@sciee.kmutnb.ac.th

## Abstract

A Poisson algebra  $A$  is a commutative algebra over a field  $F$  together with a bilinear map  $\{-, -\} : A \times A \rightarrow A$  such that  $(A, \{-, -\})$  is a Lie algebra and satisfies the Leibniz identity:

$$\{xy, z\} = x\{y, z\} + \{x, z\}y, \text{ for all } x, y, z \in A.$$

In this study, we focus on the Poisson algebras constructed by many researchers. We use the method of Erdmann and Wildon (2006) to determine the finite dimensional simple Poisson modules which is annihilated by each of the Poisson maximal ideals of each Poisson algebras.

**Keywords:** Poisson algebra, Poisson Modules, Poisson maximal ideal, Simple Poisson Modules.

**2020 MSC:** 16D25, 17B63.

## Some properties of $S$ -essential submodules

Poramate Sangchan<sup>†</sup> and Samruam Baupradist

Department of Mathematics and Computer Science, Chulalongkorn University, Faculty of Science, Bangkok 10330, Thailand

E-mail: poramate345@gmail.com

E-mail: samruam.b@chula.ac.th

### Abstract

In this talk, we study  $S$ -essential submodules, extending notions introduced by S. Rajae, Journal of Algebra and Related Topics (2022) which is a generalization of essential submodule. Besides giving many examples and properties of  $S$ -essential submodules, we generalize some results of essential submodules to  $S$ -essential submodules.

**Keywords:** essential submodules,  $S$ -essential submodules,  $S$ -essential monomorphism.

**2020 MSC:** 16D80, 16D10, 16D70.

# Appendix

## List of Participants

Juree Suwannasri (juree1511@gmail.com)	Surindra Rajabhat University
Nitipon Moonwichit (nitipontony@gmail.com)	Claremont Graduate University
Chadaphorn Punkumkerd (c.punkumkerd@swansea.ac.uk)	Swansea University
Monsikarn Jansrang (monsikarn.jan@mwit.ac.th)	Mahidol Wittayanusorn School
Sompob Saelee (sompob.sa@bsru.ac.th)	Bansomdejchaopraya Rajabhat University
Nitima Phrommarat (nitimachaisansuk@gmail.com)	Chiang Rai Rajabhat University
Supalak Srinin (supalaks@nu.ac.th)	Naresuan University
Rahat Tibpaeng (rahattib@gmail.com)	Arunothai Wittayakom School
Korn Kruaykitanon (korn.kru@student.mahidol.edu)	Mahidol University
Nithi Rungtanapirom (Nithi.R@chula.ac.th)	Chulalongkorn University
Sirawich Pornpipatpong (64050255@kmitl.ac.th)	King Mongkut's Institute of Technology Ladkrabang
Sarawut Therdchanthuk (saravut_belli23@hotmail.com)	Chulalongkorn University
Pakkapon Preechasilp (pakkapon.p@psru.ac.th)	Pibulsongkram Rajabhat University
Suthida Chanwarin (chanwarin.s.cu@gmail.com)	Dhonburi Rajabhat University
Supanat Sukpiriyakul (supanat.sukpiriyakul@gmail.com)	Chulalongkorn University
Thanongsak Kansai (thanongsak9894@gmail.com)	Bankhai School

