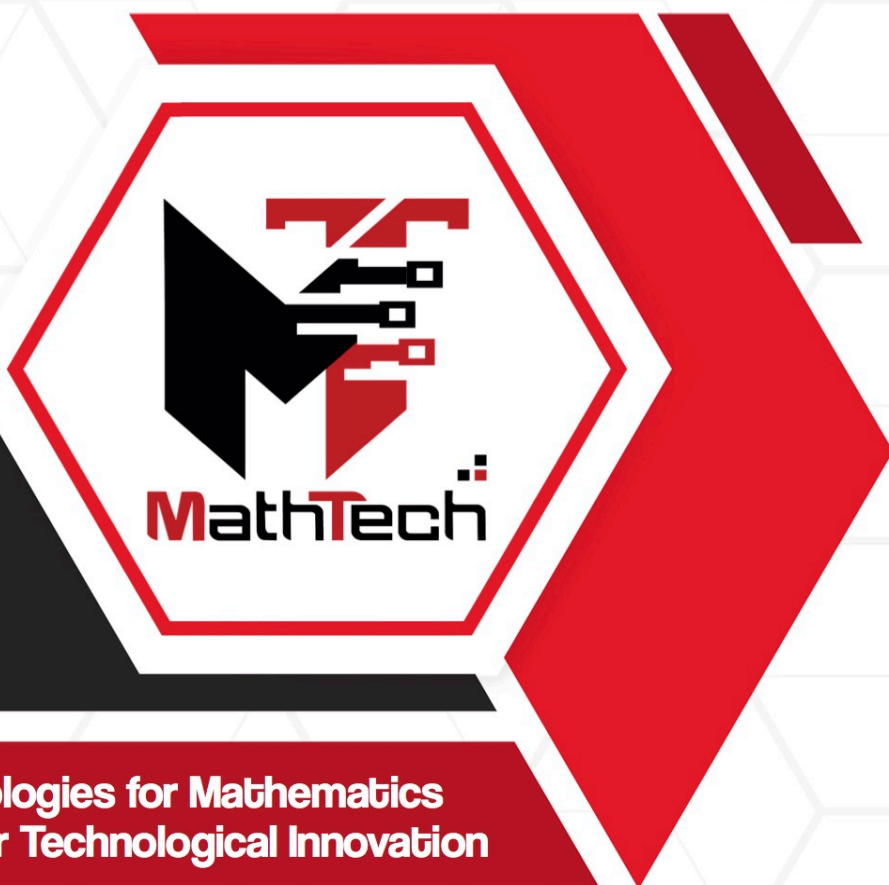# Math Tech 2018

International Conference on Mathematical Sciences and Technology 2018

MathTech

Innovative Technologies for Mathematics & Mathematics for Technological Innovation

10 - 12 December 2018
Hotel Equatorial Penang, Malaysia

CONTENTS

FOREWORD

Professor Datuk Dr. Asma Ismail, FASc.
Vice-Chancellor
Universiti Sains Malaysia

First and foremost, on behalf of Universiti Sains Malaysia, it is a great pleasure for me to welcome all participants to the International Conference on Mathematical Sciences and Technology 2018 (MathTech 2018). I wish to extend my sincere gratitude and congratulate the School of Mathematical Sciences for their enthusiasm and determination in making this conference a success.

USM will be entering the 50th year of its establishment, with the continuing mission of being a pioneering, transdisciplinary research-intensive university that empowers future talents and enables the bottom billions to transform their socio-economic well-being. USM's motto "WE LEAD" represents the university's role in advancing knowledge, teaching, research activities and community service. USM is committed in prioritising the students' well-being by providing sufficient learning space and by creating an effective learning environment.

On another note, as one of the leading research universities in Malaysia, USM always strives towards empowering research and innovation to bring the university up to global academic standards. The chosen theme for this conference "Innovative Technologies for Mathematics & Mathematics for Technological Innovation" represents our mission perfectly. Through research, an innovation can enhance the technological development in many areas including mathematical education which in return, could benefit others. I hope that this conference will create a platform for researchers to share their knowledge and present new findings as well as innovations, and thus encouraging greater collaboration among the participants.

To end, my best wishes to the presenters and participants. I also wish all participants an enjoyable stay in the beautiful Penang island as well.

Thank You.

Professor Datuk Dr. Asma Ismail, FASc.

FOREWORD

Professor Dr. Hailiza Kamarulhaili
Dean, School of Mathematical Sciences
Universiti Sains Malaysia

I am pleased to welcome our plenary speakers, invited speakers, presenters and all participants from countries across the world to MathTech 2018. MathTech 2018 serves as an international convention that brings together all researchers, academia and industries to share and exchange ideas through a plethora of sessions and discussions. This gathering is also a platform to bridge the gap between the academia at the tertiary level and those at the pre-university level and secondary school. Most importantly, MathTech 2018 is here to support and promote the Science, Technology, Engineering and Mathematics (STEM) agenda for the country as well as for STEM's global agenda.

MathTech 2018 is meant to be a pool that unites all current issues related to Pure Mathematics, Applied Mathematics, Mathematics Education, Financial Mathematics, Statistics, Operations Research, Mathematics & Technology, and other related disciplines in Mathematics. It is hoped that the knowledge shared among the researchers and participants would benefit the entire community, locally and globally. MathTech 2018 aims to bring together ideas that connect people to the fourth industrial revolution. No doubt Mathematics plays a very important role in the realization of the new era of digital age. The developments of software, data analytics and data sciences require sound and strong foundations in Mathematics and Statistics.

The use of technology in teaching and learning Mathematics is now widespread. The teaching methodology has to be in line with the current tools available that offers a new learning experience. Innovative and creative teaching has been a focus in the recent years and MathTech 2018, serves as an agent of change to what is commonly practiced as a traditional way of teaching and learning. Now, the challenge is not just to innovate teaching and learning but also to redefine abstract mathematical concepts in a way that will help people realize concepts in a more concrete and imaginative manner.

I would also like to take this opportunity to express my sincere appreciation to all those who have contributed towards the organisation of this conference, especially to the MathTech 2018 team, my deepest gratitude goes to you. I thank you all for the continuous support and tremendous effort towards making this event a success.

Thank You.

Everything makes sense with Math@USM

Professor Dr. Hailiza Kamarulhaili

FOREWORD
Dr. Yazariah Mohd Yatim
Chair
MathTech 2018

Welcome to MathTech 2018!

As educators, we commonly encounter the question - why the need to learn mathematics? There might be several ways to answer this question. Perhaps one way is to emphasise the role of mathematics that is central to our life - mathematics spurs the innovation of technology. Early Muslim scholars integrated spherical trigonometry, geography and astronomy to determine the Qiblah or bearing to Ka'bah in Mecca from any point on earth, which then led to the innovation of the Qiblah indicator. Today, mathematics is omnipresent in our daily lives without most of us realising it. Mathematics is the driver to virtually all of today's technologies and processes: digital computer, medical imaging, movie animation, security encryption system, climate change projection, financial market and risk analysis, to name a few. MathTech 2018 seeks to foster new mathematics for tomorrow's technology.

MathTech 2018 also seeks to address the use of technology in enhancing teaching and learning. Educators still grapple with certain issues in the shift of classroom dynamics and the efficient use of technology. This conference engages the many important issues. On behalf of the MathTech 2018 committee, I sincerely hope that all delegates find this conference to be rewarding and inspiring.

I wish to also take this opportunity to express my gratitude to my fellow comrades in the MathTech 2018 organising committee who have shown great dedication in making this conference a success. A special thank you to all the sponsors, especially Statworks, who have kindly contributed to the conference. My sincere gratitude also goes to all speakers, presenters and participants for being here and helping to shape, influence and direct future research and innovations in mathematics.

Wishing you a pleasant stay in Penang!
Terima kasih.

Dr. Yazariah Mohd Yatim

CONFERENCE PROGRAMME
INTERNATIONAL CONFERENCE ON MATHEMATICAL SCIENCES AND TECHNOLOGY 2018
MATHTECH 2018
10 – 12 DECEMBER 2018

	Day 0 | 9 Dec 2018	
18:00 – 21:00	Early Registration	*Fountain Terrace*

	Day 1 | 10 Dec 2018	
08:00 – 08:45	Registration	*Matahari Foyer*
08:45 – 09:00	Welcome Speech	*Matahari Ballroom*
09:00 – 10:00	**Plenary Session 1**	*Matahari Ballroom*
10:00 – 10:20	Photography Session	*Matahari Ballroom*
10:20 – 10:40	Refreshment	*Matahari Foyer*
10:40 – 11:40	**Plenary Session 2**	*Matahari Ballroom*
11:40 – 12:40	**Plenary Session 3**	*Matahari Ballroom*
12:40 – 14:00	Lunch	*Etoile Room*
14:00 – 16:00	**Invited Session 1**	*Matahari Ballroom II*
	Invited Session 2	*Matahari Ballroom II*
	PERCEPTRON – A Smart Data Science Platform for Education	
		Matahari Ballroom II
	Parallel Sessions 1	*1A - Matahari Ballroom I*
		1B - Matahari Ballroom III
		1C - Mawar Room
		1D - Melati Room
16:00 – 16:20	Refreshment	*Matahari Foyer*
16:20 – 18:00	**Workshop 1**	*Matahari Ballroom I*
	A Data Statistics Journey with TIBCO Statistica	
		Matahari Ballroom I
	Parallel Sessions 2	*2A - Matahari Ballroom II*
		2B - Matahari Ballroom III
		2C - Mawar Room
		2D - Melati Room
19:45 – 22:30	**Opening Ceremony** Dinner	*Matahari Ballroom*

| Day 2 | 11 Dec 2018 |

08:20 – 10:20	**Invited Session 3**	*Matahari Ballroom II*
	Workshop 2	*Raya Room*
	Parallel Sessions 3	*3A - Matahari Ballroom I*
		3B - Matahari Ballroom II
		3C - Matahari Ballroom III
		3D - Mawar Room
10:20 – 10:40	Refreshment	*Matahari Foyer*
10:40 – 12:40	**Workshop 3**	*Matahari Ballroom I*
	Workshop 4	*Raya Room*
	Parallel Sessions 4	*4A - Matahari Ballroom II*
		4B - Matahari Ballroom III
		4C - Mawar Room
12:40 – 14:00	Lunch	*Etoile Room*
14:00 – 16:00	**Parallel Sessions 5**	*5A - Matahari Ballroom I*
		5B - Matahari Ballroom II
		5C - Matahari Ballroom III
		5D - Mawar Room
		5E - Raya Room
16:00 – 16:20	Refreshment	*Matahari Foyer*
16:20 – 18:00	**Workshop 5**	*Raya Room*
	Parallel Sessions 6	*6A - Matahari Ballroom I*
		6B - Matahari Ballroom II
		6C - Matahari Ballroom III
		6D - Mawar Room

Day 3	12 Dec 2018

08:20 – 10:20	**Workshop 6** **Parallel Sessions 7**	*Matahari Ballroom I* *7A - Matahari Ballroom II* *7B - Matahari Ballroom III* *7C - Mawar Room* *7D - Raya Room*
10:20 – 10:40	Refreshment	*Matahari Foyer*
10:40 – 12:40	**Workshop 7** **Parallel Sessions 8**	*Matahari Ballroom I* *8A - Matahari Ballroom II* *8B - Matahari Ballroom III* *8C - Mawar Room* *8D - Raya Room*
12:40 – 14:00	Lunch	*Matahari Foyer*
14:00 – 16:20	**Workshop 8** **Parallel Sessions 9**	*Matahari Ballroom I* *9A - Matahari Ballroom II* *9B - Matahari Ballroom III* *9C - Mawar Room* *9D - Raya Room*
16:20 – 16:30	Closing Remark	*Matahari Ballroom II*
16:30 – 16:50	Refreshment	*Matahari Foyer*

DAY 1 – 10 DEC 2018

08:00 – 08:45: Registration

08:45 – 09:00: Welcome Speech

Time	Matahari Ballroom
09:00 – 10:00	Plenary Session 1 **QMH Prof. Dr. M. Ataharul Islam**

10:00 – 10:20: Photography Session

10:20 – 10:40: Refreshment

Time	Matahari Ballroom
10:40 – 11:40	Plenary Session 2 **Assoc. Prof. Dr. Tan Seng Chee**
11:40 – 12:40	Plenary Session 3 **Prof. Dr. Mohamed Ridza Wahiddin**

12:40 – 14:00: Lunch

14:00 – 16:00: Invited Session 1 + Invited Session 2 + Parallel Sessions 1

Time	Matahari Ballroom I (Session 1A)	Matahari Ballroom II	Matahari Ballroom III (Session 1B)	Mawar Room (Session 1C)	Melati Room (Session 1D)
14:00 – 14:20	AM22	Invited Session 1 **Dr. Ng Wee Leng**	PM17	ST29	IM17
14:20 – 14:40	AM15		PM09	ST25	IM02
14:40 – 15:00	AM66	Invited Session 2 **Dr. Lee Wen Jau**	PM10	ST07	ME13
15:00 – 15:20	AM61		PM07	ST23	ME03
15:20 – 15:40	AM43	*PERCEPTRON – A Smart Data Science Platform for Education*	PM16	ST19	IM19
15:40 – 16:00	AM63		PM01	FM15	IM09

16:00 – 16:20: Refreshment

16:20 – 18:00: Workshop 1 + Parallel Sessions 2

Time	Matahari Ballroom I	Matahari Ballroom II (Session 2A)	Matahari Ballroom III (Session 2B)	Mawar Room (Session 2C)	Melati Room (Session 2D)
16:20 – 16:40	Workshop 1 *Mathematical Problem Solving with TI-Nspire CX CAS*	MT06	FM09	OR12	IM01
16:40 – 17:00		MT03	FM16	OR17	IM18
17:00 – 17:20		MT08	FM04	OR16	IM16
17:20 – 17:40	*A Data Statistics Journey with TIBCO Statistica*	MT09	FM03	OR13	ME09
17:40 – 18:00				OR08	ME01

19:45 – 22:30: Opening Ceremony + Dinner

DAY 2 – 11 DEC 2018

08:20 – 10:20: Invited Session 3 + Workshop 2 + Parallel Sessions 3

Time	Matahari Ballroom I (Session 3A)	Matahari Ballroom II (Session 3B)	Matahari Ballroom III (Session 3C)	Mawar Room (Session 3D)	Raya Room
08:20 – 08:40	AM71	ME02	AM37	PM05	
08:40 – 09:00	AM62	ME05	AM26	PM15	
09:00 – 09:20	AM42	ME06	AM29	PM21	Workshop 2
09:20 – 09:40	AM49	ME08	AM46	PM22	*Introduction to Latex*
09:40 – 10:00	AM38	Invited Session 3 **Prof. Dr. Dan Seth**	AM47	PM14	
10:00 – 10:20	AM55		AM33	PM12	

10:20 – 10:40: Refreshment

10:40 – 12:40: Workshop 3 + Workshop 4 + Parallel Sessions 4

Time	Matahari Ballroom I	Matahari Ballroom II (Session 4A)	Matahari Ballroom III (Session 4B)	Mawar Room (Session 4C)	Raya Room
10:40 – 11:00	Workshop 3 *Stem Practices with TI-Nspire Technology + Explore Ratios and Scales with Graphing Calculators*	ST26	AM31	MT04	
11:00 – 11:20		ST08	AM25	MT15	
11:20 – 11:40		ST04	AM06	MT02	Workshop 4
11:40 – 12:00		ST17	AM04	MT14	*Get Started with Python*
12:00 – 12:20		ST14	AM52	MT05	
12:20 – 12:40		ST18	AM03	MT10	

12:40 – 14:00: Lunch

14:00 – 16:00: Parallel Sessions 5

Time	Matahari Ballroom I (Session 5A)	Matahari Ballroom II (Session 5B)	Matahari Ballroom III (Session 5C)	Mawar Room (Session 5D)	Raya Room (Session 5E)
14:00 – 14:20	ME07	OR18	AM21	FM07	IM06
14:20 – 14:40	ME10	OR06	AM12	FM05	IM07
14:40 – 15:00	ME14	OR01	AM68	FM14	IM12
15:00 – 15:20	ME11	OR03	AM23	ST22	IM11
15:20 – 15:40	ME12	OR11	AM17	FM02	IM05
15:40 – 16:00	ME04	OR07	AM09	FM06	IM08

16:00 – 16:20: Refreshment

16:20 – 18:00: Workshop 5 + Parallel Sessions 6

Time	Matahari Ballroom I (Session 6A)	Matahari Ballroom II (Session 6B)	Matahari Ballroom III (Session 6C)	Mawar Room (Session 6D)	Raya Room
16:20 – 16:40	ST24	PM04	AM36	AM35	
16:40 – 17:00	ST15	PM08	AM39	AM44	Workshop 5
17:00 – 17:20	ST12	PM18	AM50	AM45	*Math Made Easy with Technology*
17:20 – 17:40	ST09	PM13	AM41	AM64	
17:40 – 18:00	ST10	PM23	AM69	AM01	

DAY 3 – 12 DEC 2018

08:20 – 10:20: Workshop 6 + Parallel Sessions 7

Time	Matahari Ballroom I	Matahari Ballroom II (Session 7A)	Matahari Ballroom III (Session 7B)	Mawar Room (Session 7C)	Raya Room (Session 7D)
08:20 – 08:40		OR19	AM70	AM28	
08:40 – 09:00	Workshop 6	ST28	AM02	AM67	MT01
09:00 – 09:20	*Gamified Mathematics for Teaching and Learning for School Students*	ST21	AM19	AM05	MT07
09:20 – 09:40		ST13	AM54	AM18	MT13
09:40 – 10:00		ST16	AM51	AM27	MT11
10:00 – 10:20		ST06	AM65	AM24	MT12

10:20 – 10:40: Refreshment

10:40 – 12:40: Workshop 7 + Parallel Sessions 8

Time	Matahari Ballroom I	Matahari Ballroom II (Session 8A)	Matahari Ballroom III (Session 8B)	Mawar Room (Session 8C)	Raya Room (Session 8D)
10:40 – 11:00		FM08	AM59	PM19	IM14
11:00 – 11:20	Workshop 7	FM13	AM53	PM06	IM04
11:20 – 11:40	*Higher Order Thinking Skills in Mathematical Problem Solving*	FM01	AM56	PM03	IM03
11:40 – 12:00		FM10	AM60	PM11	IM15
12:00 – 12:20		FM12	AM16	PM02	IM13
12:20 – 12:40		FM11	AM48	PM20	IM10

9

12:40 – 14:00: Lunch

14:00 – 16:20: Workshop 8 + Parallel Sessions 9

Time	Matahari Ballroom I	Matahari Ballroom II (Session 9A)	Matahari Ballroom III (Session 9B)	Mawar Room (Session 9C)	Raya Room (Session 9D)
14:00 – 14:20	Workshop 8 *Coaching Techniques for Mathematical Olympiad*	ST11	AM57	AM07	OR02
14:20 – 14:40		ST01	AM58	AM72	OR04
14:40 – 15:00		ST27	AM11	AM08	OR05
15:00 – 15:20		ST05	AM20	AM14	OR09
15:20 – 15:40		ST02	AM32	AM13	OR10
15:40 – 16:00		ST20	AM30	AM10	OR14
16:00 – 16:20		ST03	AM34	AM40	OR15

16:20 – 16:30: Closing Remark

16:30 – 16:50: Refreshment

Time	**Venue:** *Matahari Ballroom* **Chairperson:** *Prof. Dr. Michael Khoo Boon Chong*
09:00 – 10:00	PLENARY SESSION 1 **QMH Prof. Dr. M. Ataharul Islam** *Generalized Linear Models and Analysis of Big Data*

Time	**Venue:** *Matahari Ballroom* **Chairperson:** *Prof. Dr. Norhashidah Hj. Mohd. Ali*
10:40 – 11:40	PLENARY SESSION 2 **Assoc. Prof. Dr. Tan Seng Chee** *Learning Mathematics Through Computer-Supported Collaborative Learning (CSCL): Potentials and Challenges*

Time	**Venue:** *Matahari Ballroom* **Chairperson:** *Prof. Dr. Hailiza Kamarulhaili*
11:40 – 12:40	PLENARY SESSION 3 **Prof. Dr. Mohamed Ridza Wahiddin** *IBM Quantum Computers: Now It's Easier for Everyone to Understand Quantum Mechanics*

Time	Session 1A *Matahari Ballroom I* **Chairperson:** *Dr. Syakila Ahmad*	*Matahari Ballroom II*	Session 1B *Matahari Ballroom III* **Chairperson:** *Dr. Ng Zhen Chuan*	Session 1C *Mawar Room* **Chairperson:** *Assoc. Prof. Dr. Mohd Tahir Ismail*	Session 1D *Melati Room* **Chairperson:** *Dr. Thien Lei Mee*
14:00 – 14:20	AM22 **Petarpa Boonserm** *Solving for Schwarzschild Solution Using Variation of Parameters and Frobenius Method*	INVITED SESSION 1 *Chairperson*: *Dr. Mohd Hafiz Mohd* **Dr. Ng Wee Leng** *Use of Graphing Calculators in Teaching, Learning and Assessment in the Pre-University Mathematics Curriculum in Singapore*	PM17 **Mohd Ali Khameini Ahmad** *Chaoticity of Potts-Bethe Maps of Degree Four over Q_p*	ST29 **Faridah Abdul Halim** *Dietary Habits and Caloric Intake Among Shah Alam Residents Based on Income and Gender*	IM17 **P. H. G. Perera** *Cluster Analysis of Spatial and Temporal Distribution of Dengue Disease in Sri Lanka from 2012 to 2017*
14:20 – 14:40	AM15 **Sharmina Hussain** *Heat and Mass Transfer Response in MHD Natural Convection Flow due to Oscillating Surface Temperature and Concentration*		PM09 **Musa Josiah Marut** *The Fekete-Szego Inequalities for Memomorphic Functions Associated with Quasi-Subordination*	ST25 **Spandita Majumder** *The Classical and Bayesian Modelling on the Covariates Influencing the Psychological Disorder "Depressive Syndrome" Among the Child Patients in Hospitals of Kolkata*	IM02 **Yulita Molliq Rangkuti** *Comparison of Delayed SIR Model and SEIR Model with incubation Period for the Spread of Tuberculosis Disease in Medan*
14:40 – 15:00	AM66 **Najihah Mohamed** *Curves Fitting by Rational Cubic Bézier with C^1 and G^1 Continuity Using Metaheuristics Methods*	INVITED SESSION 2 *Chairperson*: *Prof. Dr. Low Heng Chin*	PM10 **Zhen Chuan Ng** *Bohr's Inequality for Harmonic Mappings into a Wedge Domain*	ST07 **Rahmat Al Kafi** *Forecasting Indonesian Mortality Rates Using the First Generalized Cairns-Blake-Dowd Model*	ME13 **Aziah Binti Aziz** *Cartesian Plane Exploration Using TI - Nspire in MYP IB Mathematics Classroom*

15:00 – 15:20	AM61 **Somruthai Apornsaengsawang** *A Comparison Study of the Chebyshev Collocation Method and the Finite Difference Method for Solving Fourth-Order Partial Differential Equations*	**Dr. Lee Wen Jau** *Simulation Assisted Supervised Learning for Extrapolation Prediction*	PM07 **Yao Liang Chung** *Generalization of Class 𝒰*	ST23 **Mohd Tahir Ismail** *Stock Market Forecasting Using Empirical Mode Decomposition with Holt-Winter*	ME03 **Suhaila Binti Sulong** *Mathematics Learning Activities Using TI – Nspire in Middle Year Programme International Baccalaureate (MYP IB) Classroom*
15:20 – 15:40	AM43 **Mouiyad Mahmoud Ahmad Bani Yousef** *A New Modified RMIL CG Method with Global Convergence Properties*	*PERCEPTRON – A Smart Data Science Platform for Education*	PM16 **Chuei Yee Chen** *Quasiminimizer and Its Roles in Improving Variational Principle in the Calculus of Variations*	ST19 **Gan Chew Peng** *Generalized Linear Models for Insurance Claim*	IM19 **Kathiresan Gopal** *Fuzzy Conjoint Model in Describing Malaysian Undergraduates' Perceptions of Statistics Classroom Engagement*
15:40 – 16:00	AM63 **Nur Raidah Salim** *Fuzzy Conjoint Analysis in Studying Undergraduates' Statistics Motivation*		PM01 **Ghajendran Poovanandran** *Parikh Matrices and M-Ambiguity Sequence*	FM15 **Ferren Alwie** *Risk Measurement for Insurance Sector with Credible Tail Value-at-Risk*	IM09 **Nur Farhana Hazwani Binti Abdul Shamad** *Deterministic Modelling of the Dynamic Transmission of Dengue Fever*

Time	Matahari Ballroom I	Session 2A Matahari Ballroom II **Chairperson:** Dr. Kong Voon Pang	Session 2B Matahari Ballroom III **Chairperson:** Dr. Shamsul Rijal Muhammad Sabri	Session 2C Mawar Room **Chairperson:** Assoc. Prof. Adam Baharum	Session 2D Melati Room **Chairperson:** Assoc. Prof. Dr. Lee See Keong
16:20 – 16:40	WORKSHOP 1 *Mathematical Problem Solving with TI-Nspire CX CAS* **Dr. Ng Wee Leng**	MT06 **Anusa Suwanwong** *Mathematical and Statistical Analysis for LST Trend and Variation by Using MODIS Data in the Tropical Rainforest of Hala-Bala in Narathiwat, Southern Thailand During 2002-2017*	FM09 **Siti Norafidah Mohd Ramli** *Jump Diffusion Model with Copula Dependence Structure in Defaultable Bond Pricing*	OR12 **Adam Baharum** *Using Fuzzy Linear Programming to Find the Maximum Flow Point in General Networks with Application*	IM01 **Pivumi Nisansala Bandara** *Factors Associated with Motor Difficulty for Cerebral Palsy Among Infants in Sri Lanka*
16:40 – 17:00		MT03 **Bala Gabriel Abraham** *Interpretation of High Resolution Aeromagnetic (HRAM) Data over Chibok and Damboa Chad Basin, North Eastern Nigeria, Using Potent Modelling for Hydrocarbon Potentials and Other Minerals*	FM16 **Chrisseli Lukito** *Risk Measurement for Investment and Insurance Using Tail Variance Premium and Tail Standard Deviation Premium*	OR17 **Sharifah Aishah Binti Syed Ali** *A Theoretical and Computational Comparison of Lower Bounds for the Economic Lot-Sizing with Remanufacturing and Joint Setup*	IM18 **A. Bhalraj** *Mathematical Modelling of the Spread of Leptospirosis*

17:00 – 17:20	WORKSHOP 1 *Mathematical Problem Solving with TI-Nspire CX CAS* **Dr. Ng Wee Leng**	MT08 **Nur Idalisa Norddin** *A New Sufficient Descent Conjugate Gradient Method with Exact Line Search*	FM04 **Hassilah Salleh** *Investigation of Characteristics of Agricultural Commodity in Malaysia's Crude Palm Oil Futures Prices*	OR16 **Adam Baharum** *Optimal Use of a Mixed Model for Fuzzy Programming and Integer Programming to Determine the Optimal Location for Emergency Health Services*	IM16 **Fatin Afiqah binti Muhammad Fahimi** *Relative Risk Estimation of Hepatitis B and C in Peninsular Malaysia Using Poisson-Gamma Model*
17:20 – 17:40	*A Data Statistics Journey with TIBCO Statistica*	MT09 **Nurul Hafawati Fadhilah** *New Coefficient of Three-Term Conjugate Gradient Method for solving Unconstrained Optimization Problems*	FM03 **Lim Kah Boon** *Panel Threshold Effect of Oil Prices Changes on Monetary Policy: Empirical Evidence from Oil Importing Versus Oil Exporting Countries*	OR13 **Nur Aidya Hanum Aizam** *General Mathematical Model and Scheduling Problems: Expansion and Application to Real-Time Scheduling*	ME09 **Ruei Hung Lee** *Create Engaging Mathematics Class Using Graphing Calculators*
17:40 – 18:00				OR08 **Noor Hidayah Mohd Zaki** *Comparison on Queuing Performance Measures of Multi-Server Traditional and Fuzzy Queuing Model*	ME01 **Ikusika Akintayo** *An Investigation into the Teaching Effectiveness of the Trachtenberg System of Mental Calculation*

DAY 2 ● 11 DEC 2018

Time	Session 3A *Matahari Ballroom I* ***Chairperson:*** *Dr. Norazrizal Aswad Abdul Rahman*	Session 3B *Matahari Ballroom II* ***Chairperson:*** *Dr. Hajar Sulaiman*	Session 3C *Matahari Ballroom III* ***Chairperson:*** *Dr. Mohd Shareduwan Mohd Kasihmuddin*	Session 3D *Mawar Room* ***Chairperson:*** *Dr. Maisarah Haji Mohd*	*Raya Room*
08:20 – 08:40	AM71 **Abdullahi Mohammed Baba** *Modeling Breast Cancer and Its Optimal Control*	ME02 **Norhafizan Abdul Wahab** *Learning and Facilitating the New Form 1 and Form 2 Topic of Data Handling in Statistics Using Tinkerplots*	AM37 **Saratha Sathasivam** *Activation Functions Comparison in Neuro Symbolic Integration Using Agent Based Modelling*	PM05 **Nasir Ganikhodjaev** *On Classification of the Genetic and Evolution Rock-Paper-Scissor Algebras*	WORKSHOP 2 *Introduction to LaTeX* **Dr. Ong Wen Eng** and **Dr. Siti Amirah Abdul Rahman**
08:40 – 09:00	AM62 **Suzelawati Zenian** *Intuitionistic Fuzzy Set: Application to Flat Electroencephalo-graphy Image*	ME05 **Masyithoh Md Zuber** *Exploring the Effectiveness of E-Learning in Increasing Students' Achievements in Mathematics at the Primary School Level*	AM26 **Mamman Mamuda** *A Hybridized Neural Network Models for Data with Outliers*	PM15 **Khairunnisa Jaman** *A Pursuit Differential Game in a Convex Set*	
09:00 – 09:20	AM42 **Asem Al-Nemrat** *Sumudu Transform with Modified Homotopy Perturbation Method to Solve Two Point Singularly Perturbed Boundary Value Problems*	ME06 **Syahilah Md Saleh** *Gamification in T&L of Mathematics: Teacher's Willingness in Using Quizziz as an Additional Assessment Tool*	AM29 **Wachirapond Permpoonsinsup** *Variation and Prediction of Rainy Season in Thailand Using Ensemble Neural Model*	PM21 **Azizi Bin Rosli** *On Orthogonality Preserving Cubic Stochastic Operator Defined on 1-Dimensional Simplex*	

Time					
09:20 – 09:40	**AM49** **Kee Huong Lai** *Portfolio Optimization Using Genetic Algorithm and Harmony Search Algorithm with Varying Operators and Parameters Values*	**ME08** **Rizavel Corsino-Addawe** *Analysis of the Indicators of Students' Performance in Undergraduate Mathematics Program*	**AM46** **Lee Sen Tan** *Solving Ordinary Differential Equations Using Wavelet Neural Networks*	**PM22** **Sadiq Shehu** *New Cryptanalytic Results upon Prime Power Moduli $N = p^r q$*	
09:40 – 10:00	**AM38** **Norazrizal Aswad Abdul Rahman** *Fuzzy Sumudu Decomposition Method for Solving Differential Equations with Uncertainty*	INVITED SESSION 3 *Chairperson:* *Prof. Dr. Zarita Zainuddin* **Prof. Dr. Dan Seth** *Integration of Technology in Teaching, Learning and Assessment in the Pre-University and University Mathematics Curricula of USA*	**AM47** **S. Chuenjai** *Temperatures and Normalized Difference Vegetation Index Forecasting in the Tropical Rainforest: Hala-Bala Wildlife Sanctuary, Thailand Using Artificial Neural Networks*	**PM14** **Khairun Nisak Muhammad** *Some Properties of Regular Continued Fraction Expansions Related to Certain Sequence of Integers and its Applications in Elliptic Curve Cryptography*	WORKSHOP 2 *Introduction to LaTeX* **Dr. Ong Wen Eng** and **Dr. Siti Amirah Abdul Rahman**
10:00 – 10:20	**AM55** **Chin Jia Hou** *An Ant Colony Approach in the Detection of Communities in Complex Networks*		**AM33** **Mohd Shareduwan Mohd Kasihmuddin** *Students' Performance via Satisfiability Reverse Analysis Method with Hopfield Neural Network*	**PM12** **Abdulrahman Balfaqih** *On the Diophantine Equation* $x_1^a + x_2^a + \cdots + x_m^a = p^k y^b$	

Time	Matahari Ballroom I	**Session 4A** Matahari Ballroom II **Chairperson:** Dr. Fam Pei Shan	**Session 4B** Matahari Ballroom III **Chairperson:** Dr. Syakila Ahmad	**Session 4C** Mawar Room **Chairperson:** Dr. Ong Wen Eng	Raya Room
10:40 – 11:00	WORKSHOP 3 *Stem Pratices with TI-Nspire Technology* **Puteri Anis Aneeza Zakaria** and **Nurhani Mohd Yahya** + *Explore Ratios and Scales with Graphing Calculators* **Dr. Pumadevi Sivasubramaniam** and **Nurul Shahhida Abu Bakar**	ST26 **Zakiyah Zain** *Monitoring Dengue Scenario in Malaysia Using Survival Analysis*	AM31 **Kohilavani Naganthran** *Effects of Thermal Radiation and Slip in Unsteady Stagnation-Point Flow and Heat Transfer past a Permeable Shrinking Sheet: A Stability Analysis*	MT04 **Shinya Miyajima** *A Robust Algorithm for Computing Intervals containing the Stabilizing Solutions of the Discrete-Time Algebraic Riccati Equations*	WORKSHOP 4 *Get Started with Python* **Dr. Jasy Liew Suet Yan** and **Assoc. Prof. Dr. Teh Su Yean**
11:00 – 11:20		ST08 **Zainudin Arsad** *Examining Time-varying Economic Impacts on Tourism Demand for Malaysia: a Kalman Filter Approach*	AM25 **Muhammad Asim Khan** *Application of Optimal Homotopy Asymptotic Method to Some Well-Known Linear and Nonlinear Two Point Boundary Value Problems*	MT15 **Hirohide Haga** *Solving Partial Differential Equations using Multi-Agent Modelling*	
11:20 – 11:40		ST04 **Nazrina Aziz** *Survival Analysis in Insurance Attrition*	AM06 **Nurul Ainina Redwan** *Unsteady Flow of Thin Slender Rivulets of a Newtonian Fluid on an Inclined Plane*	MT02 **Fong Thai Koay** *A New Information System for Prioritisation of Product Quality Improvement*	

		ST17 **Lim Wei Khing** *E-Commerce Usage and the Buying Behaviour of Generation Y in Malaysia*	AM04 **Abubakar Ahmed Dauda** *An Analytical Approach to Non-Darcian Couette Flow of a Generalized Second Grade Fluid Between Parallel Porous Plates*	MT14 **Shinya Miyajima** *Verification Algorithms for the Matrix Lambert W Functions*	
11:40 – 12:00	WORKSHOP 3 *Stem Pratices with TI-Nspire Technology* **Puteri Anis Aneeza Zakaria** and **Nurhani Mohd Yahya** + *Explore Ratios and Scales with Graphing Calculators* **Dr. Pumadevi Sivasubramaniam** and **Nurul Shahhida Abu Bakar**				
12:00 – 12:20		ST14 **Zakiyah Zain** *Using Survival Analysis to Assess Bankruptcies in Malaysia*	AM52 **Yusuf Buba Chukkol** *Shock Wave Propagation in Monodispersed Bubbly Viscoelastic Fluid Flow*	MT05 **Wetthasinghe Arachchige Udana Kashyapa Wetthashinghe** *Multiplatform Dengue Management Android Mobile Application*	WORKSHOP 4 *Get Started with Python* **Dr. Jasy Liew Suet Yan** and **Assoc. Prof. Dr. Teh Su Yean**
12:20 – 12:40		ST18 **Anam Javaid** *Forecast the Moisture Ratio Removal During Seaweed Drying Process Using Solar Drier*	AM03 **Nor Ain Azeany Mohd Nasir** *MHD Stagnation Point Flow over a Stretching/Shrinking Sheet with a Heat Absorption/Sink and Radiation Effects*	MT10 **Nursyahida Mohamad Hasan** *Numerical Study of the Evanescent Field Coupling Effect on Two Optical Fiber Sensors*	

Time	Session 5A *Matahari Ballroom I* **Chairperson:** *Dr. Leong Chee Kin*	Session 5B *Matahari Ballroom II* **Chairperson:** *Dr. Teh Wen Chean*	Session 5C *Matahari Ballroom III* **Chairperson:** *Dr. Ahmad Lutfi Amri Rahman*	Session 5D *Mawar Room* **Chairperson:** *Dr. Zainudin Arsad*	Session 5E *Raya Room* **Chairperson:** *Dr. Mohd Hafiz Mohd*
14:00 – 14:20	ME07 **Yue Zhao** *Technology Transform the Classroom: A Case Study of Chinese Senior School Statistics Classroom*	OR18 **Usman Waziri** *Pursuit Game with Coordinate-Wise Integral Constraints for System of Infinite Differential Equations*	AM21 **Tayyaba Akram** *An Extended Cubic B-Spline Collocation Scheme for Time Fractional Sub-Diffusion Equation*	FM07 **Kee Seng Kuang** *Universal Portfolios Generated by f-Disparity Differences*	IM06 **Anthony Meneses Pasion** *Stability and Hopf Bifurcation Analysis of SIS Epidemic Model with Latency and Nonlinear Incidence Rate*
14:20 – 14:40	ME10 **Jeyaletchumi Muthiah** *Exploring Graphs of Functions with Graphing Technology*	OR06 **Vineeta Singh** *Augmenting Operations Research Methods for Relatively Poor Farmers of India*	AM12 **Azhar Ahmad** *A Comparative Numerical Study Based on Cubic Exponential B-Splines and Finite Difference Method for the Nonlinear Schrödinger Equation*	FM05 **Zainudin Arsad** *Assessing Dynamic Linkages Between Stock Market in Malaysia and Stock Markets in the Asian Region*	IM07 **Mohd Hafiz Mohd** *Combined Effects of Prey Refuge and Death Rate of Predator on the Prey-Predator Population Dynamics*
14:40 – 15:00	ME14 **Jayaseelan Durairaj** *"Technology Embedded Self-directed Learning" a Future of Education*	OR01 **Mansur Hassan** *Modified Courant-Beltrami Penalty Function and Its Convergence*	AM68 **M Safdar** *Lie Point Algebraic Classification of Linear Third Order ODEs Using Differential Invariants*	FM14 **Cheong Huey Tyng** *Valuation of American Option with Discrete Dividend Payments*	IM12 **Nur Fariha Mohd Isa** *Sensitivity Analysis and Empirical Model Using Silica Oxide Injection in Enhanced Oil Recovery*

Time					
15:00 – 15:20	ME11 **Corrienna Abdul Talib** *Developing Student's Computational Thinking Through Graphic Calculator in STEAM Education*	OR03 **Lakmal Prabhash Ranasinghe** *Portfolio Optimization Using Weighted Historical Return Values: Investors View Approach*	AM23 **Nur Nadiah Mohd Rahan** *Cubic B-Spline Collocation Method for Solving Benjamin-Bona-Mahony Equation*	ST22 **Syerrina Binti Zakaria** *Spatial Distribution Patterns and Influencing Factors of Poverty*	IM11 **Zuhaila Ismail** *Numerical Simulation of Biomagnetic Fluid Flow in a Stenosed Bifurcated Artery*
15:20 – 15:40	ME12 **Jin Yiming** *Demonstration of Matrix Transformation with Graphing Calculator*	OR11 **Leow Soo Kar** *Optimal Routing of Tanker Trucks to Petrol Stations Using Excel*	AM17 **Nur Aliah Izzati Rosman** *B-Spline Alternating Group Explicit (BSPAGE) in Solving Heat Equation*	FM02 **Chu Jenq Fei** *Threshold Effects on Inflation on Economic Growth: Evidence from a Static Threshold Analysis for 18 Developed Economies*	IM05 **Olusola Tosin Kolebaje** *A Comparative Study of Jacobi Stability Analysis via the Kosambi-Cartan-Chern Theory and Linear Stability for Predator-Prey Models with Holling-type I, II and III Functional Responses*
15:40 – 16:00	ME04 **Younbae Jun** *Dynamic Construction of a Triangle from Three Located Points*	OR07 **Devy Mathelinea** *Inventory Optimization Model Through Nonlinear Programming and Forecasting Techniques: A Case Study*	AM09 **Azhar Iqbal** *Numerical Solution of Nonlinear Schrödinger Equation by Cubic B-Spline Galerkin Method*	FM06 **Zainudin Arsad** *Comparing Dynamic Impact of Fundamental Macroeconomic Variables on Sectoral Stock Indices in Malaysia*	IM08 **Mohd Hafiz Mohd** *Dynamical Analysis of Prey-Predator Interactions with Group Defence Using a Lotka-Volterra Model*

Time	Session 6A *Matahari Ballroom I* **Chairperson:** *Dr. Norhashidah Awang*	Session 6B *Matahari Ballroom II* **Chairperson:** *Dr. Shamani Supramaniam*	Session 6C *Matahari Ballroom III* **Chairperson:** *Dr. Md Yushalify Misro*	Session 6D *Mawar Room* **Chairperson:** *Dr. Siti Amirah Abdul Rahman*	*Raya Room*
16:20 – 16:40	ST24 **Chan Lay Guat** *A Statistical Study of Employment Insurance Scheme (EIS)*	PM04 **Alia Husna Mohd Noor** *On a Graph Related to the Conjugacy Classes of 3-Generator p-Groups*	AM36 **Ahmad Ramli** *Obstacle Avoidance Road Design with Speed Profile using Bezier Curve*	AM35 **Asma Izzati Asnor** *Higher Order Block Backward Differentiation Formula for Solving Third Ordinary Differential Equations*	
16:40 – 17:00	ST15 **Jibrin Sanusi Alhaji** *A FURI Approach in Modelling and Forecasting Tapis Crude Oil Price*	PM08 **Rawdah Adawiyah Tarmizi** *Nilpotent Groups Having a Maximal Irredundant 11-Covering with Core-Free Intersection*	AM39 **M. Y. Misro** *Determining Degree of Elevation Using Spatial Bézier Curve*	AM44 **Fatihah Anas Muhiddin** *The Red-Black SOR Iteration Based on Grünwald Fractional Scheme for One-Dimensional Time-Fractional Parabolic Equations*	WORKSHOP 5 *Math Made Easy with Technology* **Dr. Maisarah Haji Mohd** and **Dr. Nur Nadiah Abd Hamid** and **Dr. Mohd Hafiz Mohd**
17:00 – 17:20	ST12 **Suzilah Ismail** *The Effect of Free Food Scheme on UUM Students Financial Management*	PM18 **Yean-Nee Tan** *Enumeration of Tilings of Holey Squares with Straight Polyominoes*	AM50 **Wan Zafira Ezza Wan Zakaria** *Bezier Curves Interpolation with End Point Constraints*	AM45 **Noor Julailah Abd Mutalib** *Adaptive Step Size Stochastic Runge-Kutta Method of Order 1.5(1) for Stochastic Differential Equations (SDEs)*	