Wichayaporn Jantanana (wichayaporn.jan@bru.ac.th)	Buriram Rajabhat University
Ananya Anantayasethi (ananya.a@msu.ac.th)	Maharakham University
Thaned Onnom (thaned.o@ovec.moe.go.th)	Don Bosco Technological College
Nuthawud Sungthong (nuthawud@gmail.com)	Rajamangala University of Technology Lanna
Suphawan Janphaisaeng (suphawanj@nu.ac.th)	Naresuan University
Anuson Buakhaw (otsuiq@gmail.com)	Chulalongkorn University
Arnupap Yamkaew (anupap.yamkaew43@gmail.com)	Uttaradit Rajabhat University
Songkiat Sumetkijakan (songkiat.s@chula.ac.th)	Chulalongkorn University
Muntiranee Mongkolsin (muntiranee@outlook.com)	Chulalongkorn University
Saofee Busaman (saofee.b@psu.ac.th)	Prince of Songkla University Pattani Campus
Sureeporn Chaopraknoi (sureepornc@nu.ac.th)	Naresuan University
Tuangrat Chaichana (tuangrat.c@chula.ac.th)	Chulalongkorn University
Chaiwat Namnak (Chaiwatn@nu.ac.th)	Naresuan University
Noppawit Yanpaisan (nop_math@hotmail.com)	Chulalongkorn University
Kanokwan Sawangsup (kanokwan.sws@gmail.com)	Rajamangala University of Technology Lanna
Supaporn Suksern (supapornsu@nu.ac.th)	Naresuan University
Benchawan Sookcharoenpinyo (benchawans@nu.ac.th)	Naresuan University
Rattanakarn Khomson (bim2401@gmail.com)	Rajamangala University of Technology Lanna

Chollawat Pookpienlert (chollawat.po@gmail.com)	Rajamangala University of Technology Lanna
Koonthaleerat Pimpila (koonthaleerat.pim@pcru.ac.th)	Phetchabun Rajabhat University
Muhammad Mansur Zubairu (mmzubairu.mth@buk.edu.ng)	Bayero University, Kano, Nigeria
Sorasak Leeratanavalee (sorasak.l@cmu.ac.th)	Chiang Mai University
Thodsaporn Kumduang (thodsaporn.kum@rmutr.ac.th)	Rajamangala University of Technology Rattanakosin
Samruam Baupradist (samruam.b@chula.ac.th)	Chulalongkorn University
Somnuek Worawiset (wsomnu@kku.ac.th)	Khon Kaen University
Thananya Kaewnnoi (thananya.k2538@gmail.com)	Prince of Songkla University
Krittapon Chaikan (prabchaikan@gmail.com)	Prince of Songkla University Pattani Campus
Nareupanat Lekkoksung (nareupanat.le@rmuti.ac.th)	Rajamangala University of Technology Isan, Khon Kaen Campus
Kanokporn Changtong (kanokporn.c@ubu.ac.th)	Ubon Ratchathani University
Nithi Rungtanapirom (nithi.r@chula.ac.th)	Chulalongkorn University
Poramate Sangchan (poramate345@gmail.com)	Chulalongkorn University
Nagornchat Chansuriya (nagornchat.c@sciee.kmutnb.ac.th)	King's Mongkut University of Technology North Bangkok Rayong Campus
Nuchanat Tiprachot (tiprachotn@gmail.com)	Rajamangala University of Technology Isan, Khon Kaen Campus
Khwancheewa Wattanatripop (khwancheewa.wat@rmutl.ac.th)	Rajamangala University of Technology Lanna
Preeyanuch Honyam (preeyanuch.h@cmu.ac.th)	Chiang Mai University
Jaturon Wattanapan (wattanapan.jaturon@gmail.com)	Chiang Mai University

Chunya Tisklang (chunya.ti@udru.ac.th)	Udon Thani Rajabhat University
Thiti Gaketem (thiti.ga@up.ac.th)	University of Phayao
Grienggrai Rajchakit (kreangkri@mju.ac.th)	Maejo University
Pornpimol Kunama (pornpimol5331@gmail.com)	Rajamangala University of Technology Lanna Chiangrai
Anusorn Simuen (asimuen96@gmail.com)	Prince of Songkla University
Kanrop Hukaew (fairbwn@gmail.com)	Chulalongkorn University
Nasiru Mohammed Mangga (nasirumangga@bosu.edu.ng)	Borno State University (BOSU)
Warud Nakkhasen (warud.n@msu.ac.th)	Maharakham University
Jibrin Jibrin to (sadiqjibril170@gmail.com)	Bayero University, Kano
Ontima Pankoon (ontimapa@kkumail.com)	Khon Kaen University
Denpong Pongpipat (denpong_p@kkumail.com)	Khon Kaen University
Aiyared Iampan (aiyared.ia@up.ac.th)	University of Phayao
Chatsuda Chanmanee (chatsuda.chanmanee@gmail.com)	University of Phayao
Worachead Sommanee (worachead_som@cmru.ac.th)	Chiang Mai Rajabhat University
Varaporn Karnjanatawee (varaporn@mut.ac.th)	Mahanakorn University of Technology
Oravan Arunphalungsanti (oravan@mut.ac.th)	Mahanakorn University of Technology
Thanakarn Soonthornkrachang (thanakarn@mut.ac.th)	Mahanakorn University of Technology
Sureeporn Sungsuwan (sureeporn@mut.ac.th)	Mahanakorn University of Technology

Ampika Boonmee (ampika.boo@ku.th)	Kasetsart University Sriracha Campus
Karntita Sampanna (karntita@mut.ac.th)	Mahanakorn University of Technology
Kaboon Thongtha (kaboon@mut.ac.th)	Mahanakorn University of Technology
Kittisak Tinpun (kittisak.ti@psu.ac.th)	Prince of Songkla University Pattani Campus
Lee Sassanapitax (Lee.sa@buu.ac.th)	Burapha University
Nattapol Rachpira (nattapol_ra@kkumail.com)	Khon Kaen University
Pongsan Prakitsri (pongsan.pr@ku.th)	Kasetsart University Sriracha Campus
Ratana Srithus (srithat_r@silpakorn.edu)	Silpakorn University
Rukchart Prasertpong (rukchart.p@nsru.ac.th)	Nakhon Sawan Rajabhat University
Yuno Otsuka (yuno.ots@student.mahidol.edu)	Chulalongkorn University
Pannawit Khamrot (pannawit.k@gmail.com)	Rajamangala University of Technology Lanna
Bunlong Lang (bunlong.l@kkumail.com)	Khon Kaen University
Salihu Lawan Aliyu (sal1800061.mmt@buk.edu.ng)	Bayero University Kano, Nigeria
Wannasiri Wannasit (wannasiri.w@cmu.ac.th)	Chiang Mai University
Nares Sawatraksa (nares.sa@nsru.ac.th)	Nakhon Sawan Rajabhat University
Sasisophit Buada (sasisophit.b@nsru.ac.th)	Nakhon Sawan Rajabhat University
Sarawut Phuapong (phuapong.sa@gmail.com)	Rajamangala University of Technology Lanna
Jukkrit Daengsaen (daengsaen.j@gmail.com)	Chiang Mai University



Thawat Changphas (thacha@kku.ac.th)	Khon Kaen University
Panuwat Luangchaisri (panulu@kku.ac.th)	Khon Kaen University
Kritsada Sangkhanan (kritsada.s@cmu.ac.th)	Chiang Mai University
Bundit Pibaljommee (banpib@kku.ac.th)	Khon Kaen University
Ronnason Chinram (ronnason.c@psu.ac.th)	Prince of Songkla University
Teerapong Suksumran (teerapong.suksumran@cmu.ac.th)	Chiang Mai University
Songpon Sriwongsa (songpon.sri@kmutt.ac.th)	King Mongkut's University of Technology Thonburi
Chakkrid Klin-eam (chakkridk@nu.ac.th)	Naresuan University
Anak Nongmanee (anak_nongmanee@cmu.ac.th)	Nakhon Sawan Rajabhat University
Kanruethai Jeenkaew (kanruethai_jeenkaew@cmu.ac.th)	Chiang Mai University
Pattarawan Singavananda (pattarawan.pe@gmail.com)	Songkhla Rajabhat University
Saranya Hangsawat (saranya.nu@skru.ac.th)	Songkhla Rajabhat University
Panyuth Noipinit (panyuth@gmail.com)	
Patiwet Boonpeng (patiwet.boonpeng@gmail.com)	

## Organizing committee

Prof. Dr.Sorasak Leeratanavalee	Chiang Mai University
Asst. Prof. Dr.Sarawut Phuapong	Rajamangala University of Technology Lanna
Dr.Thodsaporn Kumduang	Rajamangala University of Technology Rattanakosin
Dr.Khwancheewa Wattanatripop	Rajamangala University of Technology Lanna
Mr.Anak Nongmanee	Nakhon Sawan Rajabhat University
Ms.Kanruethai Jeenkaew	Chiang Mai University