17:20 – 17:40	ST09 **Sayed Kushairi Bin Sayed Nordin** *Threshold Effects of CO2 and Energy Use on Economic Growth in Oil Importing and Exporting Countries*	PM13 **Amirul Aizad Ahmad Fuad** *The Decomposition of Electroencephalo-graphy Signals During Epileptic Seizure*	AM41 **Shehab Alzaeemi** *2-Satisfiability Logic Programming in Radial Basis Function Neural Networks*	AM64 **Nor Alisa Mohd Damanburi** *A General Numerical Approximation of the Stress Characteristic Field at a Singular Point*	WORKSHOP 5 *Math Made Easy with Technology* **Dr. Maisarah Haji Mohd** and **Dr. Nur Nadiah Abd Hamid** and **Dr. Mohd Hafiz Mohd**
17:40 – 18:00	ST10 **Fauhatuz Zahroh Shaik Abdullah** *A Population-Averaged Model for Analyzing Longitudinal Binary Data*	PM23 **Nor Suriya Abd Karim** *Chromatic Uniqueness of a Type of 6-Bridge Graph*	AM69 **M Safdar** *Differential Invariants for Nonlinear Third Order Partial Differential Equations*	AM01 **Hanis Safirah Saiful Anuar** *Solving Coupled Nonlinear Schrodinger Equation Using Finite Difference Method and Hybrid Cubic B-spline Collocation Method*	

DAY 3 ● 12 DEC 2018

Time	Matahari Ballroom I	Session 7A Matahari Ballroom II Chairperson: Mrs. Zalila Ali	Session 7B Matahari Ballroom III Chairperson: Dr. Nur Nadiah Abd Hamid	Session 7C Mawar Room Chairperson: Dr. Norshafira Ramli	Session 7D Raya Room Chairperson: Dr. Noor Saifurina Nana Khurizan
08:20 – 08:30	WORKSHOP 6 *Gamified Mathematics for Teaching and Learning for School Students* **Dr. Ahmad Lutfi Amri Ramli**	OR19 **Hali Ibrahim Abba** *Reducing Server Redundancies in ATM Lines via Queue Disciplines*	AM70 **Muhammad Khairul Anuar Mohamed** *MHD Free Convection Boundary Layer Flow near the Lower Stagnation Point of a Horizontal Circular Cylinder Embedded in a Ferrofluids*	AM28 **Anuar Jamaludin** *Stability Analysis of Magnetohydro-dynamic Stagnation-Point Flow over a Nonlinearly Permeable Stretching/Shrinking Sheet with Velocity Slip*	
08:40 – 09:00		ST28 **Nurbaizura Borhan** *The Impact of Social Factors on Tourism Demand for Malaysia and the Neighbouring Countries*	AM02 **Che Haziqah Che Hussin** *Analytical Solutions of Fractional Nonlinear Schrodinger Equations Using Multistep Modified Reduced Differential Transform Method*	AM67 **Nirwana Binti Japil** Stagnation Point Flow and Heat Transfer over an Exponentially Stretching/Shrinking Sheet in a Porous Medium	MT01 **Siti Nur Alwani Salleh** *Stability Analysis of Nanofluid Flow past a Moving Thin Needle subject to Convective Surface Boundary Conditions*
09:00 – 09:20		ST21 **Mukminah Darus** *CARMA Processes with Stochastic Speed of Mean Reversion*	AM19 **Lim Ai Hui** *Measuring Linearity by Area-Length of Convex Hull*	AM05 **Jibrin Helma Mbaya** *Modelling and Simulation of Transient Flow Characteristics in a Producing Gas Well*	MT07 **Yong-Poh Yu** *A Comparative Study on the Time Series Models for Forecasting Facebook Reactions*

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		ST13 **Anam Javaid** *Modified LASSO as Efficient Phase in Standard Operating Procedure in Multiple Regression*	AM54 **Rizavel Corsino-Addawe** *Analysis of the SA-Like Selection Operator in Differential Evolution-Simulated Annealing (DESA) Algorithm*	AM18 **Nur Syazana Anuar** *Homogenous-Heterogeneous Reactions in the Stagnation-Point Flow and Heat Transfer of Nanofluids over an Exponentially Stretching/Shrinking Sheet with Stability Analysis*	MT13 **Nurulhuda A.Manaf** *Generating Service Choreographies from SBVR Models*
09:20 – 09:40					
09:40 – 10:00	WORKSHOP 6 *Gamified Mathematics for Teaching and Learning for School Students* **Dr. Ahmad Lutfi Amri Ramli**	ST16 **Zalila Ali** *Ordinal Logistic Regression Modelling of Dental Caries Status Among Preschool Children in Bachok District, Kelantan, Malaysia*	AM51 **Taufiq Khairi Ahmad Khairuddin** *Fitting the First Order Polarization Tensor by Spheroid: A Semi Analytical Approach*	AM27 **Ahmad Danial Bin Lokman** *Dual Solutions of Exponentially Stretched/Shrinked Flows of Carbon Nanotubes*	MT11 **Chukwuneke Jeremiah Lekwuwa** *Mathematical Modelling of Stabilizing Wave Attenuation Effects in High-Speed Milling Process*
10:00 – 10:20		ST06 **Mohd Syazwan Mohamad Anuar** *Bootstrap Confidence Intervals for Circular Regression Model*	AM65 **Nooraihan Abdullah** *A Lagrange-mesh Method for Solving Two-Dimensional Schrödinger Equation*	AM24 **Norshafira Ramli** *Stability Analysis of MHD Mixed Convection Flow over a Moving Flat Plate in Ferrofluids with Thermal Radiation, Suction and Second-order Slip Effects: Heat Flux Case*	MT12 **Nur Farah Adilah Che Omar** *Integrated Index Measure of Technological Capabilities for Technology-Based SME's*

Time	Matahari Ballroom I	Session 8A Matahari Ballroom II **Chairperson:** Assoc. Prof. Dr. Sek Siok Kun	Session 8B Matahari Ballroom III **Chairperson:** Dr. Yazariah Mohd Yatim	Session 8C Mawar Room **Chairperson:** Dr. Azhana Ahmad	Session 8D Raya Room **Chairperson:** Dr. Amirah Azmi
10:40 – 11:00		FM08 **Siti Fatimah Ismail** *Investigating the Effects of Fiscal and Monetary Policy on Economic Performance: A Static Panel Threshold Regression Approach*	AM59 **Phithakdet Phoo-Ngurn** *Optimal Vaccination Strategies for Controlling the Spread of Porcine Reproductive and Respiratory Syndrome Virus in a Swine Population*	PM19 **Muhammad Zillullah Mukaram** *Combination of Graphs with Pseudo Degree Zero Generated by $FTTM_n^k$*	IM14 **Nuzlinda Abdul Rahman** *Time Series Modelling of Dengue Cases for Several States in Malaysia*
11:00 – 11:20	WORKSHOP 7 *Higher Order Thinking Skills in Mathematical Problem Solving* **Mohd Suhaimi Ramly**	FM13 **Rahela Abdul Rahim** *Modelling Gross Domestic Product Using Discrete Dynamical Systems*	AM53 **Ummi Nurmasyitah Hassan** *Modelling Overtaking Behavior for Pedestrian Dynamics Using a Modified Social Force Model*	PM06 **Noor A'lawiah Binti Abd Aziz** *Some Properties of k-Step Hamiltonian Graphs*	IM04 **Nur Atikah Mohd Rozali** *Laplace Transform on the Recursive Moments of Aggregate Discounted Claims with Weibull Interwaiting Time*
11:20 – 11:40		FM01 **Lavaneesvari Manogaran** *Monetary Conditions in Indonesia: A Pre- and Post-IT Analysis*	AM56 **Silas A. Ihedioha** *Optimal Investment and Consumption Decision for an Investor with Ornstein-Uhlenbeck Stochastic Interest Rate Model Through Utility Maximization*	PM03 **Nabilah Najmuddin** *Domination Polynomial of the Commuting and Noncommuting Graphs of Some Finite Groups*	IM03 **A.M.C.H Attanayake** *Spatial-Temporal Risk Mapping for Dengue Disease in Colombo, Sri Lanka*

11:40 – 12:00		FM10 **Leong Kah Hou** *Estimating Level of Stock Market Integration for Emerging Asian and European Countries Using Kalman Filter Technique*	AM60 **Nur Baini Ismail** *Using Partial Differential Equation in Modelling a Drinking Can with Texture Features*	PM11 **Noorsufia Abd Shukor** *On Hamiltonian Polygonal Paths in Assembly Graph $FTTM_n$*	IM15 **Nurul Syafiah Abd Naeeim** *Fitting Spatio-Temporal Infectious Disease Model with Different Choice of Dependence Matrices: A Case Study of Dengue in Peninsular Malaysia*
12:00 – 12:20	WORKSHOP 7 *Higher Order Thinking Skills in Mathematical Problem Solving* **Mohd Suhaimi Ramli**	FM12 **Lau Kein Joe** *An Empirical Study on Asymmetric Jump Diffusion for Option and Annuity pricing*	AM16 **Lawal Jibril** *On Existence and Sensitivity-Index of a Cholera Carrier Epidemic Model*	PM02 **Olayiwola Babarinsa** *Mixed Hourglass Graph and Its Mixed Energy*	IM13 **Amirah Azmi** *Effect of Biodiversity on the Spread of Leptospirosis Infection*
12:20 – 12:40		FM11 **Leong Kah Hou** *Stock Market Integration, Investment and Economic Growth: Evidence from Asian and European Countries Using Heterogeneous Panel Model*	AM48 **Johannah Jamalul Kiram** *Comparison Analysis Between Linear and Nonlinear Models to Predict Language Proficiency in Proportion to Language Learning Strategy*	PM20 **Siti Salwana Mamat** *Taxonomy of Tournament in Relation to Autocatalytic Set*	IM10 **Stephenie Yeoh** *Graphene Based Nonlinear Multimode Interference Waveguide for Refractive Index Sensing*

Time	Matahari Ballroom I	Session 9A Matahari Ballroom II **Chairperson:** Dr. Nuzlinda Abdul Rahman	Session 9B Matahari Ballroom III **Chairperson:** Assoc. Prof. Dr. Farah Aini Abdullah	Session 9C Mawar Room **Chairperson:** Assoc. Prof. Dr. Noor Atinah Ahmad	Session 9D Raya Room **Chairperson:** Dr. Majid Khan Majahar Ali
14:00 – 14:20		ST11 **Mohd Tahir Ismail** *The Spatial Effects of Neighbours on the Trading Activities of COMESA Countries*	AM57 **Maharani Abu Bakar** *New Switching Strategy to Combat Breakdown in Lanczos-Types for the Solution of High Dimensions of Linear Equations*	AM07 **Vigneshwer Kathirvel** *Comparison between Various Activation Functions in Hopfield Neural Network*	OR02 **Md. Mijanoor Rahman** *Increase the Efficiency of Car Following Parameters Through Calibration Model*
14:20 – 14:40	WORKSHOP 8 *Coaching Techniques for Mathematical Olympiad* **Mohd Suhaimi Ramly**	ST01 **Babangida Ibrahim Babura** *Stairboxplot and the Visual Analysis of Univariate Datasets*	AM58 **Nur Awanis Helmee** *Comparison of Handwriting Curve Reconstruction Using Whale Optimization Algorithm and Least Square Approximation*	AM72 **Saifullahi Yusuf** *Mixed Convection Heat Transfer in a Vertical Channel in the Presence of Heat Loss and Chemical Reaction*	OR04 **Siti Nurleena Abu Mansor** *Maintenance Model in Coevolution Opinions in Adaptive Networks*
14:40 – 15:00		ST27 **Adamu Adamu Muhammad** *Robust Inference in the Presence of Heteroscedasticity and High Leverage Points*	AM11 **Xiaojing Pei** *The Gradient Descent with Curvilinear Search Method for Non-Negative Matrix Factorization*	AM08 **Vigneshwer Kathirvel** *Performance Comparison Between Exhaustive Search and Imperialist Competitive Algorithm for 3-Satisfiability Programming*	OR05 **Md. Mijanoor Rahman** *Vehicle Dynamics and Simulations of Gipp's Model Compared Malaysia Data*

15:00 – 15:20		ST05 **Jibrin Sanusi Alhaji** *R Package FURI for Fractional Unit Root Integral (FURI) and ARFURIMA Models*	AM20 **Muhammad Aminu** *Feature Extraction and Classification for Spoken Letter Recognition Using Locality Preserving Partial Least Squares Discriminant Analysis*	AM14 **Kho Liew Ching** *2-Satisfiability Logical Rule by Using Ant Colony Optimization in Hopfield Neural Network*	OR09 **R. Chandrashekar** *Forecasting and Economic Order Quantity Model for Inventory Control: A Case Study at XYZ Company*
15:20 – 15:40	WORKSHOP 8 *Coaching Techniques for Mathematical Olympiad* **Mohd Suhaimi Ramly**	ST02 **Sajal Saha** *Side-Sensitive Group Runs Chart for Detecting Mean Shifts Using Auxiliary Information*	AM32 **Ajmal Ali** *New Group Fractional Damped Wave Iterative Solvers Using Mathematica*	AM13 **Kho Liew Ching** *Agent Based Modelling and Neural Symbolic Integration*	OR10 **Saw Veekeong A/L Saw Hin** *Using the ε -Constraint Method to Solve the Multicriteria Path Planning Problem*
15:40 – 16:00		ST20 **Lim Hui Yin** *Estimation of Precipitation Data by Using Deterministic Interpolation Methods to Study Landslide: A Case Study in Penang Island, Malaysia*	AM30 **Altaf. A. Al-Shawba** *The (G'/G)-Expansion Method for Solving the Conformable Time Fractional Hirota-Satsuma Coupled KdV System*	AM10 **Mohammad Athar Azim** *Agent Based Modelling for Comparing the Performances of Hyperbolic and Zeng and Martinez Activations Functions*	OR14 **Gaeithry Manoharam** *Proposing an Effective Route for Transporting Solid Waste from Seberang Perai Industry Area Using GIS Approach*
16:00 – 16:20		ST03 **Mohd Azri Pawan Teh** *Group Chain Acceptance Sampling Plans for Truncated Life Test by Using Minimum Angle Method*	AM34 **Umair Ali** *Modified Implicit Difference Method for One-dimensional Fractional Wave Equation*	AM40 **Shehab Alzaeemi** *Comparing Logic Programming between Hopfield Network and Radial Basis Function Network*	OR15 **Mohamad Shahiir Saidin** *Crisp and Fuzzy Approaches on Staff Performance Evaluation: a Comparison*

PLENARY SPEAKER 1

QMH Professor Dr. M. Ataharul Islam
Institute of Statistical Research and Training (ISRT)
University of Dhaka, Bangladesh

BIODATA

M. Ataharul Islam is currently QMH Professor at Institute of Statistical Research and Training (ISRT), University of Dhaka, Bangladesh. He is a former professor of statistics at the University Sains Malaysia, King Saud University, University of Dhaka and East West University. He served as a visiting faculty at the University of Hawaii and University of Pennsylvania. He is a recipient of the Pauline Stitt Award, Western North American Region (WNAR) Biometric Society Award for content and writing, University Grants Commission Award for book and research, and the Ibrahim Memorial Gold Medal for research. He has published more than 100 papers in international journals on various topics, mainly on longitudinal and repeated measures data including multistate and multistage hazards model, statistical modelling, Markov models with covariate dependence, generalized linear models, conditional and joint models for correlated outcomes. He authored a book on Markov models, edited one book jointly and contributed chapters in several books.

Generalized Linear Models and Analysis of Big Data

ABSTRACT

The generalized linear model has emerged as a very important approach of modeling data under variety of conditions, such as discrete or continuous, qualitative or quantitative, etc. The generalized linear models belong to a special class of distributions known as exponential family. One of the major advantages lies in the fact that some of the important properties of likelihood estimation such as the minimal sufficient statistics are restricted to the exponential family. The bivariate conditional probability distributions belonging to specified exponential families have been shown in the past (Arnold and Strauss, 1991; Arnold et al. 2001). Similarly, the conditional generalized linear models have been developed with covariate dependence (Islam and Chowdhury, 2017) for bivariate outcomes. In longitudinal or repeated measures data, we face the challenge of formulating models based on multivariate outcomes. The bivariate or multivariate outcomes are generally correlated. The knowledge about the underlying marginal probability distribution of outcomes at different times are not adequate for modeling the longitudinal outcome data due to lack of knowledge about the underlying correlation structure. Islam (2018) proposed a trivariate Bernoulli regression model using marginal and conditional approach. Fahrmeir and Tutz (2001) and Islam and Chowdhury (2017) proposed alternative regression models for multivariate outcomes. In this paper, a multivariate generalized linear model is proposed with underlying estimation and test procedures. The models based on quasi-likelihood methods are also highlighted. The application of the models to big data is discussed in this paper using the divide and recombine (D&R) framework (Buhlman et al., 2016). Lee et al. (2017) explored the concepts of sufficiency and summary statistics for model fitting. In this paper, the exponential family of distributions for multivariate outcome variables and the corresponding sufficient statistics are shown to have great potential in analyzing big data where traditional statistical methods fail to provide any result due to very large data sets. The use of sufficiency may provide the opportunity to make use of the grouped data characteristics (summary statistics D&R) instead of unit level characteristics (horizontal D&R). The proposed method is designed to reduce the complexity arising from the very large data sets by using an effective and feasible data reduction technique.

PLENARY SPEAKER 2

Associate Professor Dr. Tan Seng Chee
National Institute of Education
Nanyang Technological University, Singapore

BIODATA

Tan Seng Chee is the Acting co-director of the Centre for Research and Development in Learning (CRADLE@NTU) at the Nanyang Technological University, Singapore and an Associate Dean with the Graduate Studies and Professional Learning Office at the National Institute of Education. He earned his Ph.D. in Instructional Systems from the Pennsylvania State University and joined Nanyang Technological University in 2000. Prior to the appointment in CRADLE, he has taken on different roles related to advancing the use of ICT in education, including the Head of Learning Sciences and Technologies academic group in the National Institute of Education and an Assistant Director in the Educational Technology Division in the Ministry of Education. He has taught courses on instructional design and learning sciences at graduate level and has conducted professional courses for organizations such as MOE and MINDEF. His research interests include Computer-Supported Collaborative Learning, knowledge creation in education, and teacher education. His most recent publications include the book "Knowledge Creation in Education" (Springer, 2014) and "Pushing the Frontier: A cohesive system-wide approach to integrating ICT into education" (Springer, 2017).

Learning Mathematics Through Computer-Supported Collaborative Learning (CSCL): Potentials and Challenges

ABSTRACT

This talk focuses on the use of technology to support learning of mathematics, specifically, the use of computer-supported collaborative learning (CSCL) for learning mathematics. Among various technologies for education, the use of CSCL only began to gain traction in the late 90s. While the predominant computer-assisted instruction programs tend to focus on taking the roles of teachers to provide instructions, usually for individual learning, CSCL breaks away from this approach by providing a platform that encourages interactions and dialogues among learners, which is regarded as key mechanisms leading to effective learning. Pertinent questions arise for learning of mathematics with CSCL: Does CSCL has a place for mathematics learning? What values do CSCL contribute to the learning of mathematics? This talk aims to answer these questions by reviewing research studies and theoretical perspectives. Several examples from research reports will be discussed. One example is the use of an online forum (Knowledge Forum) by Grade 4 Canadian students, who explored multiple rules for generalizing problems and were able to revise their rules through peer interactions. While CSCL can support learning of mathematics, mathematics has also been used to enhance CSCL tools. Developers of Knowledge Forum, for example, are equipping this online platform with learning analytics, which allow teachers and students to visualize their online interaction and behavioral patterns. Using CSCL for learning of mathematics, however, has its own challenges. For example, given the symbolic representation is an important part of mathematics learning, most generic CSCL tools may not support representation of mathematical symbols well, and consequently compromise the usability of the CSCL tools. More critically, there could be limited awareness of how CSCL could support learning of mathematics.

PLENARY SPEAKER 3

Professor Dr. Mohamed Ridza Wahiddin
Kulliyah of Information and Communication Technology
International Islamic University Malaysia, Malaysia

BIODATA

Ridza obtained his PhD (UMIST, UK) in August 1989 in Quantum Optics, and the higher doctoral degree DSc (UMIST, UK) in December 2004. He is the MOSTE 1994 National Young Scientist Award winner in recognition of his research in Quantum Optics. He is also recognized by Academy of Sciences Malaysia (ASM) as one of the 2017 Top Research Scientists Malaysia. He is a Fellow of the Malaysian Mathematical Sciences Society and Fellow of the Malaysian Institute of Physics. Presently, he is a Professor at the Department of Computer Science, IIUM.

IBM Quantum Computers: Now It's Easier for Everyone to Understand Quantum Mechanics

ABSTRACT

The main consideration for a scalable quantum computer is whether the step from 2 qubits (quantum bits) to n qubits is possible. This situation may be compared to the first implementations of classical computers: The first machines made from electro-mechanical (Zuse Z1 in 1938) and later electrical subunits (electrical tubes, IBM in 1948) could have been scaled up in principle to increase the computer's power. But, realistically the failure probability and the energy consumption would have scaled as well. Only the invention of the semiconductor-based subunits made scaling feasible. On another front there is no known classical algorithm that can simulate a quantum computer. Perhaps the most persuasive argument we have that quantum computing is powerful is simply that we don't know how to simulate a quantum computer using a digital computer; that remains true even after many decades of effort by physicists to find better ways to simulate quantum systems. Most students will avoid quantum mechanics. It is counter intuitive and not easy to understand. Very recently, IBM has introduced a set of quantum computers in the cloud and these may be accessed freely from the classroom through your smart phones, tablets, laptops having an internet connection. I will share the experience of workshop participants who are not physicists and mathematicians and have accessed the IBM quantum computers. They were exposed to several quantum mechanics experiments which were previously very challenging to be realised in the classroom. The one-day workshop has successfully shown the participants enjoyed its activities, and they find it quite easy to understand the realisation and results of these experiments.

INVITED SPEAKER 1

Dr. Ng Wee Leng
National Institute of Education
Nanyang Technological University, Singapore

BIODATA

Ng Wee Leng is a senior lecturer at the National Institute of Education, Nanyang Technological University (NTU). He holds a Bachelor of Science (Honours) degree, a Master of Education degree, a Master of Science degree, and a Doctor of Philosophy degree in mathematics. Prior to joining NTU, Dr Ng was an Assistant Director at the Ministry of Education, Singapore. Ng is a very experienced teacher educator whose main research interest is the use of technology in mathematics education. He has been the recipient of several research grants and had played a pivotal role in training teachers in the use of graphing calculators in teaching and learning mathematics when the Education Ministry of Singapore implemented a graphing calculator-integrated pre-university mathematics curriculum in 2006. He has published eight books, four of which are on handheld technology, and many research articles, and has been invited to deliver keynote or plenary lectures at international conferences in Brazil, China, Japan, Malaysia, Taiwan and Thailand.

Use of Graphing Calculators in Teaching, Learning and Assessment in the Pre-University Mathematics Curriculum in Singapore

ABSTRACT

This presentation will provide an account of how graphing calculators have become part of teaching, learning and assessment in school mathematics in Singapore. Critical issues associated with effective implementation of graphing calculators into the Singapore mathematics curriculum will be discussed and examples of how graphing calculators have been used, in the context of Singapore, in the teaching and learning process, and in examinations will be given.

INVITED SPEAKER 2

Dr. Lee Wen Jau
Invantest DSG Sdn. Bhd.
Suntech @ Penang Cybercity, Penang

BIODATA

Wen Jau joined Invantest as a Director of R&D and engineering. He is responsible for the inception and startup of Invantest R&D center in Penang, Malaysia to develop intelligent Industrial 4.0 semiconductor factory automation solutions. He will define the factory automation software, AI systems and roadmaps and lead the corporate software engineering team and data scientists to create state-of-the-art factory automation software products to leap frog to I4.0 predictive analytics and intelligent decision support systems. He has considerable experience in the strategic planning process for analytics and software application, setting up analytic modelling centre and has successfully transformed teams for innovations and achieved breakthrough results. Wen Jau is a seasoned automation software development professional for assembly and test semiconductor manufacturing industry. In his last 23 years career as an engineer, a technologist and an organization leader at Intel, he gained a broad experience in product development, test software development, advanced analytics modelling and factory automation software development. Wen Jau has created many novel advanced analytics and computational statistical solutions to solve a myriad of problems at Intel. He has published IPs and technical papers for Intel. He collaborated with local universities, drove research in machine learning and data mining for Intel applications. He was a member of the Industrial Advisory Panel for two leading local universities and facilitated technical talks at other universities. Wen Jau obtained his BSc in Computer Science from Campbell University, North Carolina, USA in 1989, Master of Science in Electronic Engineering from Queen's University of Belfast, Belfast, UK in 1990 and his PhD in Computational Applied Statistics from University of Malaya, Malaysia in 2008. He is a Chartered Engineer of Engineering Council, UK and a member of Institute of Engineering and Technology (IET), UK.

Simulation Assisted Supervised Learning for Extrapolation Prediction

ABSTRACT

Machine learning is a useful advanced analytics tool to mine the hidden relationship of an underlying dataset, often being employed for big data analytics and data mining. In the presence of strong predictors and sufficient training data the supervised learning models will perform very well. However, in reality modelers are often constraint by the lack of training data to build accurate supervised learning model especially when the learning is insufficient due to the shallow knowledge presented in the limited dataset. Simulation models are proposed as a data source for machine learning data. A method is proposed to integrate simulation as a strong form of prior knowledge into machine learning. Based on the parametric distribution of the predictors, the simulation model will generate random variates and provide unlimited training data to train the supervised learning model. It will alleviate the dependency of data collection to meet the sample size. The technique will be useful when the predictors follow certain known parametric distributions or that can be easily extracted from the underlying dataset. The talk will describe the concept of random variate generation, supervised learning, and discuss the integration of these two data science methods. It will discuss a procedure for the simulation assisted supervised learning to generate a population distribution to infer descriptive statistics of interest with 95% accuracy for certain application.

INVITED SPEAKER 3

Professor Dr. Dan Seth

Department of Mathematics, School of Engineering, Computer Science & Mathematics
West Texas A & M University, USA

BIODATA
Dan received his PhD from Texas Tech University in 1987 then was a postdoctoral fellow at Ames Lab, Iowa State University. He served as a research assistant and visiting scientist at Los Alamos National Laboratory, USA, as a visiting scientist at Matscience, Chennai, and has collaborated with scientists of Indira Ghandi Centre for Atomic Research (IGCAR), Kalpakkam, India. From 1991-2006 he worked at Morehead State University, Morehead, Kentucky USA. In 2006 he was appointed department head of Mathematics, Chemistry and Physics, West Texas A&M University (WTAMU) and currently serves as Professor of Mathematics in the Math Department of WTAMU. The areas of expertise are in computational sciences, including the numerical resolution of transport equations, high performance and parallel computing, and the development of mathematical models for physical problems. Dan has been involved with the integration of technology into the mathematics classroom since 1995. Activities include integration of Graphic Calculators into Algebra, Calculus, and Statistics; integration of Matlab in Linear Algebra and Numerical Analysis; and MINITAB in Elementary and Mathematical Statistics. In 2001-2002 he visited Universiti Sains Malaysia (USM), Penang, to collaborate with the Department of Mathematical Sciences Graphic Calculator Interest Group on development of a new course *MSS391: Teaching and Learning Mathematics with Graphic Calculators*.This collaborative effort led to publication of *Explorations with a Graphing Calculator*, 2011, co-authors Prof. Rosihan M. Ali and Dr. Suraiya Kassim, a book of Graphic Calculator labs. In 2014, he published *Linear Algebra Manual and Lab Projects*, John Wiley and Sons, a book of MATLAB laboratory explorations for the linear algebra classroom. The labs are also available individually at the companion site for *Introduction to Linear Algebra*, Anton/Rorres, 11th, Wiley (2014).

Integration of Technology in Teaching, Learning and Assessment in the Pre-University and University Mathematics Curricula of USA

ABSTRACT
This presentation will provide a summary of technology use, including graphing calculators, for teaching, learning and assessment in University and Public-School mathematics of USA. Critical issues associated with effective implementation of technology into the mathematics curricula and testing will be explored. Examples of how the various technologies have been used in the teaching and learning process, assessment of programs and in examinations will be included.

PERCEPTRON – A Smart Data Science Platform for Education

Rohini Sooriamoorthy
CTO, Statworks Group

In recent times, the most talked about emerging technology trends not only in Asia but in the rest of the world are Data Science Platforms which are predicted to grow at a staggering speed and value by the year 2020. The Data Science Platforms are the buzzword since 2017 in the Asia market but many have no clear idea on what is a data science platform, what are the features of a good data science platform and why an organization needs a data science platform. Data science platform contains all necessary tools required for executing different phases of Analytics workspace such as data ingestion, integration and exploration as well as model development and deployment. A data science platform helps data scientists enhance their analysis by helping them run, track, reproduce, share and deploy analytical models faster and more efficiently. The best data science platforms offer the flexibility of open-source tools and the scalability of elastic compute resources. This presentation would introduce the 1st local data science platform known as the Smart Data Science Platform incorporating various technology in the area of data ingestion, cleansing, data manipulation and model building in the area of predictive analytics, machine learning and prescriptive analytics with access to both open source technologies such as R, Python, Spark, Anaconda etc and also easy UI such as Modeler that many users can jump on board easily and slowly grow to incorporate open source tools. Statworks Smart Data Science Platform would have real world business examples in various area of fraud, CRM, profiling, chatbots that allows users to collaborate and share these example models with their own local inputs and applications.

PERCEPTRON – A Smart Data Science Platform for Education
1st Local Data Science Platform as a Service

A Data Statistics Journey with TIBCO Statistica

Nor Ashiera

Application Data Scientist, Statworks Group

Statistics has been in existence for a very long time and Statistics is everywhere but in recent times Statistics has been evolving to include technology and hence the emergence of Statistics embedded within various technology tools. The field of statistics touches our lives in many ways. From the routines in our personal lives to businesses, the effects of statistics are everywhere. It's the journey of data statistics - collecting, exploring and presenting large amounts of data to discover underlying patterns and trends. Traditional methods for statistical analysis or data analytics - from data preparation to data exploration to analytics to interpreting results – have been used by statisticians or now popularly known as data scientists. But today's data volumes make statistics ever more valuable and powerful where powerful applications and advanced algorithms have all led to an increased use of computational statistics or analytics. Today's statistician's mantra is working with large volumes of data and running multiple algorithms of calculations where statistical computing with or without coding has become the core of their statistics journey. Statworks would like to introduce the award winning statistical computing solution that address data statistics - TIBCO Statistica - an advanced analytics tool that provides both a no-code and code environment. The new TIBCO Statistica™ Ultimate Academic Bundle offers a combination of data analysis, data management, visualization, data mining, and exploratory techniques with support for R, Python and C# codes. This presentation would showcase the powerful capability of TIBCO Statistica in the area of data access and preparation using data access templates, comprehensive analytics with built in smart algorithms from data statistics to data mining, easy deployment of models in PMML and extend analytical workflows using open source technology as well as using best practices built-in templates that can be reused throughout the organization.

WORKSHOP 1

Mathematical Problem Solving with A TI-Nspire CX CAS

Dr. Ng Wee Leng
Nanyang Technological University

Empowering students to make effective use of technological tools in the learning and application of mathematics is identified as an important objective of many school mathematics curricula. In this workshop, participants will engage in activities which explore uses of the TI-Nspire CX CAS Learning Handheld, at different stages of the problem-solving process, in solving a collection of mathematical problems suitable for upper secondary students.

WORKSHOP 2

An Introduction to LaTeX

Dr. Ong Wen Eng and Dr. Siti Amirah Abdul Rahman
School of Mathematical Sciences, Universiti Sains Malaysia

LaTeX is a document preparation system that is widely used in academia for the communication and publication of scientific documents in many fields, including mathematics. Unlike WYSIWYG (what you see is what you get) processors such as MS Word, LaTeX is a WYSIWYM (what you see is what you mean) processor that uses its own (coding) language and typesetting program for formatting its output. This workshop gives a brief overview on preparing a basic document with mathematical elements in LaTeX. Come and explore an alternative word processor that creates beautiful mathematical documents.

WORKSHOP 3

STEM Practices with TI-Nspire Technology

Puteri Anis Aneeza Zakaria and Nurhani Mohd Yahya
Statworks (M) Sdn. Bhd.

During this workshop, participants will have the opportunity of learning Texas Instruments STEM technology. Participants will experience new ways of learning and teaching with TI-Innovator, TI-Rover together with graphing calculator.

Explore Ratios and Scales with Graphing Calculators

Dr. Pumadevi Sivasubramaniam and Nurul Shahhida Abu Bakar
IPG Raja Melewar

This workshop provides a hands-on experience for participants to explore ratios and scales using lines. The power of the graphing calculator will illustrate a fun-filled lesson which everyone will enjoy. Even if you have never used a graphing calculator you will be able to master the operation during the workshop in a matter of minutes. The content of the workshop has been tried out in schools (with students and teachers) and the results have proved to have positive effects on students understanding and ability to aid understanding of ratios and scales. It also aids teachers to overcome pedagogical difficulties in teaching ratios and scales. The workshop is based on the theory of distributed cognition which claims that when a powerful tool such as the graphing calculator takes over routine tasks such as drawing of lines and routine calculations, it allows students to focus on more relevant activities such as understanding the calculations. In addition to all these exciting features, the workshop will also provide a means to evaluate understanding using HOTS items.

WORKSHOP 4

Get Started with Python

Dr. Jasy Liew Suet Yan[1] and Assoc. Prof. Dr. Teh Su Yean[2]
[1]*School of Computer Sciences, Universiti Sains Malaysia*
[2]*School of Mathematical Sciences, Universiti Sains Malaysia*

Learning to code is a necessary life skill that fuels the innovation and growth of technologies for the Fourth Industrial Revolution. The coding language, Python, has a simple easy-to-use syntax, making it the perfect language particularly for someone trying to learn computer programming for the first time. So register for this course now to increase your career prospects and gain a valuable life skill that will serve you well in your current and future undertakings.

WORKSHOP 5

Math Made Easy with Technology

Dr. Maisarah Haji Mohd, Dr. Nur Nadiah Abd Hamid and Dr. Mohd Hafiz Mohd
School of Mathematical Sciences, Universiti Sains Malaysia

Optimizing the potential of technology allows us to increase our proficiency in a subject. Online websites for examples, offer a variety of lesson plans and virtual manipulation. It is vital for us to have an admission to technologies that support and advance the mathematical sense making, reasoning, problem solving, and communication. We will use *WolframAlpha* and *Symbolab* in engaging participants for some topics in this workshop. These free accessible websites are two among hundreds of online applications that can be utilized in class. We have also designed online quizzes using *Kahoot!* for fun and game-like learning environment.

WORKSHOP 6

Gamified-mathematics for Teaching and Learning for School Students

Dr. Ahmad Lutfi Amri Ramli
School of Mathematical Sciences, Universiti Sains Malaysia

While Mathematics is being perceived as a boring subject, there are various approaches can be taken to make a class more exciting. Interactive Learning Experience is a concept of making a class more effective with two-way interaction and hands-on activities. Gamification is an approach to create a game out of something. This workshop will discuss the idea, concept and integrate it into an interactive learning experience with Mathematics for school students. Participants will experience hands-on activities and learn how to gamify different topics in the syllabus. This workshop will also concentrate on using non-technological-devices to cater to the current situation where there is limited availability of computers and internet in a class setting.

WORKSHOP 7

Higher Order Thinking Skills in Mathematical Problem Solving

Mohd Suhaimi Ramly
Head Coach of Malaysian International Mathematical Olympiad Team

The presentation introduces a practical method for teaching mathematical problem solving in a classroom based on the Polya problem solving model (understand → plan → execute → reflect). A proper implementation of Polya model in classroom can help to develop mathematical abilities at the higher order of Bloom's Taxonomy, namely analyzing, evaluating and creating. In a workshop setting, we will discuss some sample problems and how to present them in a classroom so that students discover the joy of solving the problems themselves, rather than being fed the solution by their teacher. We follow the maxim of Polya: "It is better to solve one problem five different ways, than to solve five problems one way."

WORKSHOP 8

Coaching Techniques for Mathematical Olympiad

Mohd Suhaimi Ramly
Head Coach of Malaysian International Mathematical Olympiad Team

Mathematical Olympiad is well-known as a mathematical competition for highly gifted students in mathematics. In this workshop, I will argue otherwise, that introducing Mathematical Olympiad in the classroom develops general problem-solving abilities for all students, which leads to higher academic attainment. I will share my personal experience leading the Malaysian team to the International Mathematical Olympiad since 2007, and how such coaching program can be started at any level -- classroom, school, district, or state -- even with a small number of students, and no Math Olympiad background whatsoever. Practical coaching techniques will be discussed. We will attempt some (fun!) Olympiad problems in a laidback setting.

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AM01
Solving Coupled Nonlinear Schrodinger Equation using Finite Difference Method and Hybrid Cubic B-spline Collocation Method

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Abstract. Coupled Nonlinear Schrodinger (CNLS) equation is a second order nonlinear partial differential equation which is commonly relating to nonlinear optical fiber. In this paper, CNLS equation is solved using two methods chosen which are Finite Difference Method (FDM) and Hybrid Cubic B-spline collocation method (Hybrid CuBS) with appropriate initial and boundary conditions. Theta weighted scheme is applied to the equations and the nonlinear terms are linearized using Taylor series expansion. Temporal space is discretized by forward difference and for spatial dimensions, central difference is applied for FDM while b-spline functions are applied for Hybrid CuBS. The Hybrid CuBS collocation method is shown to be unconditionally stable using Von Neumann stability analysis. To test the accuracy, a numerical example is discussed and the error norms are computed. The results obtained show that FDM and Hybrid CuBS collocation method are reliable and easy to implement.

Keywords: Coupled nonlinear Schrodinger equation, Finite difference method, Hybrid cubic b-spline collocation method, Linearization, Stability analysis

AM02
Analytical Solutions of Fractional Nonlinear Schrodinger Equations Using Multistep Modified Reduced Differential Transform Method

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Abstract. In this paper, we propose and execute the Multistep Modified Reduced Differential Transform Method (MMRDTM) to obtain the solution of fractional nonlinear Schrodinger equations (FNLSEs). Through this proposed technique, the nonlinear term is substituted by the corresponding Adomian polynomials followed by the application of a multistep approach. The fractional NLSE solutions can be obtained with less computational effort. Besides that, it offers precise estimated solutions over a longer time period. We considered a few FNLSEs and represent the features of these solutions in the form of graphs to demonstrate the power and precision of the MMRDTM.

Keywords: Adomian polynomials, multistep approach, Reduced Differential Transform Method (RDTM), fractional nonlinear Schrodinger equations

AM03
MHD Stagnation Point Flow over a Stretching/Shrinking Sheet with a Heat Absorption/Sink and Radiation Effects

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Abstract. This paper is concerning with MHD stagnation-point flow problem of a viscous and incompressible fluid passing through a stretching/shrinking sheet with the effects of heat sink and radiation. A suitable similarity transformation is chosen to reduce the governing nonlinear partial differential equations into the system of higher order nonlinear ordinary differential equations. The computed results are then being verified by comparing the current values with the existing results. The behaviors of the skin friction coefficient and heat transfer rate are plotted in the form of graph to facilitate analysis. From the analysis, it is found out that the velocity inside the boundary layer increases with the increase of magnetic strength as the boundary layer thickness decreases. The temperature decreases as the magnetic strength and heat sink increase.

Keywords: shrinking sheet, heat absorption, radiation

AM04
An Analytical Approach to Non-Darcian Couette Flow of a Generalized Second Grade Fluid Between Parallel Porous Plates

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Abstract. This paper investigates transient non-Darcian Couette flow of a generalized second grade fluid between two parallel porous plates taking into consideration the porosity forces and temperature distribution inside the fluid. The coupled non-linear partial differential equations describing the phenomenon have been decoupled using parameter expanding method and solved analytically using eigenfunctions expansions techniques. The results obtained revealed that temperature distribution is enhanced as a result of increase in Eckert number while increase in Prandtl number and suction parameter values decreases the temperature. Also, the velocity decreases as a result of increase in values of porosity, suction and non-Darcian parameters.

Keywords: Non-Darcian Couette flow, porous plates, analytical simulation

AM05
Modeling and Simulation of Transient Flow Characteristics in a Producing Gas Well

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Abstract. Modeling transient flow characteristics in a producing gas well has been a problem long over in natural gas industry due to parameter changing with both space and time. In the past, authors concentrate on application of correlations and steady state approach, but most of their works does not give satisfactory results because the used applications neglect the transient aspect leading to premature closure of most wells. Many existing models are proposed to correct these anomalies using simplified governing equation ignoring the transient aspect of the flow characteristics. In this paper, a one-dimensional transient compressible model according to conservation of mass, momentum and energy has been presented for investigating the transient behavior of flow characteristics in a producing gas well. The model is solved numerically using the implicit Steger-Warming flux vector splitting method (FSM). The work investigates flow characteristics along depth of the well using different wellbore diameter of 0.073m, 0.0883m, at different time and different thermal conductivities. It shows that transient occurs due to the temperature difference between the produced gas and the flow environment while gas pressure increases due to difference between wellbore pressure and reservoir pressure. The results of this work reflect gas flow law and the characteristics of heat transfer in formation.

Keywords: Modelling Transient Flow, Producing Gas Well, FSM

AM06
Unsteady Flow of Thin Slender Rivulets of a Newtonian Fluid on an Inclined Plane

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Abstract. In the present study, we use the lubrication approximation to investigate the unsteady flow of a symmetric thin slender non-uniform rivulet of a Newtonian fluid on an inclined plane. The general equations subject to surface tension are solved and the fourth-order governing partial differential equation is obtained. The latter is then transformed into the ordinary differential equation using similarity transformation. Similarity solutions corresponding to single-humped and double-humped cross-sectional profiles are obtained. The rivulet at any time $t(>0)$ widens according to $x^{3/8}$ and thickens according to $x^{1/2}$, and at any station $x(>0)$ down the plane, it narrows according to $t^{-1/2}$ and thins according to $t^{-1/8}$, while maintaining its cross-sectional shapes.

Keywords: similarity solution, rivulet, strong surface-tension effect, lubrication approximation

AM07
Comparison Between Various Activation Functions in Hopfield Neural Network

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Abstract. Artificial Neural Network are roughly based on our brains neural network, not in the way that they are made up of a biochemical mixture, but in the way that multiple nodes or neurons are interconnected, and signals can pass through these nodes. It is incredibly exciting to study the mathematical relations of deep neural networks and ways of improving them. Activation functions introduce nonlinear properties to neural network. By using a nonlinear activation, the mapping of the input to the output is nonlinear. The whole idea of activation functions is to roughly model the way neurons communicate with each other. In this paper, we shall discuss on the differences of various activation functions, focusing on Hyperbolic Tangent Activation Function, McCulloch-Pitts model, Binary Activation Function and Bipolar Activation Function. Performance comparisons of these activations functions in doing logic programming in Hopfield network will be carried out. The expected outcome from this paper is that the Hyperbolic Tangent Activation Function will outperform the other activation functions.

Keywords: Artificial Neural Network, Hyperbolic Tangent Activation Function, McCulloch-Pitts model, Binary Activation Function, Bipolar Activation Function

AM08
Performance Comparison between Exhaustive Search and Imperialist Competitive Algorithm for 3-Satisfiability Programming

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Abstract. Logic programming is extensively used to describe relations and have both a declarative and an operational meaning. A 3-Satisfiability (3-SAT) program is a Boolean Satisfiability problem where just 3 literals/clauses are involved. There are various methods/algorithms utilized to solve the 3-Satisfiability logic program. Exhaustive Search (ES) is the standard method, where the algorithm enumerates for every possible way to search for a solution. Imperialist Competitive (IC) algorithm, on the other hand, an evolutionary optimization method that is inspired by the imperialistic competition model. Applying the Imperialist Competitive algorithm to 3-Satisfiability logic programming shows its ability in dealing with different types of optimization problems. In this paper, the objective is to compare IC algorithm and ES algorithm in doing 3-SAT logic programming with Hopfield Neural Network (HNN). The performance of both models will be evaluated by performance evaluation metrics such as Root Mean Square Error, Mean Absolute Error, Global Minima Ratio and CPU Time. The expected outcome of the experiment is that the IC algorithm should outperform ES in 3-SAT logic programming.

Keywords: 3-Satisfiability, exhaustive search, imperialist competitive, Hopfield neural network

AM09
Numerical Solution of Nonlinear Schrödinger Equation by Cubic B-Spline Galerkin Method

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Abstract. The non-linear Schrödinger (NLS) equation has often been used as a model equation in the study of quantum states of physical systems. In this paper we use cubic B-spline Galerkin finite element method to find the approximate solution of the NLS equation. The Crank–Nicolson scheme is used for nodal parameters and a finite difference scheme is used for the time integration. The resulting system of the ordinary differential equations is discretized to obtain a nonlinear system of algebraic equations. The proposed numerical approach is tested on two problems involving one soliton solution and interaction of two solitons. To assess the performance of the method, the error norms L_2 and L_∞ are determined. The obtained results show that the approach is accurate and efficient. The stability of the method was analyzed using the Von Neumann method.

Keywords: non-linear Schrödinger equation, cubic B-spline Galerkin finite element method, interaction of solitons

AM10
Agent Based Modeling for Comparing the Performances of Hyperbolic and Zeng and Martinez Activations Functions

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Abstract. There are many common activation functions in use with artificial neural networks (ANNs). The role of activation functions for artificial neural networks (ANNs) is used as transfer functions in research and engineering. The most common reasons for the use of this activation functions are its boundedness in the unit interval, the functions, and its derivative's fast computability, and a number of amenable mathematical properties in the realm of approximation theory. The purpose of this paper is to find the most effective activation function in doing logic programming in the context of Hopfield network. A comparison is carried out between hyperbolic tangent activation functions and Zeng and Martinez function based on Wan Abdullah method. These evaluations are done on the basis of global minima ratio, hamming distance and computational time. Moreover, computer simulations using software NETLOGO 5.3.1 are carried out to compare the effectiveness of these two activations functions.

Keywords: Logic Programming Hopfield network, Wan Abdullah method, Zeng and Martinez function, Hyperbolic Tangent activations function

AM11
The Gradient Descent with Curvilinear Search Method for
Non-Negative Matrix Factorization

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Abstract. Non-negative matrix factorization (NMF) and most of its variants are commonly solved using the multiplicative update algorithm. However, the multiplicative update algorithm has been shown to give poor convergence. Alternatively, the projected gradient descent method has been shown to have strong optimization property in NMF. Recently, a new gradient descent method with curvilinear search (GDCS) is proposed, which has wide applications in a variety of optimization problems with orthogonality constraints. In this paper, we discuss the suitability of GDCS in computing NMF, particularly in its ability to preserve the nonnegative structure of NMF. Following that, a projected gradient method with curvilinear search is proposed. We conduct several experiments on the face image database to test the effectiveness of this algorithm.

Keywords: curvilinear search, non-negative matrix factorization, projected gradient descent method, orthogonality

AM12
A Comparative Numerical Study Based on Cubic Exponential B-Splines and
Finite Difference Method for the Nonlinear Schrödinger Equation

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Abstract. Finite difference method (FDM) and Cubic Exponential B-Spline collocation method (CuEBSM) from different background are used as the numerical solution of the Nonlinear Schrödinger (NLS) equation. The approach is based on the Crank-Nicolson scheme where FDM is applied on the time and space discretization, while the CuEBSM is utilized as an interpolation function in the space dimension. The error between the numerical and the analytical solutions is measured by using the discrete maximum norm and Euclidean norm when the analytical solutions exist. The stability of the proposed method is investigated by the Von Neumann stability analysis. The results from CuEBSM are found to be more reliable and accurate compared to the FDM.

Keywords: Cubic Exponential B-spline collocation method, finite difference method, Nonlinear Schrödinger equation, Von Neumann stability analysis

AM13
Agent Based Modeling and Neural Symbolic Integration

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Abstract. Agent-based modeling (ABM) is a powerful simulation modeling technique that has been applied in several fields over the last decade. ABM allows the separation of systems into discrete components that can possibly have their own characteristics and rule sets. ABM is used as an approach to simulate the interaction of agents with each other. Neural network is inspired by the way biological nervous system, such as the brains process information. Neural network consists of large amount of interconnected neurons which enables it to solve complex recognition and analysis problem. Hopfield network is a recurrent neural network in which all neurons are connected to each other in both directions. In this paper, we will discuss on the advantages and disadvantages of ABM in integrating with neural networks and logic programming.

Keywords: ABM, neural network, logic programming, Hopfield network

AM14
2-Satisfiability Logical Rule by Using Ant Colony Optimization in Hopfield Neural Network

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Abstract. This finding presents the limitation of traditional Hopfield Neural Network in doing 2-Satisfiability problem (2-SAT). More precisely, both traditional exhaustive search method (ES) and ant colony optimization (ACO) were proposed in doing 2-SAT problem. Both learning method will reduce logical inconsistencies of 2-SAT in Hopfield Neural Network. Since both learning method will eventually complete the learning phase, the efficiency of both methods is difficult to describe. In this study, both learning method will undergo restricted learning environment during learning phase of Hopfield Neural Network. The robustness of ACO and ES in doing 2-SAT will be evaluated based on root mean square error, mean absolute error and mean percentage error. The result obtained from the computer simulation demonstrates the effectiveness of ACO in doing 2-SAT in Hopfield Neural Network.

Keywords: 2-Satisfiability, Ant colony optimization, Hopfield neural network, exhaustive search method

AM15
Heat and Mass Transfer Response in MHD Natural Convection Flow due to Oscillating Surface Temperature and Concentration

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Abstract. Magnetohydrodynamic (MHD) flow along a vertical flat plate is studied widely, considering the oscillating boundary conditions with small amplitude temporal variations for surface temperature and species concentration. Moreover, it has been assumed that in some undisturbed flow region, there is a uniform magnetic field making a nonzero angle with it. This assumption assures that there must be an electric field in such region, directed perpendicularly to both the stream velocity and magnetic-field vectors. In this study, flow field for the entire region is simulated by applying finite difference method. The transformed governing equations obtained from the stream function formulation are solved by applying the implicit finite difference method. Wide ranges of some important parameters, such as the magnetic parameter, Prandtl number, Schmidt number have been considered in order to elucidate the effect of these on heat and mass transfer coefficient and shear stress. Results obtained for varying these parameters are presented in terms of amplitude and phase angles of shear stress, surface heat transfer and surface species concentration coefficient, both in tabular and graphical forms. In some cases, presently obtained numerical values are compared with published results by other authors so that the present numerical simulations are validated.

Keywords: magnetohydrodynamic flow, heat transfer, mass transfer

AM16
On Existence and Sensitivity-Index of a Cholera Carrier Epidemic Model

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Abstract. In this work, a new deterministic mathematical model for a cholera carrier epidemic is developed and validated for the existence and uniqueness; hence the Lipschitz conditions are satisfied. The model threshold quantity R_0 for the cholera dynamics is computed using next generation matrix operator approach. The model sensitivity-index of the key parameters that has influence on the basic reproduction number R_0 is carried out. The results showed that the force of infection in the pathogen population, β_3 with the value of 0.4895 followed by the force of infection in the carrier population, β_2 with the value of 0.4473 are found to be the most sensitive parameters in the cholera prevalence and transmissions targeted for intervention and control strategies in the community. Plotted illustrations are presented to support our findings. Therefore, to curtail the spreads of cholera in the community, it is recommended that public health campaigns be conducted frequently.

Keywords: Cholera carrier, Reproduction number, Sensitivity-index

AM17
B-Spline Alternating Group Explicit (BSPAGE) in Solving Heat Equation

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Abstract. In this paper, B-Spline Alternating Group Explicit (BSPAGE) iterative method is proposed to solve one dimensional diffusion equation which is the heat conduction equation. The Alternating Group Explicit (AGE) iterative method is derived from the cubic B-Spline collocation technique called BSPAGE iterative method. We only consider the stationary case with odd number of points with even number of intervals for both time and space dimension. The comparison will be made based on AGE iterative method, Spline Alternating Group Explicit iterative method, BSPAGE iterative method and the exact solution.

Keywords: AGE iterative method, cubic spline approximation, cubic B-spline, parabolic p.d.e., heat equation, finite difference

AM18
Homogenous-Heterogeneous Reactions in the Stagnation-Point Flow and Heat Transfer of Nanofluids over an Exponentially Stretching/Shrinking Sheet with Stability Analysis

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Abstract. This study focuses on the steady two-dimensional stagnation-point flow of nanofluids over an exponentially stretching/shrinking sheet in presence of homogeneous-heterogeneous reactions. Three type of nanoparticles, namely copper, alumina and titania in the water-based fluid with Prandtl number Pr = 6.2 are considered. Similarity transformations are used to transform the partial differential equations into non-linear ordinary differential equations and are solved numerically using bvp4c solver in Matlab. The influence of various parameters such as solid volume fraction, homogeneous and heterogeneous reaction rate, Schmidt number and the stretching/shrinking parameter on the dimensionless velocity, temperature, concentration, skin friction and heat transfer are explored and presented in the form of graphs and interpreted physically. The results indicate that dual solutions exist for exponentially shrinking sheet. A stability analysis has been performed to show which solutions are stable and physically realizable. Based on the analysis, the results indicate that the first solutions are stable, while the second solutions are unstable. Comparison of the present analysis is made with the previously existing literature and an appreciable agreement in the values is observed.

Keywords: stability analysis, dual solutions, homogeneous-heterogeneous effect, exponentially stretching/shrinking sheet, nanofluids

AM19
Measuring Linearity by Area-Length of Convex Hull

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Abstract. Dominant point detection serves the purpose of reducing the number of data points from an image where the remained data shall able to reflect the original shape of image data. Region of support plays a key role in detecting dominant point. Linearity measures are essential in defining support region asset of points that possess relatively linear pattern. In this work, the linearity is measured by considering the convex hull of the image data. An area-length ratio is introduced to quantify the convex hull. The measure is simple and resistant to protrusion in data set. Besides, it is invariant under affine transformations such as scaling, rotation and translation. The capability of the suggested linearity measure is presented graphically with several binary images.

Keywords: linearity, convex hull, support region, dominant point

AM20
Feature Extraction and Classification for Spoken Letter Recognition Using Locality Preserving Partial Least Squares Discriminant Analysis

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Abstract. Partial least squares (PLS) is a feature extraction technique that projects explanatory variables on to a subspace in which the first component has the largest covariance between the explanatory and response variables. In partial least squares discriminant analysis, class labels are used as the response variables. The subspace obtained using partial least squares discriminant analysis is more suitable for classification than that obtained using the traditional partial least squares method. Recently, we proposed a new feature extraction technique called locality preserving partial least squares discriminant analysis (LPPLS-DA) which extract meaningful features of data while preserving the neighborhood structure of the data. LPPLS-DA does not only extract features of the dataset but also discriminate among the different classes of the data. In this paper, we investigate the use of LPPLS-DA in spoken letter recognition. Finding relevant features for the classification of spoken letters is affected by high dimensionality of the data. To address this problem, we use LPPLS-DA to extract relevant features of the data and classification is automatically achieved using the LPPLS-DA method. Experimental results on the ISOLET (Isolated Letter Speech Recognition) data set demonstrate the effectiveness of the LPPLS-DA method. The classification accuracies in the experiments are measured using the normalized mutual information (NMI) metric. The LPPLS-DA obtained higher accuracies than PLS-DA and other feature extraction methods compared with.

Keywords: classification, feature extraction, neighbourhood

AM21
An Extended Cubic B-Spline Collocation Scheme for
Time Fractional Sub-Diffusion Equation

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Abstract. An extended cubic B-spline scheme is developed to solve the time fractional sub-diffusion equation. The time fractional derivative is represented using Caputo's formula and the discretization utilizes the theta-weighted scheme. The scheme is unconditionally stable and the convergence is shown to be of second order. The results of numerical experiments indicate the effectiveness of the proposed method.

Keywords: Fractional sub-diffusion equation, Extended cubic B-spline basis functions, Collocation method, Caputo's derivative, Stability, Convergence

AM22
Solving for Schwarzschild Solution Using Variation of Parameters and
Frobenius Method

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Abstract. In general relativity, the phenomenon of gravity is described using the Einstein equations. These equations are a set of complicated nonlinear partial differential equations which the exact solutions describing the gravitational phenomenon cannot be obtained. However, under certain conditions, the Einstein equations take a simpler form and the exact solutions can then possibly be found such as the Schwarzschild solution. One of these conditions is a static perfect fluid sphere, which can be expressed as an ordinary differential equation. In this paper, such a differential equation is solved using the method of the variation of parameters and the Frobenius method.

Keywords: differential equation, general relativity, Frobenius method, perfect fluid, variation of parameters

AM23
Cubic B-Spline Collocation Method for Solving Benjamin-Bona-Mahony Equation

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Abstract. In this research, the Benjamin-Bona-Mahony equation is solved numerically using cubic B-spline (CBS) collocation method. Forward difference approximation is used to discretize the time derivative while the CBS function is used to discretize the space dimension. To deal with nonlinearity, the nonlinear term is replaced with a known parameter. At every time level, calculations are repeated two or three times to increase the accuracy of the results. Applying von-Neumann stability analysis, the proposed technique is shown to be unconditionally stable under Crank-Nicolson scheme. Comparison of the numerical results is done with the results from some recent schemes.

Keywords: Benjamin-Bona-Mahony equation, cubic B-spline, collocation method

AM24
Stability Analysis of MHD Mixed Convection Flow over a Moving Flat Plate in Ferrofluids with Thermal Radiation, Suction and Second-order Slip Effects: Heat Flux Case

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Abstract. In this study, the magnetohydrodynamic (MHD) mixed convection flow over a moving flat plate with thermal radiation, suction and second-order slip effects when the plate is maintained at a variable heat flux is investigated. By using the similarity transformation, the partial differential equations are transformed into the ordinary differential equations which are then solved numerically using the shooting method. The variations of the numerical solutions for the skin friction coefficient and local Nusselt number, as well as the velocity and temperature profiles are acquired for several values of the governing parameters by considering two types of base fluids (water and kerosene) with three selected ferroparticles (magnetite, cobalt ferrite and manganese-zinc ferrite). It is found that triple solutions exist for both assisting and opposing flows when the radiation parameter, mass transfer parameter for suction and moving parameter for a surface moving towards the origin are applied. Stability analysis is then performed to determine which solution is stable by implementing the bvp4c function in Matlab software. The results from this analysis demonstrate that the first solution is stable and physically realizable, while the second and third solutions are unstable and not physically realizable.

Keywords: stability analysis, MHD, mixed convection, moving flat plate, ferrofluids, thermal radiation, suction, second-order slip flow

AM25
Application of Optimal Homotopy Asymptotic Method to Some Well-Known Linear and Non-Linear Two Point Boundary Value Problems

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Abstract. The objective of this paper is to obtain an approximate solution for some well-known linear and nonlinear two-point boundary value problems. For this purpose, a semi analytical method known as Optimal Homotopy Asymptotic Method (OHAM) is used. Results show the effectiveness and reliability of OHAM for application to two-point boundary value problems. The obtained results are compared to the exact solutions and Homotopy Perturbation Method.

Keywords: Approximate solution, two-point boundary value problems, semi analytical method

AM26
A Hybridized Neural Network Models for Data with Outliers

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Abstract. In this research, a hybridized neural network technique was developed with the aim of investigating and comparing its performance with the performance of the standalone neural network in the case of deviation from the assumption of homoscedastic relationship in dataset. Modelling using real data as asserted by Hampelet'al, (2011) is presumed to contain between 1% to 10% contaminations. Presence of outliers in dataset may contradict the assumption of normality or even both normality and homoscedasticity (Atkinson and Riani, 2012). Two neural networks i.e Cascade forward back propagation neural network (CFBNN) and Feed forward back propagation neural network (FFBNN) were considered in this research. The functional potentiality of neural network has led to a verse studies comparing its performance in the predictive capability (Jiang and Chen, 2016). A clustering algorithm based on robust measure were introduced to each of this neural network to form a hybridized neural network known as the cascade forward backpropagation neural network over a filtered data by clustering algorithm based on robust measure acronym as (CFBNFDCARM) and Feed forward back propagation neural network over a filtered data by clustering algorithm based on robust measure acronym as (FFBNFDCARM). The proposed hybridized techniques were employed on six (6) different dataset obtained from data repository dataset (UCI). The clustering technique tends to filter out the outliers from each of the obtained dataset. The filtered dataset were then introduced to the two neural networks in order to determine their performances. The results obtained from the proposed hybridized neural network techniques were compared with the results obtained from the standalone neural network techniques. The comparison indicates that, the emerging performance results from the proposed hybridized techniques generally on the average outperformed the performance results from the standalone techniques in terms of the evaluating metrics of the mean square error (MSE), root mean square error (RMSE), mean absolute error (MAE) as well as the mean absolute percentage error (MAPE).

Keywords: hybridized, technique, neural network, outliers

AM27
Dual Solutions of Exponentially Stretched/Shrinked Flows of Carbon Nanotubes

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Abstract. The solution to the heat transfer problem due to exponentially stretching/shrinking sheet and the steady two-dimensional boundary layer flow of a carbon nanotube is analyzed and discussed thoroughly in this paper. The governing partial differential equations and boundary conditions are then converted into a set of nonlinear ordinary differential equations using suitable similarity transformations which are then solved numerically for single wall carbon nanotubes as nanoparticle with three types of base fluids, namely water, kerosene and engine oil. This carbon nanotube model incorporates the effect of nanoparticle volume fraction and stretching/shrinking parameter. The effects of the governing parameters on the dimensionless velocity, temperature, skin friction and Nusselt numbers are presented graphically and discussed. Dual solutions are found to be exists in a certain range of the suction parameter for both stretching and shrinking cases. It is found that engine oil is to be the best heat transfer and kerosene has higher skin friction compared to the other base fluids.

Keywords: boundary layer, carbon nanotubes, dual solutions, exponentially stretching/shrinking, heat transfer

AM28
Stability Analysis of Magnetohydrodynamic Stagnation-Point Flow over a Nonlinearly Permeable Stretching/Shrinking Sheet with Velocity Slip

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Abstract. This study presented the numerical solutions of two-dimensional stagnation-point flow in an incompressible electrically conducting viscous fluid, over a nonlinearly stretching/shrinking sheet, with suction, magnetic field and velocity slip effects. The governing partial differential equations were first reduced to the ordinary differential equations, using the similarity transformations, and the obtained equations were then solved using the bvp4c programme in MATLAB. It was found that there existed dual (first and second) solutions in a certain range of the shrinking case. Stability analysis was employed to identify which solution is stable. The results showed that the first solution was stable, while the second solution was unstable. In addition, the study established that the presence of magnetic, nonlinearity and velocity slip effects could delay the separation of boundary layer.

Keywords: dual solutions, magnetohydrodynamic, stability analysis, velocity slip

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AM29

Variation and Prediction of Rainy Season in Thailand Using Ensemble Neural Model

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Abstract. The variation and prediction of rainy season play a role in many aspects especially agriculture and water management resources. In order to examine the variation and prediction of rainfall, an ensemble neural model (ENM) is proposed. The model aims to explore the relationships between rainfall and other weather conditions and also to improve the accuracy in prediction skill. In experiment, the monthly rainfall data by the Thai Meteorological Department (TMD) from 2013 to 2016 for five meteorological stations are used. They have been interpolated as observed data in the training set including the forecast data from Coupled Model Intercomparison Project Phase 5 (CMIP5) as input data. The analysis shows how temperature, humidity, pressure and wind affect rainfall patterns in Thailand. The ensemble neural model can improve the accuracy in prediction skill compared with traditional neural network.

Keywords: CMIP5, ensemble neural model, rainy season, variation and prediction

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AM30

The (G'/G)-Expansion Method for Solving the Conformable Time Fractional Hirota-Satsuma Coupled KdV System

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Abstract. Recently, Kaplan and Bekir have used the $\exp\left(-\phi(\xi)\right)$ method to extract the exact solutions of fractional Hirota-Satsuma coupled KdV (FHScKdV) system of equations. In this study, we apply a different technique called a (G'/G)-expansion method proposed by Wang et al (2008) in the sense of conformable fractional derivative for finding other novel travelling wave solutions for the same model mentioned above. The obtained results from these two different methods will be compared. The obtained solutions show that the proposed method with conformable fractional derivative is efficient and very reliable for a wide variety of fractional systems in engineering mathematics.

Keywords: Hirota-Satsuma coupled KdV system, conformable fractional derivative, (G'/G)-expansion method

AM31

Effects of Thermal Radiation and Slip in Unsteady Stagnation-Point Flow and Heat Transfer past a Permeable Shrinking Sheet: A Stability Analysis

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Abstract. This paper solves the problem of unsteady viscous fluid flow and heat transfer near the stagnation-point over a permeable stretching/shrinking surface. The effects of thermal radiation, velocity and thermal slip conditions are considered in this study. The problem modelled in the form of partial differential equations, subjected to the respective boundary conditions, and transformed to a system of nonlinear ordinary differential equations by applying the right similarity transformations. The MATLAB solver bvp4c function produces every numerical solution with the variation in pertinent parameters. Excellent agreement in comparison with previous literature is presented. The presences of dual solutions are noticeable when the permeable sheet is stretching. Stability of the dual solutions is checked by obtaining lowest eigenvalues of the governing linearized boundary value problem. The effects of the governing parameters on the reduced skin friction coefficients, reduced local Nusselt number, dimensionless velocity and temperature profiles are given in the form of graph and discussed in detail.

Keywords: dual solutions, shrinking sheet, slip effects, stagnation-point flow, stability analysis, thermal radiation

AM32

New Group Fractional Damped Wave Iterative Solvers Using Mathematica

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Abstract. In this paper, the formulation of explicit group iterative methods, which are based on both standard and skewed five point finite difference discretisation are considered in solving the two dimensional second order time-fractional diffusion wave equation with damping. The Caputo formula of order α ($1<\alpha<2$) is utilized for the fractional time derivative. The implementation of the group iterative schemes are demonstrated on solving several numerical examples using Mathematica 11 software. The feasibility of the derived schemes are presented and compared.

Keywords: fractional derivative, explicit group methods, damped fractional wave equation, standard, skewed finite difference approximations

AM33
Students' Performance via Satisfiability Reverse Analysis Method with Hopfield Neural Network

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Abstract. This finding presents a logic mining technique to model the performance of the high school students in Malaysia. In this study, k-satisfiability reverse analysis method (kSATRA) will be proposed to extract the logical relationship among the school in the specified subjects. The extracted logical rule of the student's performance will be used to classify or project the outcome of the current and future performance. kSATRA is a method that utilized the beneficial feature of Hopfield Neural Network and k-satisfiability representation. The dataset used in this study includes the data from several schools which contain insightful features. The robustness of kSATRA in extracting logical rule in students' performance will be evaluated based on root mean square error, mean absolute error and mean percentage error. The result obtained from the computer simulation demonstrates the effectiveness of kSATRA in representing the performance of the students.

Keywords: satisfiability, logic mining, Hopfield neural network, 2-satisfiability reverse analysis method

AM34
Modified Implicit Difference Method for One-dimensional Fractional Wave Equation

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Abstract. In this paper, we introduce a new implicit finite difference scheme in solving the one-dimensional time-fractional diffusion wave equation with fractional order $\alpha(1 < \alpha < 2)$. The proposed scheme will be shown to be convergent to the exact solution with order $O(\tau^2 + (\Delta x)^2)$. Numerical examples are provided to test the applicability and efficiency of the proposed scheme.

Keywords: fractional wave equation, implicit difference method, numerical experiments

AM35
Higher Order Block Backward Differentiation Formula for Solving Third Ordinary Differential Equations

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Abstract. A higher order block backward differentiation formula method (HOBBDF) is presented in this paper as an alternative solver for solving third order ordinary differential equations (ODEs). The HOBBDF method is able to solve the problems directly using the variable step size technique. The numerical experiment is conducted to verify the capability of this method on accuracy and efficiency when solving the third order ODEs. The comparison of performances are made between HOBBDF method and two ODE solvers in MATLAB, which are known as ode15s and ode23s. From the experiments, numerical results show that the proposed method outperform the ODE solvers with better accuracy and lesser number of total steps.

Keywords: backward differentiation formulae, block backward differentiation formulae, ordinary differential equations, stiff ordinary differential equations, third order ordinary differential equations

AM36
Obstacle Avoidance Road Design with Speed Profile Using Bezier Curve

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Abstract. Speed profile of a road design may give indication of a smooth driving experience. In this paper, a simulated map with obstacles had been generated. Selected possible roads were constructed by Bezier curves where each road avoids the obstacles through the end points. Different Bezier curves are constructed, and its curvature information are calculated from the derivatives of the Bezier curve. Different results can be seen in terms of the design of the roads, curvature values and speed profile. The generated speed profile gives designers options to choose.

Keywords: road design, Bezier curve, obstacle avoidance, speed profile

AM37
Activation Functions Comparison in Neuro Symbolic Integration Using Agent Based Modelling

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Abstract. Logic program and neural networks are two important aspects in artificial intelligence. This paper is part of an endeavour towards neural networks and logic programming integration. The goal in performing logic programming based on the energy minimization scheme is to achieve the best ratio of global minimum. However, there is no guarantee to find the best minimum in the network. To achieve this, activations functions are modified to accelerate the neuro symbolic integration. These activation functions will reduced the complexity of doing logic programming in Hopfield Neural Network (HNN).The activations functions discussed in this paper are new learning rule, Pseudo Inverse Rule and Hyperbolic Tangent Activation function. This paper also focused on agent based modelling for presenting performance of doing logic programming in Hopfield network using various activation functions. The effects of the activation function are analyzed mathematically and compared with the existing method. Computer simulations are carried out by using NETLOGO to validate the effectiveness on the new activation function. The results obtained showed that the Hyperbolic Tangent Activation function outperform other activation functions in doing logic programming in Hopfield network. The models developed by agent based modelling also support this theory.

Keywords: neuro-symbolic, logic programming, Hopfield, activation function, agent based modelling

AM38
Fuzzy Sumudu Decomposition Method for Solving Differential Equations with Uncertainty

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Abstract. In this paper, fuzzy Sumudu decomposition method (FSDM) is introduced for handling differential equations with uncertainty, where the differential equations are interpreted under the concept of strongly generalized differentiability. Under this type of interpretation, two cases of differentiability are considered. Solutions in terms of infinite series are produced using FSDM, converging to the accurate solutions of the problems considered. Finally, several numerical examples are demonstrated to illustrate the effectiveness and capability of FSDM.

Keywords: fuzzy Sumudu decomposition method, fuzzy Sumudu transform, fuzzy differential equations

AM39
Determining Degree of Elevation Using Spatial Bézier Curve

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Abstract. Curvature information can be used to design and evaluate the maximum speed of highways. Past research on highway designs only considered planar or two-dimensional space where vertical and horizontal alignments of the road are examined separately. Three-dimensional alignment should be considered to get better approximation and representation of highway designs. In this study, a simple procedure to develop a mathematical methodology that allows the curve fitting of Bézier curves on three-dimensional alignments of highways by using Spatial Bézier Curve is proposed. Degree of the angle elevation of the highway can be determined at different time values by incurring other factors such as superelevation and side skin friction coefficient.

Keywords: Bézier curve, degree of elevation, highway design, spatial Bézier curve

AM40
Comparing Logic Programming Between Hopfield Network and Radial Basis Function Network

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Abstract. Logic programming is a superior language because it operates on a higher level mathematical or logical reasoning. It is well-suited in building the artificial intelligence systems. In this paper, we reviewed the performance of the logic programming in Hopfield Neural Network (HNN) and Radial Basis Function Neural Network (RBFNN). Logic programming by using the Embedding method will improve the performance of RBFNN. In HNN, logic programming can be implemented by finding the optimal synaptic weight via Wan Abdullah method. This study gives an overview for HNN and RBFNN in terms of architectures, learning processing, and their application in 2-Satisfiability logic programming. Both networks will be assessed based on the accuracy, sensitivity and robustness. Pursuing that, RBFNN is expected to outperform HNN in doing 2-Satisfiability logic programming.

Keywords: logic programming, Hopfield neural network, radial basis function neural network, 2-Satisfiability

AM41
2-Satisfiability Logic Programming in Radial Basis Function Neural Networks

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Abstract. The training of a radial basis function neural network (RBFNN) involves finding the optimal number of hidden neurons in the hidden layer and finding the RBFNN parameters such as center, width and the output weight. 2-satisfiability (2SAT) logic programming will be embedded in RBFNN during the training phase. Two training techniques, no-training, and half-training are proposed in this paper. The experiment of both techniques has been examined by using Microsoft Visual Studio 2008 C# Express software. The detailed comparison of the performance of two different techniques in performing 2SAT is discussed in term of the number of the hidden neurons and CPU time. The results obtained from the computer simulation have shown that RBFNN-2SAT in half-training technique outperform than RBFNN-2SAT in no-training technique.

Keywords: radial basis function neural network, no-training technique, half-training technique, 2-satisfiability

AM42
Sumudu Transform with Modified Homotopy Perturbation Method to Solve Two Point Singularly Perturbed Boundary Value Problems

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Abstract. In this paper a class of linear and nonlinear two point singularly perturbed boundary value problems (SPBVPs) has been solved by a new powerful technique called modified Sumudu transform homotopy perturbation method (MSTHPM). This technique relies on the Sumudu transform (ST) and homotopy perturbation method (HPM). The proposed scheme is based on the freedom of homotopy perturbation method by introducing a suitable initial approximation; in addition, the residual error will be canceled in several points of the interest interval (RECP). Only a first order approximation of MSTHPM will be required. In this work, the method has been applied to solve some examples and the results have been compared with those obtained from other methods and exact solutions, where it is found that the proposed solutions are of high accuracy and therefore, MHPSTM is extremely efficient, simple and can be applied to other nonlinear problems.

Keywords: Sumudu Transform, Homotopy Perturbation Method, Singularly Perturbed Boundary Value Problems

AM43
A New Modified RMIL CG Method with Global Convergence Properties

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Abstract. The conjugate gradient (CG) method is a widely used approach for solving large-scale optimization problems. The efficiency of this method is attributed to its global convergence properties and low memory requirement. In this study, a new CG coefficient, β_k is proposed based on the Rivaie-Mustafa-Ismail-Leong (RMIL) method. The proposed method is proved to be globally convergent under exact line search. This is supported by the results of the numerical tests, which at the same time shows that the new CG method is more efficient compared with existing CG methods.

Keywords: conjugate gradient method, global convergence, exact line search

AM44
The Red-Black SOR Iteration Based on Grünwald Fractional Scheme for One-Dimensional Time-Fractional Parabolic Equations

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Abstract. In this paper, we investigate the effectiveness of the Red-Black Successive Over-Relaxation (RBSOR) iterative method in solving the one-dimensional (1D) time-fractional parabolic equations. The approximation equations were constructed based on Grünwald fractional derivative and implicit finite difference schemes and then solved iteratively. In order to access the efficiency of the RBSOR iterative method, comparison was made by considering three parameters, which are the iteration numbers, the computation time and the maximum error. Based on the results of the numerical experiments, it shows that the application of red-black ordering strategy to the classical SOR method have improved its performances in solving 1D time-fractional parabolic equation based on Grünwald fractional derivative scheme.

Keywords: Time-Fractional Parabolic equation, Grünwald formula, implicit finite difference, RBSOR iteration

AM45

Adaptive Step Size Stochastic Runge-Kutta Method of Order 1.5(1) for Stochastic Differential Equations (SDEs)

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Abstract. This paper deals with the development of an embedded stochastic Runge-Kutta (SRK) pair method for solving stochastic differential equations (SDEs). The proposed method is an adaptive step size SRK method. The method is constructed by embedding a SRK method of 1.0 order into a SRK method of 1.5 order of convergence. The technique of embedding is applicable for adaptive step size implementation, henceforth an estimate error at each step can be obtained cheaply. Stability properties of the embedded SRK pair method of 1.5(1) are also investigated. Numerical experiments are performed to demonstrate the efficiency of the method.

Keywords: embedded stochastic Runge-Kutta, adaptive step size, stochastic differential equations

AM46

Solving Ordinary Differential Equations Using Wavelet Neural Networks

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Abstract. In this paper, we present an artificial neural network (ANN) approach to approximate the solution of ordinary differential equations (ODEs) with initial conditions. The wavelet neural network (WNN) model with Gaussian Wavelet activation function is applied as a universal approximator, where the presented method forms a trial solution which is expressed in an analytical closed form solution of the ODE. The proposed method converts the application of solving ODEs from a constrained optimization problem into an unconstrained optimization problem by satisfying the initial conditions exactly. Then the momentum backpropagation (mBP) is employed to minimize the unsupervised error function, in which the only adjustable parameters are the weights from the hidden layer to the output layer. Different types of initial value problems (IVPs) are solved to illustrate the applicability and accuracy of the proposed momentum backpropagation wavelet neural network (mBPWNN) method. In comparison with the solution of other existing artificial neural network methods, numerical results showed that the mBPWNN method yields a superior accuracy.

Keywords: wavelet neural network, artificial neural network, ordinary differential equations, initial value problems

AM47
Temperatures and Normalized Difference Vegetation Index Forecasting in the Tropical Rainforest: Hala-Bala Wildlife Sanctuary, Thailand using Artificial Neural Networks

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Abstract. Hala-Bala Wildlife Sanctuary is one of the preserved areas in Thailand. It is situated at the boundary of Thai-Malaysia which covers the area of San Kala Khiri Mountain. The prediction of temperatures and normalized difference vegetation index (NDVI) will help predict fertility changes in these areas. This research aim ed to study the prediction of temperatures an d NDVI in Hala-Bala wildlife sanctuary, Thailand. The data used in this research is time series data for seventeen years from 2001 to 2017. Artificial Neural Networks was used in this research for forecasting these data and tracking signal was used to find the appropriate period. The predicted result from Artificial Neural Networks with sigmoid activation function (Mean Square Error = 2.17, Mean Absolute Error = 1.10) for temperatures in Hala-Bala wildlife sanctuary found that the suitable prediction period is one period only. Besides, the suitable prediction period for NDVI (Mean Square Error = 0.00072, Mean Absolute Error = 0.017) is five periods, respectively.

Keywords: Artificial Neural Networks, Hala-Bala Wildlife Sanctuary, NDVI, temperatures

AM48
Comparison Analysis between Linear and Nonlinear Models to Predict Language Proficiency in Proportion to Language Learning Strategy

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Abstract. An extension to previous studies, the model comparison of all five models whereby the consideration of nonlinear models, specifically Gompertz model and Modified Gompertz model, were fit into the social data of Language Learning Strategies (LLS) as its independent variables and its dependent variable, Language Proficiency. A self-report questionnaire called the Strategy inventory for language learning (SILL) was administered to two hundred and thirty pre-university students of Universiti Malaysia Sabah, and their language proficiency was measured using the Malaysian University English Test (MUET). A comparison analysis was done between the three best linear models and the two nonlinear models using these goodness of fit tests and information criterions; root mean square error (RMSE), mean absolute error (MAE), residual standard error (RSE), corrected Akaike's information criterion (AICC) and Bayesian Information Criterion (BIC).

Keywords: modified Gompertz model, Gompertz model, Language Learning Strategies

AM49
Portfolio Optimization Using Genetic Algorithm and Harmony Search Algorithm with Varying Operators and Parameter Values

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Abstract. Portfolio optimization concerns the selection of the best combination of assets, so as to meet certain pre-defined objectives. In general, portfolio optimization aims to maximize the expected return, and at the same time, minimize the portfolio risk. Various mathematical techniques have been employed in the task of portfolio optimization, ranging from the classical non-integer programming method and statistical-based principal component analysis, to the more recent metaheuristic approach. Specifically, metaheuristic-based methods have gained much attention from the research community, owning to their excellent search capabilities. Two metaheuristic-based approaches, namely, genetic algorithm and harmony search algorithm, are considered in this work. A common dataset is used to compare the performance of the two algorithms. The algorithms are studied using different operators and parameters values. The performance of the best portfolio, found by the metaheuristic algorithms, is evaluated using the Sharpe ratio. Empirical simulation shows that the two algorithms yield comparable results. It is also found that algorithms that have been enhanced in various aspects outperform the stand-alone counterparts. In addition, sensitivity analysis reveals that the convergence speed is dependent on the parameter values.

Keywords: Portfolio optimization, genetic algorithm, harmony search

AM50
Bezier Curves Interpolation with End Point Constraints

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Abstract. This paper presents a path or curve generated based on Bezier curve. Derivation of smooth curve is one of important subjects for good visualization. Bezier curve is a smooth parametric curve but adequate assignments of its control points that determine the shape of Bezier curve is not a simple problem. Therefore, nth order base Bezier curve is derived with the end point constraints which are location and velocity. Results and comparison between interpolation of Cubic and Quartic Bezier curve visualization are shown and discussed in this paper. Application on reconstructing a curve from a road map is shown.

Keywords: curve generated, Bezier curve, end point constraint

AM51
Fitting the First Order Polarization Tensor by Spheroid: A Semi Analytical Approach

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Abstract. The perturbation in an electrical field due to the presence of a small conducting object can mathematically be represented in terms of an asymptotic series where the dominant term of the series is called as the first order Polarization Tensor (PT). The first order PT itself contains information about shape and conductivity of the conducting object and thus, the first order PT can be used to describe the object. This technique is applied in many real applications such as to improve biomedical imaging, increase the capability of metal detection for security screening or landmine clearance and also to study electrosensing fish. In electrical imaging and electrosensing fish, it is useful to sometimes fit the first order PT by an ellipsoid. In this case, given the first order PT related to the perturbation caused by a known or unknown object, we want to determine an ellipsoid that has the same first order PT. Previously, a numerical method has been developed to determine all three semi axes of an ellipsoid at a fixed conductivity from a given first order PT that is associated with ellipsoid. This is because the first order PT for ellipsoid is explicitly given by system of integral equations where all integral equations are approximated numerically by nonlinear equations. In this case, the numerical method is needed to derive and solve the resulting system of nonlinear equations. In this study, we will discuss on how to determine a spheroid, an ellipsoid with two equal axes, from a given first order PT. In contrast to the previous approach which used totally numerical method, we will use both analytical and numerical approaches to find the two distinct axes of the spheroid at a fixed conductivity. Numerical examples will be given to justify our methods.

Keywords: conductivity, integral equations, matrix

AM52
Shock Wave Propagation in Monodispersed Bubbly Viscoelastic Fluid Flow

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Abstract. In this work, a weakly non-linear wave equation in bubbly viscoelastic liquid flow is derived using reductive perturbation method. Viscosity, elasticity and surface tension are considered under isothermal condition. A kink travelling wave solution is obtained using tangent hyperbolic method. Graphical representation of the solution is given and analysed with different values of parameter. The result shows that the steepening of the kink wave decreases with the increase of viscosity while the dispersion of the wave is greatly affected by the elasticity of the liquid. It is also observed that at high viscosity the shock wave propagates and at very low viscosity the soliton propagates. The result may be applied in sono-chemistry and biomedical application.

Keywords: shock waves, bubbly liquid, reduction perturbation method, evolution equation

AM53
Modeling Overtaking Behavior for Pedestrian Dynamics Using a Modified Social Force Model

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Abstract. The study of pedestrian dynamics is of great theoretical significance for the design of proper walking facilities to avoid disasters during panic and evacuation situations. The Social Force Model (SFM) is one of the most popular models to describe the motion of pedestrians as it is able to simulate successfully the behavior of pedestrians in real life. Since the introduction of the overtaking behavior, many researchers have adopted this idea either in microscopic or macroscopic models. Previous studies have proposed the concept of the visual angle and the addition of overtaking force to minimize the pushing behavior and also to model the overtaking behavior. In this paper, we propose to completely eliminate the pushing behavior and to model the overtaking behavior with minimal modifications to the original SFM. This modification is based on the strength parameter of the existing social repulsion force term and the actual velocity of the pedestrian. Simulations are performed in a normal unidirectional walkway to compare the movement of the pedestrians by using snapshots of the video simulation of the pedestrians. Subsequently, comparisons of the pedestrian movements between the original Helbing model, the Helbing perception model and the modified SFM are conducted to examine the behavior of the pedestrians. The results show that the modified SFM are able to generate more realistic overtaking behavior compared to the other models. Moreover, the pushing over behavior is successfully eliminated.

Keywords: Social Force Model, overtaking behavior, pushing behavior, unidirectional walkway, Helbing model

AM54
Analysis of the SA-Like Selection Operator in Differential Evolution-Simulated Annealing (DESA) Algorithm

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Abstract. This paper presents a mathematical analysis of the hybrid algorithm DESA, a combination of Differential Evolution (DE) and Simulated Annealing (SA) algorithm. DESA is a DE-based algorithm with SA-like selection operator. The discussion includes detailed algorithmic frameworks and characteristics of the DESA-population and its comparison with the classical DE algorithm. An expression of the relative difference in learning rates and momentum of the gradient of the objective function implies that SA-like selection operator improves the performance of the classical DE algorithm.

Keywords: differential evolution, simulated annealing, learning rate, momentum

AM55
An Ant Colony Approach in the Detection of Communities in Complex Networks

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Abstract. Community structure is one of the most important properties of complex networks. Over the years, various approaches had been used to detect communities in complex networks. In this paper, the ant colony optimization (ACO) algorithm is implemented to detect the initial communities. By utilizing the similarity between the nodes as the heuristic information, this variant of ACO is developed to optimize the densities of the communities within a limited number of iterations. Once the initial communities are detected, other community detection methods are implemented to obtain the final detection results. The ACO algorithm can produce good initial communities in both synthetic and real-world networks. By combining the proposed algorithm with the existing community detection methods, good quality final communities can be detected in those networks.

AM56
Optimal Investment and Consumption Decision for an Investor with Ornstein-Uhlenbeck Stochastic Interest Rate Model Through Utility Maximization

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Abstract. In this work; it is considered that an investor's portfolio is comprised of two assets: 1) a risky stock, in which the price process is driven by the geometric Brownian motion; and,2) a risk-free asset with Ornstein-Uhlenbeck Stochastic interest rate of return, where consumption, taxes, transaction costs and dividends are involved. This paper aimed at the optimization of the investor's expected utility of consumption and terminal return on his investment at the terminal time having power utility preference. Using dynamic optimization procedure of maximum principle, a second order nonlinear partial differential equation (PDE) (the Hamilton-Jacobi-Bellman equation [HJB]) was obtained from which an ordinary differential equation (ODE) was obtained via the elimination of variables. The solution to the ODE gave the closed form solution of the investor's problem. It was found the optimal investment in the risky asset is horizon dependent, a ratio of the total amount available for investment, and the relative risk aversion coefficient.

AM57
New Switching Strategy to Combat Breakdown in Lanczos-types for the Solution of High Dimensions of Linear Equations

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Abstract. Breakdown in Lanczos method, or other non-stationary iterative methods, is kind of a latent disease which sustains every time we solve the systems of linear equations (SLEs). A number of approaches to deal with the issue has been investigated. However, the problem is not fully addressed, so far. Here, we propose switching strategy to combat the breakdown in Lanczos-type algorithms, particularly in A_{12}, A_8/B_6 (Orthodir), A_5/B_{10} (Orthomin), and A_4 (Orthores) algorithms. When breakdown occurs in a Lanzcos-type algorithm, the polynomial basis of Krylov subspace lost its orthogonality. It causes the algorithm to halt before a good solution is found. Switching the infected algorithm to another Lanczos-type can maintain the convergence of the algorithms. Our novelty here includes the use of the quality points for switching, namely the last iterate preceeding breakdown, and the iterate with the minimum residual norm. We also use the unfixed number of iterations to get more good points to switch. Imposing the quality points into a Lanczos algorithm yields new algorithms, they are called SLULast (switching based on the last iterate) and SLUMinRes (switching based on the iterate with the lowest residual norm). Both theoretical and numerical results were presented, and we compared our new algorithms with the existing switching strategy.We solved various SLEs, ranging from 1000 to 20000 dimensions. Our results showed that SLULas and SLUMinRes perform better than the existing switching algorithmin terms of the efficiency.

Keywords: Lanczos-type algorithms, breakdown, switching strategy, quality points

AM58
Comparison of Handwriting Curve Reconstruction Using Whale Optimization Algorithm and Least Square Approximation

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Abstract. Curve representation is widely used in reverse engineering to reconstruct the curves. This paper discusses the comparison on using two different approaches of curve fitting for curve reconstruction. The two approaches, namely Whale Optimization Algorithm (WOA) and Least Square Approximation are used for comparison purposes. The WOA is a novel nature-inspired meta-heuristic algorithm in solving optimization problem. Both techniques are used in the curve fitting process to find the optimal value for the control points of the cubic Bézier curve. Sum Square Error (SSE) is used to determine the difference in distance of the original curve with the reconstructed curve. Then, SSE between the two techniques are compared. Visualization and numerical comparison are then obtained.

Keywords: curve fitting, Whale Optimization Algorithm, Least Square Approximation

AM59
Optimal Vaccination Strategies for Controlling the Spread of Porcine Reproductive and Respiratory Syndrome Virus in a Swine Population

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Abstract. Porcine reproductive and respiratory syndrome (PRRS) is an important swine disease causing reproductive failure and respiratory problems in pigs. It results in economic loss in the swine industries worldwide. In this study, the effects of vaccination control strategies for newborns and susceptible pigs are investigated in a mathematical model for describing the transmission dynamics of PRRS virus to find an optimal way to minimize the number of an infected population. Our results suggest the maximum effort towards vaccination of newborns and they also identify certain factors that may influence the recovery time of the swine population.

Keywords: PRRS, mathematical modeling, optimal control, transmission dynamics, vaccination strategies

AM60
Using Partial Differential Equation in Modelling a Drinking Can with Texture Features

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Abstract. The elliptic partial differential equation (PDE) known as biharmonic equation has been utilized by many to model complex objects due to its ability in producing smooth surface using small sets of parameters. To solve biharmonic equation, information on suitable boundary condition is prominent. These boundary conditions are determined based on the extraction of boundary curves from a physical object. In this paper, advantage of applying boundary-value approach is demonstrated by modelling a drinking can. Even better, a texture feature is incorporated into that model to make it more realistic.

Keywords: boundary conditions, Fourier curves, biharmonic equation, PDE surface

AM61
A Comparison Study of the Chebyshev Collocation Method and the Finite Difference Method for Solving Fourth-Order Partial Differential Equations

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Abstract. To investigate two numerical techniques, the Chebyshev collocation method and the finite difference method, for solving fourth-order partial differential equations, we provide some examples and explore the numerical errors. Each problem is transformed into linear algebraic equations to solve for unknown Chebyshev coefficients which can be used for approximating a solution. Each problem is then solved by the finite difference method for comparisons of the error results and discretization strategies. Based on some examples in this study, the Chebyshev collocation method can be a powerful tool to tackle with fourth-order partial differential equations and their complex forms of boundary and initial conditions.

Keywords: Chebyshev collocation method, fourth-order partial differential equations, finite difference method

AM62
Intuitionistic Fuzzy Set: Application to Flat Electroencephalography Image

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Abstract. Flat Electroencephalography (fEEG) is a technique that mapped high dimensional signal into low dimensional space. An image of fEEG which is in grayscale is obtained via fuzzy approach by the process of digitization and quantization. In this paper, the enhancement of fEEG images of two epileptic patients at varied time is described. The images are enhanced by using intuitionistic fuzzy set theory. Moreover, the quality test of the images is determined by structural similarity index measure (SSIM) for particular values of parameter namely lambda, λ in the Sugeno type intuitionistic fuzzy generator. The relationship between the membership, non-membership, and hesitation degree is also demonstrated graphically.

Keywords: fEEG image, Intuitionistic fuzzy set, image enhancement

AM63
Fuzzy Conjoint Analysis in Studying Undergraduates' Statistics Motivation

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Abstract. This study discussed the application of fuzzy sets to measure undergraduate students' perceptions towards their motivation in statistics classroom. By implementing fuzzy conjoint analysis, the elements of fuzziness in the questionnaire would be transformed into a mathematical model. This approach was used to analyze data from 250 undergraduate students taking introductory statistics course as a compulsory subject to graduate. Students' perceptions on their motivation were recorded in form of degrees of similarity and level of agreeableness in six components of motivation. Ordinal values in Likert scale that represents the linguistic terms of motivation level were used. The highest degree of similarity indicated that students were persistent to capture and understand the concept of statistics. Meanwhile, the attribute with lowest degree of similarity revealed that students were uncertain of the purpose of their involvement in statistics classroom, which might be just to show-off in front of their peers. Therefore, the findings provided useful information to improve students' statistics motivation in finding the attributes that needed to be taken care by the lecturers or instructors.

Keywords: perceptions, fuzzy conjoint analysis, statistics motivation, statistics classroom, degree of similarity.

AM64
A General Numerical Approximation of the Stress Characteristic Field at a Singular Point

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Abstract. A general numerical approximation for the construction of the stress characteristic field in the deformation of ideal granular material at a singular point is considered. The self weight of the granular material is neglected and the stresses are assumed to obey the Coulomb yield criterion. A numerical approximation using finite difference method is used to solve a boundary value problem that leads to the construction of a complete stress characteristic field. The method is presented in this paper and tested within the MATLAB program at each stage of the construction.

Keywords: plasticity, granular, double rotating

AM65
A Lagrange-mesh Method for Solving Two-Dimensional Schrödinger Equation

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Abstract. The solution of Schrödinger equation is obtained using the Lagrange-mesh method. The method is applied for the computation of the eigenvalues of the two-dimensional Henon-Heiles potential. The energy eigenvalues, the corresponding wave functions and the eigenvalues potential are obtained. A comparison is discussed with the experimental data and recent works. The nonrelativistic energy equations are calculated, while the wave functions are discussed.

Keywords: variational method, spherical coordinates, grid points Hamiltonian

AM66
Curves Fitting by Rational Cubic Bézier with C^1 and G^1 Continuity Using Metaheuristics Methods

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Abstract. Rational cubic Bézier curves are used to approximate the data sets while minimizing the least-squares error function using different metaheuristics algorithms. Those metaheuristics algorithms are Genetic Algorithm, Particle Swarm Optimization and Modified Harmony Search (MHS). This scheme is implemented with continuity of C^1 and G^1, as well as the comparative and analysis behaviour between the two conditions for the curve fitting on four outlines of the test images boundary will be discussed. Based on the analysis, MHS algorithms is more stable, accurate and precise compared to other algorithms. G^1 continuity condition also leads to a better curve fit compared to C^1.

Keywords: rational cubic Bézier, continuity, metaheuristics, modified harmony search, genetic algorithm, particle swarm optimization

AM67
Stagnation Point Flow and Heat Transfer over an Exponentially Stretching/shrinking Sheet in a Porous Medium

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Abstract. The steady stagnation point flow in a porous medium caused by an exponentially stretching/shrinking sheet is investigated. Similarity transformations have been applied to transform the system of partial differential equation into a system of ordinary differential equations. The system is then solved numerically using a shooting method in Maple software. The effect of the governing parameters on the skin friction coefficients and the local Nusselt numbers as well as the velocity and temperature profiles are analyzed and discussed. Results obtain in this study are illustrated graphically. It is found that the dual solutions exist for certain values of the governing parameters.

Keywords: porous medium, stretching/shrinking, stagnation point

AM68
Lie Point Algebraic Classification of Linear Third Order ODEs Using Differential Invariants

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Abstract. We obtain equivalence transformations for general linear third order ordinary differential equation (ODE) using Lie infinitesimal method. These equivalence transformations are then employed to deduce associated invariants. MAPLE code is developed to perform the desired derivation in two steps. Firstly, it constructs the group of equivalence transformations for linear third order ODEs and secondly employs it to deduce associated invariants. Derived invariants are used to reduce the linear third order ODEs with variable coefficients to simpler equations of this family with a few constant coefficients. It is shown that these reductions help in identifying the canonical forms of the linear third order ODEs with 4, 5, and 7-dimensional Lie point symmetry algebras. Though this algebraic classification for linear third order ODEs has already been presented, here differential invariants are shown to provide an alternate procedure to recover the same.

Keywords: equivalence transformations, invariants, canonical forms, linearizable equations

AM69
Differential Invariants for Nonlinear Third Order Partial Differential Equations

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Abstract. We derive differential invariants for a class of nonlinear third order evolution type partial differential equations (PDEs) using Lie infinitesimal method. This class is obtained from general linear third order evolution equation via an invertible change of the dependent and independent variables (point transformations). Reduction of the nonlinear evolution type PDEs under point transformations to their simpler and solvable forms is achieved by employing derived differential invariants. A MAPLE program is also developed and presented to facilitate the said derivations, i.e., MAPLE code is written to obtain the set of equivalence transformations and corresponding invariants for the nonlinear third order evolution type PDEs.

Keywords: evolution equation, infinitesimal method, differential invariants, linearization

AM70
MHD Free Convection Boundary Layer Flow near the Lower Stagnation Point of a Horizontal Circular Cylinder Embedded in a Ferrofluids

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Abstract. Present paper deals with the steady magnetohydrodynamic (MHD) free convection of some ferrofluid flow near the lower stagnation point of a horizontal circular cylinder. The governing ordinary differential equations are solved via Keller-box method. The effect of magnetic parameter and nanoparticle volume fraction on temperature and velocity profiles as well as the values of reduced Nusselt number and skin friction coefficient are analyzed and discussed for the three selected ferroparticles which are ferrite magnetite (Fe_3O_4), cobalt ferrite ($CoFe_2O_4$) and Mn-Zn ferrite (Mn-Zn Fe_2O_4) with water-based fluid. It is found that the increase of magnetic parameter and nanoparticle volume fraction had increased the thermal boundary layer thicknesses while the value of reduced Nusselt number and reduced skin friction coefficient decreases. In comparing the heat transfer among the ferrofluid considered, it is found that the $CoFe_2O_4$ ferrofluid produced the highest reduced Nusselt number while gives a smallest thermal and velocity boundary layer thicknesses compared to Fe_3O_4 and Mn-ZnFe_2O_4 ferrofluids.

Keywords: circular cylinder, ferrofluid, free convection, magnetohydrodynamic, stagnation point

AM71
Modeling Breast Cancer and Its Optimal Control

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Abstract. Breast cancer is the most common cancer amongst womenfolk, impacting above 1.5 million women every year, and correspondingly roots the utmost number of cancer-related deaths amongst women. In 2015, 570,000 women died from the disease that is about 15% of all cancer deaths amongst womenfolk. Although the disease rates are higher amongst womenfolk in more industrialized regions, rates are increasing in nearly every region globally. In this paper, a model of the disease is developed. Conditions are derived for the existence of disease-free equilibrium. Stability analysis of the model shows that that disease-free equilibrium is both locally asymptotically stable and globally asymptotically stable. Optimal control theory is applied to the model and Pontryagin's Maximum Principle is applied for analysis of the control. To this end, three control strategies were incorporated into disease transmission model. The impact of using possible combinations of the three control strategies was investigated.

Keywords: breast cancer, optimal control, modeling

AM72
Mixed Convection Heat Transfer in a Vertical Channel in the Presence of Heat Loss and Chemical Reaction

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Abstract. The problem of heat transfer on steady fully developed mixed convection flow of an exothermic fluid in a channel formed by two infinite vertical parallel plates with heat loss under Arrhenius kinetic has been investigated. Neglecting consumption of the material the governing differential equations are obtained and solved for temperature field, velocity field, rate of heat transfer and skin friction by perturbation method. Results are presented graphically to show the effects of the parameters embedded in the problem. It is observed that increasing reaction parameter results in increase in both temperature and velocity. It is also oberved that increase in heat loss decreases the fluid temperature thereby preventing thermal runaway in the system. Rate of heat transfer is found to decrease with increase in heat loss and increases with decrease in heat loss.

Keywords: Mixed convection, perturbation, Arrhenius kinetic

FM01
Monetary Conditions in Indonesia: A Pre- and Post-IT Analysis

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Abstract. Monetary Conditions Index (MCI) is a measure of monetary policy stance either tight, neutral or loose relative to the targeted objective. The MCI is designed specifically for small open economies as both exchange rates and interest rates are influential in describing the economic behaviour of a country. In this study, we exclusively focusing on Indonesia as it was severely attacked by financial crisis (1997-2000) that spin out with worst recession than any other neighboring regions. Eventually, causing a drastic shift in the exchange rate regime from a fixed to a floating exchange rate system as well as the monetary policy regime transformed from money targeting to inflation targeting (IT) policy. Hence, we use two variant time series data consists of the pre-IT period (1980Q1-1996Q4) and post-IT period (2002Q1-2015Q4) by incorporating the auto regressive distributed lag (ARDL) model estimation and bounds testing procedure to construct the weights of MCIs. The results reveal that the exchange rate channel is more robust than the interest rate channel in the transmission mechanisms for both policy regimes. However, the interest rate channel is much weightier in the post-IT than the pre-IT. Besides that,the plotted MCIs characterizing almost a tighter stance in the pre-IT whilst looser stance in the post-IT. As a whole, the movements in the MCIs are feasible enough to illuminate the behaviour of policy making which is parallel to the economic condition in Indonesia.

Keywords: monetary policy stance, inflation targeting, transmission mechanism

FM02
Threshold Effects of Inflation on Economic Growth: Evidence from a Static Threshold Analysis for 18 Developed Economies

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Abstract. Many studies have been conducted in studying the inflation-growth relationship. However, the relationship still remains a contentious issue if there exists a trade-off between inflation and growth. We extend the study by considering the threshold relationship on inflation-growth by applying the static panel threshold regression (SPTR). The panel data study involves 18 developed countries over the period 1980–2016. Testing with various threshold variables, our results capture the existence of threshold relationship between inflation and growth due to influences of inflation, producer price, trade openness and oil price. In all cases, higher inflation is associated with higher output growth, implying a trade-off relationship. The higher threshold level of inflation is compensated with higher growth. Other determinants of growth include producer price, trade-openness, exchange rate and oil price. Among these determinants, producer price, trade-openness, and oil price have a smaller direct effect on growth, but they have larger indirect effects on growth through their threshold influences on inflation. Although higher inflation may boost the economic growth, the policymaker should control the level of inflation in order to balance the objective of high growth and stable/lower inflation rate. This is important for stable and sustainable economic growth in a longer term.

Keywords: Inflation threshold, growth, Static threshold regression

FM03
Panel Threshold Effect of Oil Price Changes on Monetary Policy: Empirical Evidence from Oil Importing Versus Oil Exporting Countries

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Abstract. Many studies have proven the impact of the changes of oil price on global economy. The main objective of this study is to examine the impact of oil price changes and other non – oil factors on monetary policy behavior and decision empirically. Generally, this study investigates the monetary policy reaction of oil importing versus oil exporting countries in response to the threshold effect of oil price changes and inflation. An advanced panel threshold regression is employed to study the money policy reaction function for the quarterly period from 1999 to 2016. For oil exporting countries, our results revealed that the existence of double – threshold effect of the oil price changes and inflation on monetary policy reaction. The results capture threshold effects of inflation and changes of oil price on determining the monetary policy reaction in both groups of countries. In both cases, higher inflation triggers to expansionary policy in which oil exporting exhibits higher threshold inflation rate (10.66% and 11.16%) compared to oil importing countries (1.11% and 4.97%). On the other hand, oil price changes imposed to higher threshold impact on monetary policy in oil exporting countries but not in oil importing countries. The results imply both oil and non-oil inflation are the main policy concern in oil exporting countries but only non-oil (consumer price) inflation is the concern of policy reaction in oil importing countries.

Keywords: panel threshold, oil price changes, inflation, oil importing countries, oil exporting countries

FM04
Investigation of Characteristics of Agricultural Commodity in Malaysia's Crude Palm Oil Futures Prices

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Abstract. Incorporating more than one characteristic of agricultural commodities futures is found to give a better pricing model in most of the past researches. Due to non-existence of similar research in pricing Malaysia's Crude Palm Oil Futures (FCPO), this paper investigates the presence of stochastic volatility, price jumps and seasonality in the FCPO prices. For that purpose, daily FCPO log returns are examined by using GARCH(1,1) model and stochastic volatility (SV) model and then both models are compared to show that SV model is better to forecast FCPO returns. For seasonality analysis, monthly volatilities is used, meanwhile Barndorff-Nielsen and Shephard (BNS) jump test is conducted with realized variance and bipower variation. As a result, it is found that only stochastic volatility and seasonality characteristics present in FCPO price. These characteristics can be considered further in pricing the FCPO.

Keywords: FCPO, pricing characteristic, agricultural commodity

FM05
Assessing Dynamic Linkages between Stock Market in Malaysia and
Stock Markets in the Asian Region

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Abstract. Financial market liberalization and deregulation have been seen as the main reason for greater level of co-movement and market integration in recent years. This study investigates dynamic market linkages between Malaysia stock market (KLCI) with each of that of China (SHCI), Singapore (STI) and relative to All Country Asian Index (ACAI) by employing Ordinary Least Square (OLS) regression and Kalman filter (KF) estimation technique. Weekly data covering the period from January 1995 to December 2015 is utilized. Unlike constant restriction on model parameters in the OLS regression, the KF technique allows for time-varying parameters that should better reflect changes in financial and economic relationship. The results show that linkages between KLCI with that of SHCI, STI and ACAI vary across the sample period. The impact of SHCI on KLCI increases over time while the impact of STI on KLCI is consistently high across the sample period. KLCI is also found to follow the general performance of the Asian stock indices, ACAI.

FM06
Comparing Dynamic Impact of Fundamental Macroeconomic Variables on
Sectoral Stock Indices in Malaysia

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Abstract. Individual investors, fund managers and Market practitioners often look at sectoral performance as sectoral stock indices yield different returns and risks, which allow them to actively manage their portfolios and to target the performance of a particular sector. This study investigates the short-run dynamic impact of changes in the macroeconomic variables on a few selected sectoral indices at the Bursa Malaysia. To better reflect the continuous changes in the economic and financial climates, the Kalman filter technique is employed to estimate the short-run dynamic impact for the period from January 1996 to December 2014. Generally, all the impact coefficients are larger in magnitude during the 97-98 Asian Financial Crisis period and smaller magnitude during the stability periods. Overall, the finance sector is found to be the most sensitive sector as the changes in the impact coefficient is the largest for all the macroeconomic variables. Despite the varying impact, the plantation sector is found to be the least affected by the changes in the macroeconomic variables while the industrial product and trade & services sectors generally show equal impact of changes in all the variables. The findings imply that market practitioners need to make necessary continuous adjustments in their pricing and portfolio diversification decision.

FM07
Universal Portfolios Generated by *f*-Disparity Differences

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Abstract. The *f*-divergence of Csiszar is well-known in information theory and statistical inference as a measure of the distance between two probability distributions. The *f*-divergence is generated by a convex function. A weaker form of the *f*-divergence is known as a *f*-disparity difference which is generated by a *f*-disparity function which is not necessarily convex. The universal portfolio generated by a *f*-disparity difference is studied empirically with respect to the accumulation of wealth of the investor. It is possible to increase the investor wealth using such a portfolio in investing in a stock market.

Keywords: universal portfolio, *f*-disparity difference, investment wealth

FM08
Investigating the Effects of Fiscal and Monetary Policy on Economic Performance: A Static Panel Threshold Regression Approach

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Abstract. For ages, there are controversial debates from different school of thoughts on the behavior of economic experience incidents. In this paper, we carefully examine and compare the impacts of fiscal policy (government expenditure, current account balance, budget deficit and government debt) versus monetary policy (broad money, exchange rate and real interest rate) on economic growth using a static panel threshold regression of Hansen (1999). In particular, the main objectives include (1) to model the threshold effect of budget deficit in stimulating regime dependent switching of variables on economic growth and (2) to compare the impacts of both policies on economic growth between two groups of countries with current account deficit versus current account surplus. The study is based on a panel of two groups of countries for the period of 1980-2017. The results reported a single threshold effect of budget deficit on inflation in determining economic growth. When budget deficit is relatively low, inflation has no significant effect on economic growth whereas higher level of budget deficit may boost up inflation which will further leads to negative outcome of economic growth. Here we observed the positive impact of budget deficit (fiscal policy) to stimulate economic growth. On the other hand, the negative outcome of monetary policy is observed where higher interest rate induced a significant decline in economic growth. Overall, the results imply a successful fiscal policy to stimulate growth but an inefficient monetary policy which led to negative outcome in group of current deficit countries.

Keywords: economic growth, monetary policy, fiscal policy, threshold effects

FM09
Jump Diffusion Model with Copula Dependence Structure in Defaultable Bond Pricing

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Abstract. We study the pricing of a defaultable bond under various copulas. For that purpose, we use a bivariate jump diffusion process for a bond issuer's default intensity and the short rate of interest. We assume two jumps in this process occur simultaneously and their sizes are dependent. For these simultaneous jumps and their sizes, a homogeneous Poisson process and three copulas, which are a Farlie-Gumbel-Mogenstern (FGM) copula, a Gaussian copula and a Student-t copula are used, respectively. We utilized the joint Laplace transform for bivariate processes with jumps to obtain an expression for the defaultable bond price. We then compute zero coupon defaultable bond prices and their yields using the three copulas and exponential marginal distributions. This is then followed by the calibration of a zero coupon bond and we notice that Student-t copula provides the better fit relative to the other two copulas for the particular bond.

Keywords: bivariate jump diffusion model, default intensity, short rate, copula, defaultable bond

FM10
Estimating Level of Stock Market Integration for Emerging Asian and European Countries Using Kalman Filter Technique

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Abstract. 1980s has seen the increased in global financial integration among the developed countries. Following reduction of many trade and financial barriers, deregulation and liberalization of financial markets, financial integration subsequently spread to the emerging markets. This study assesses the level of market integration between emerging stock markets in Asia and Europe with the world market. Kalman Filter methodology is used on the International Capital Asset Pricing Model. The result generally shows that the emerging stock markets is segmented from the world in the late 1990s and early 2000s. The level of market integration increases afterwards with most markets are highly integrated in recent years. However, with debt crisis blanketing the country, the Greek stock market is found to be segmented from the world for most part of 2011 through to 2018. Increasing level of stock market integration reduces benefits of portfolio diversification as well as making the stock markets to be more sensitive to shocks originated from other countries.

Keywords: stock market integration, ICAPM, Kalman filter estimation

FM11
Stock Market Integration, Investment and Economic Growth: Evidence from Asian and European Countries Using Heterogeneous Panel Model

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Abstract. While economic integration and financial development have been continuously found to promote productivity and economic growth, the impact of stock market integration on economic growth is much less documented in the literature. Consequently, this paper investigates the impact of stock market integration, trade openness and foreign investment on the economic growth in developed and developing countries in Asia and Europe. The study applies heterogeneous panel models of MG and PMG on 52 countries for the period from 1995 to 2015. Evidence from the study shows that economic growth, foreign investment, trade openness and stock market integration are cointegrated for high and middle income countries in both regions. Generally, in the long run, trade openness and stock market integration are found to positively affecting the economic growth while foreign investment is found to negatively affecting the growth. On the other hand, in the short run, trade openness and foreign investment are found to have positive effect on the economic growth while stock market integration is found to have negative effect on the growth. The findings implies that countries should foster stock market integration asit accelerate economic growth of the countries.

Keywords: stock market integration, Panel cointegration, MG and PMG

FM12
An Empirical Study on Asymmetric Jump Diffusion for Option and Annuity pricing

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Abstract. In this paper, we are presenting a method for estimation of market parameters modeled by jump diffusion process. The method proposed is based on Gibbs sampler and empirical methods, while the market parameters are the drift, the volatility, the jump intensity and its rate of occurrence. Demonstration on how to use these parameters to estimate the fair price of European call option and annuity will be shown, for the situation where the market is modeled by jump diffusion process with different intensity and occurrence. The results are compared to conventional options to observe the impact of jump effects.   .

Keywords: asymmetric jump diffusion, Gibbs sampler, annuity, European call option

FM13
Modeling Gross Domestic Product Using Discrete Dynamical Systems

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Abstract. The Gross Domestic Product (GDP) is one of the primary macroeconomic indicators that represents the total monetary value of all goods and services produced over a specific time period. It is one of the primary macroeconomic indicators used to assess the condition of state economy. This study models the GDP data of the state of Kedah, Malaysia for year 2005-2016. A mathematical model is developed for the state GDP data using Discrete Dynamical System. Data analysis using different constant value r, of the expression was performed. The equilibrium value for the GDP data of year 2005 – 2016 was obtained. This equilibrium value will be the estimated long-term GDP value that the state will obtained, if the state maintains its GDP value performance as per year 2005-2016.

Keywords: Gross Domestic Product, Discrete Dynamical System, mathematical model, equilibrium

FM14
Valuation of American Option with Discrete Dividend Payments

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Abstract. An option is a type of financial derivative that gives its holder the right to buy or sell the underlying asset when the payoff is positive to them. Options are the most traded financial derivative in the exchanges all over the world. Its importance to the derivatives market has led to numerous researches conducted on option valuation. Several pricing models have been developed, such as binomial model and Black-Scholes model. The Black-Scholes model is a stochastic differential equation that gives option values based on the price of underlying asset at any time to option's maturity. European options can be valued by solving the Black-Scholes model analytically, as European options are only allowed to be exercised upon maturity. Conversely, American options can be exercised any time before maturity date. Hence, American options can only be valued using numerical methods, such as finite difference method. This paper considers log normal stock price process, and hence transformation has to be performed on the Black-Scholes partial differential equation. Besides that, discrete dividend payments on the stock is considered and therefore, stock prices on ex-dividend date must be recalculated. The partial differential equation is then discretized using finite difference approximations and solved within the domains for stock prices and time to maturity. The results are then presented graphically on the option prices at any time to maturity date. American put option will be the focus of this paper as it is never optimal to early exercise an American call option with dividend payments.

Keywords: option valuation, American options, finite difference method

FM15
Risk Measurement for Insurance Sector with Credible Tail Value-at-Risk

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Abstract. Providing protection against probability of losses is important issue in insurance company. Insurance company must certainly estimate all the risks which can be done by using risk measures. Value-at-Risk (VaR) is one of risk measures that is widely used in insurance industry. However, this risk measure can be inaccurate if there are loss values which far exceed the VaR value. In this paper, Tail Value-at-Risk (TVaR) can be more representative to be the risk measure. In practical uses, TVaR can represent the amount of capital that will be needed due to certain losses which possibly happen. Better risk estimation can also be obtained by combining both individual and group of policyholder risk. One method to combine both these risks is by using credibility theory which will give certain weights for both individual and group risk measures. The proper weights are obtained by minimizing the mean squared error between a parameter used to predict future losses and its estimator. In general, this paper will derive credible TVaR model which uses Bühlmann credibility theory. Individual risk will be represented by TVaR of certain policyholder; meanwhile, group of policyholder risk will be represented by the average of every policyholder's TVaR value. Estimator of each parameter used in the model will be derived as it will use real data for application. In the end of this paper, numerical simulation which uses one of Indonesia life insurance company's data about policyholder claims in certain periods of time will also be presented.

Keywords: Bühlmann credibility, mean squared error, tail value-at-risk

FM16
Risk Measurement for Investment and Insurance using Tail Variance Premium and Tail Standard Deviation Premium

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Abstract. Information related to the tail of loss distribution especially its variability is vital since tail of distribution is related to big losses and overall risk. A commonly used risk measure is Tail Conditional Expectation (TCE). TCE measures expectation of loss that possibly occur given loss exceeded certain percentiles. However, TCE could not describe clearly the behavior and variability of loss along its tail since it only provides measure of central tendency. Additional information is needed to describe variability of loss, for instance measure of dispersion. This paper will discuss further about risk and variability measurement named Tail Variance Premium (TVP) and Tail Standard Deviation Premium (TSDP). They are combination of both central tendency and dispersion statistics, which can measure variability of loss along the right tail better. TVP and TSDP could be alternative risk measure, especially when risk is bigger than a certain threshold is concerned. Besides, we will also discuss the criteria satisfied by both risk measures with the proves for each criterion. Next, we also provide the explicit formula of TVP and TSDP for loss with normal distribution in particular. In general, TVP and TSDP for individual risk do not satisfy monotonicity and sub-additivity, so they are not coherent. But in this paper we are able to prove that TVP and TSDP for loss with normal distribution satisfy sub-additivity. Then we will also show calculation for risk measurement of a stock and comparison of risk measurement generated by Value-at-Risk, TCE, TVP, and TSDP.

Keywords: tail variance premium, tail standard deviation premium, variability

IM01
Factors Associated with Motor Difficulty for Cerebral Palsy Among Infants in Sri Lanka

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Abstract. Cerebral Palsy (CP) is one of the most common and costly neuro develop mental disorder of posture and movement among infants. CP has no cure, hence, intervention from the earliest is crucial to improve the life of the patient. To magnify the complications with CP, the exact causes of CP is yet not clear. However, there had been many attempts to find the risk factors associated with CP around the world, but, contribution from middle and lower income countries on the subject of CP is noticeably lacking. Further, early detection of CP becomes time consuming as the necessary technology is limited and expensive, therefore, these countries are in dire need for alternate early CP detection method. Motor delays are considered as the first warning sign of possibility of CP. Predicting Motor Difficulty (MD) for CP can be considered as a huge leap on CP in developing countries. Objective of this study is to analyze MD to find the association of that with risk factors. Sample size of 170 was selected from risk infants discharged at the pediatric professorial Neonatal Intensive Care Unit (NICU) at the North Colombo Teaching Hospital (NCTH), Sri Lanka, over a period of two year. Motor and communication disorders were assessed when they visited the clinics for follow up. Among that 170, 41.76% were identified with MD. Chi-square test proved that there were significant associations between Ventilated, Hypoglycemia, Anemia/Blood transfusion, Septicemia, Congenital Hypothyroidism, Abnormal Neuro-imagining and Antenatal Risk with Motor Difficulty. Additionally, Prematurity and Jaundice were also considered when analyzing using binary logistic regression. According to binary logistic regression Anemia/Blood transfusion, Septicemia and Antenatal risk were positively contributed to Motor Difficulty.

Keywords: motor difficulty, cerebral palsy, binary logistic regression

IM02
Comparison of Delayed SIR Model and SEIR Model with incubation Period for the Spread of Tuberculosis Disease in Medan

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Abstract. Tuberculosis (TB) disease has become one of the greatest death threats in Medan. In previous research, delayed SIR model with considering the term of recovery in time delay was investigated. A delayed SEIR model with a period of incubation time inside the hosts before the hosts become infectious is built. In this paper, a comparison of the delayed SIR and SEIR models in terms of local stability. Reproduction number indicated that Medan city is safe from the transmission of TB. Numerical simulations are shown to illustrate the spread of Tuberculosis in Medan.

Keywords: SEIR model, delayed SIR Model, vaccination, recovery time delay, Tuberculosis

IM03
Spatial-Temporal Risk Mapping for Dengue Disease in Colombo, Sri Lanka

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Abstract. Dengue is a mosquito-borne viral infection which is spreading rapidly all over the world. Sri Lanka has experienced a marked increase in the reported dengue cases over recent years. 43% of dengue cases were reported from the Western Province of Sri Lanka with the most affected area is Colombo district. The modelling and predicting the dengue behavioral patterns will be useful to understand the dynamics of it and thus to control it. The objective of the present study is to develop risk levels of dengue cases in Colombo which is generated from the negative binomial regression models based on rainfalls and temperature climatic variables. Furthermore, to develop a risk map in between actual reported dengue risk and predicted dengue risk in each week of the year. Data consists of weekly reported dengue cases, weekly average rainfall, weekly average maximum temperature and weekly average minimum temperature in Colombo district from 2009 to 2017. In each year around April/May and October/November have high average rainfall. Average minimum temperature reduces during January/February in each year whereas average maximum temperature maximizes during the first quarter of each year. Fitted values for dengue cases for a year found using the negative binomial regression model built on data of the previous year. Negative binomial regression models for each of the year 2009 to 2016 were used to find fitted values for dengue cases for years 2010 to 2017. Fitted values categorized into three risk intervals; low risk, moderate and high risk. Categorized fitted values were mapped with categorized actual reported dengue cases. Mapping percentages of risk categories vary in each year. Incorporate extra factors into the negative binomial regression models will lead to produce an effective risk mapping. Thus this study produces a base for a development of an accurate risk index for dengue disease to identify dengue risk category in each week of the year and to propose timely controlling strategies for explosive dengue epidemic.

Keywords: dengue, negative binomial regression model, risk map

IM04
Laplace Transform on the Recursive Moments of Aggregate Discounted Claims with Weibull Interwaiting Time

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Abstract. We consider the recursive moments of aggregate discounted claims, where the dependence between the inter-claim time and the subsequent claim size is captured by a Farlie-Gumbel-Mogenstern (FGM) copula and the interwaiting time is represented by a Weibull distribution with shape parameter equals to 2. The equations of the recursive moments, which take the form of the Volterra integral equation (VIE), are then solved using the Laplace transform. We then compute its mean and variance, and compare with the results obtained in previous literature.

Keywords: aggregate discounted claim, FGM copula, Laplace transform, Volterra integral equation

IM05
A Comparative Study of Jacobi Stability Analysis via the Kosambi-Cartan-Chern Theory and Linear Stability for Predator-Prey Models with Holling-type I, II and III Functional Responses

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Abstract. In this study, we perform the Jacobi stability analysis of the LotkaVolterra type predator-prey models with Holling-type I, II and III functional responses. The Jacobi stability analysis is based on the geometry of Finsler spaces and is generally known as the Kosambi, Cartan and Chern (KCC) theory. In the KCC theory, one associates a non-linear connection, and a Berwald type connection to the dynamical system, and five geometrical invariants were obtained. The second invariant known as the curvature deviation tensor gives the Jacobi stability of the system which is a measure of the robustness or relative stiffness of the system to small perturbations of the whole trajectory. Particularly in this study, we review the linear stability of the models and perform a full Jacobi stability analysis of the models via the KCC theory. The Jacobi stability of equilibrium points of the models was studied and a comparative study of the linear stability and Jacobi stability was done to determine the special regions where they both overlap. Conclusively, the time evolution of the components of the deviation near each equilibrium point of the predator-prey models was also considered. We observed that the Jacobi stability of equilibrium points for the Holling-type I and II models guarantees linear stability. Also, parameter regions were the Jacobi and Linear stability overlaps were presented in the form of phase diagrams. The torsion tensor components are all equal to zero for all the models. Also, there was no transition of the sign on the curvature κ_0 in the vicinity of the equilibrium points of the models studied for the range of parameters adopted. This eliminates the possibility of the onset of chaos in the models.

Keywords: KCC theory, Jacobi stability, linear stability, functional response, predator-prey models

IM06
Stability and Hopf Bifurcation Analysis of SIS Epidemic Model with Latency and Nonlinear Incidence Rate

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Abstract. In this paper, we formulate and study a time-delayed SIS epidemic model with latency and nonlinear incidence rate, where the susceptible host population satisfies the logistic equation and the incidence rate is of saturated form with the susceptible. A threshold value which determines whether the disease dies out or remains endemic is derived. By regarding the time lag as bifurcation parameter, the local stability of the endemic equilibrium is investigated and sufficient conditions for occurrence of stability switches through Hopf bifurcations are obtained. Further, the direction of Hopf bifurcation and the stability of bifurcating periodic solutions are determined by using the center manifold reduction and the normal form method. Numerical simulations are carried out to illustrate theoretical results.

Keywords: SIS model, stability switch, Hopf bifurcation

IM07
Combined Effects of Prey Refuge and Death Rate of Predator on the Prey-Predator Population Dynamics

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Abstract. The study of population dynamics involving prey-predator interactions has received significant attention in ecology due to the influential role that biotic interactions (i.e., inter-specific interactions) has played in the development of ecological theory. One way to understand this role is by using mathematical models. To address this problem, we employ a Rosenzweig-MacArthur system incorporating a prey refuge. This general model consists of prey-predator interactions and prey dispersal terms. We examine the existence and stability of different steady states in this model, which correspond to different possible outcomes of species interactions. We also investigate the combined influences of prey refuge and the death rate of predator on species population dynamics. In particular, we observe the occurrence of different bifurcations in this model, which can shape the overall dynamics of the system. These threshold phenomena determine the conditions under which different outcomes of species interactions such as species coexistence, species extinction and oscillatory dynamics occur as the strength of some ecologically-relevant parameters change.

Keywords: prey-predator interactions, Rosenzweig-MacArthur model, prey refuge

IM08
Dynamical Analysis of Prey-Predator Interactions with Group Defence Using a Lotka-Volterra Model

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Abstract. Species interactions such as predation have long been perceived as major factors in shaping community compositions within ecology. In the main, the study of ecological dynamics involving prey-predator interactions with group defence has received significant attention in ecology due to the influential role that biotic interactions (i.e., interaction between species) played in the development of ecological theory. In this paper, we study a Lotka-Volterra two-species model consisting of the death rate of the predator and the search efficiency of predator for prey species. The existence and stability of steady states are determined to illustrate different possible outcomes of species interactions with group defence. We also examine the joint influences of the death rate of the predator and the search efficiency of predator for prey on community dynamics; in particular, the effects of varying some ecologically-relevant parameters on species coexistence and the occurrence of limit cycle are explored. In addition, we also observe the emergence of local bifurcations in this model i.e., transcritical bifurcation and Hopf bifurcation, which has interesting implications on ecological dynamics.

Keywords: prey-predator interactions, Lotka-Volterra two-species model, group defence

IM09
Deterministic Modelling of the Dynamic Transmission of Dengue Fever

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Abstract. Dengue fever has been spreading rapidly among human populations across the world. It is a disease of great complexity, due to interactions between humans, mosquitoes and different biological factors that can determine the transmission of the disease. Due to this reason, understanding the factors influencing the spread of dengue fever has been a challenge for epidemiologists and policy makers. To address this problem, we employ a deterministic ordinary differential equations (ODE) model to investigate the combined effects of various factors related to humans and vectors, which can affect the viral transmission of dengue fever. We compute the steady- states of the model and analyse its stability to understand the dynamical behaviours of the system. We also examine the effects of varying some biological parameters on the dynamics of this epidemiological model. In particular, we conduct a bifurcation analysis by computing one-parameter and two-parameter bifurcation diagrams. Our preliminary results show the conditions under which certain dynamics e.g. a stable steady-state, bistability, and oscillatory solutions can occur in this dengue model. These outcomes are determined by the occurrences of different bifurcations e.g. saddle node bifurcation, transcritical bifurcation, and Hopf bifurcation, which has significant implications on the spread of dengue fever.

Keywords: dengue fever; ordinary-differential equations; dynamical systems; bifurcation analysis

IM10
Graphene Based Nonlinear Multimode Interference Waveguide for Refractive Index Sensing

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Abstract. In this paper, a nonlinear optical refractive index sensor is proposed by adopting a thin, local and isotropic multilayer graphene into a multimode interference (MMI) waveguide. The self-imaging characteristics of the proposed MMI waveguide are simulated using the Beam Propagation Method (BPM) in three different wavelengths in the visible spectrum. BPM considers monochromatic signals and is related to solving the Helmholtz equation. The output intensity is found to show correspondence to field change in different wavelengths by varying the refractive index of the surrounding layer. The results showed that graphene is able to guide the electromagnetic field in the MMI region as the potential difference applied on graphene tuned its conductivity. The correlation integral between the input field and the propagating field of the waveguide is numerically analysed. This design is a high precision optical refractive index sensor that is suitable to be employed as real-time environmental monitoring device.

Keywords: Numerical analysis, nonlinear system, multimode interference waveguide, refractive index metrology, optical sensor, graphene

IM11
Numerical Simulation of Biomagnetic Fluid Flow in a Stenosed Bifurcated Artery

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Abstract. Biomagnetic fluid dynamics (BFD) is an important application in medical sciences and bioengineering research. Due to this, biomagnetic fluid flow through a stenosed bifurcated artery is numerically studied. A biomagnetic fluid can be found in a living creature and its flow is influenced by the presence of a magnetic field. Blood is a typical biomagnetic fluid due to the interaction of intercellular protein, cell membrane and the haemoglobin. This study considered the flow to be incompressible, laminar, two-dimensional, fully developed viscous flow of a Newtonian biomagnetic fluid (blood) in a stenosed bifurcated artery under the effect of a spatially varying magnetic field. A simplified mathematical model of BFD was developed only for isothermal case. Numerical results are obtained using COMSOL Multiphysics 5.2 based on finite element method. Results concerning the different values of magnetic field intensity produce a considerable effect on the blood flow characteristics such as the velocity profiles and the streamlines patterns, and these results are carefully observed and explained.

Keywords: BFD, stenosis, bifurcated artery

IM12
Sensitivity Analysis and Empirical Model using Silica Oxide Injection in Enhanced Oil Recovery

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Abstract. Energy consumption worldwide is expected to increase in coming years. However, since the availability of new core is limited, it is important to use Enhanced Oil Recovery (EOR) methods because large amount of the original oil in place is left after the production through primary and secondary recovery. One of the interesting method in EOR is injecting nanofluids. Silica oxide in a size of nanoparticle was chosen for this paper. A mathematical model for oil mobility by using silica oxide nanofluid is developed. Curve fitting techniques is used to produce a sustainability analysis for the properties of silica oxide. Normalized sensitivity index shows that viscosity of nanofluids is the most important parameter in order to increase oil production. The optimal values for particle size, concentration, viscosity, density and injection rate were obtained respectively as 15nm, 0.50 wt%, 0.92 cp, 1.00 g/cm³ and 0.4 ml/min in order to get 12.07% recovery factors.

Keywords: recovery factor, particle size, concentration, viscosity, density, injection rate

IM13
Effect of Biodiversity on the Spread of Leptospirosis Infection

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Abstract. In this paper, we study the effect on the spread of Leptospirosis in an ecosystem where human population shares the ecosystem with rodents and another species (alien). An existence of the alien has an important consequence for the prevalence of the infectious agent in the rodents. Rodents can easily spread Leptospirosis disease in humans through direct contact with urine and droppings of rodents and water contaminated with rodents' urine and droppings. In this paper, we utilize a multi-species model by including the effects of biodiversity in the ecosystem. From there, qualitative studies regarding equilibrium point and local stabilities are carried out. In addition, numerical experimentations of the model are conducted. It was found that when rodent and alien populations live in the same ecological system, the biodiversity condition may have an impact in the reduction or elimination of the prevalence of Leptospirosis infection in the rodents.

Keywords: Leptospirosis, mathematical model, competition, biodiversity model

IM14
Time Series Modeling of Dengue Cases for Several States in Malaysia

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Abstract. Dengue infection is known as one of the life threatening disease. It has become a serious health problem and has gained attention worldwide. This study attempts to model and forecast the number of dengue cases for three selected states in Malaysia: Selangor, Penang and Kuala Lumpur. The weekly dengue cases from February 2010 to April 2015 are applied in this study. The Box-Jenkins modeling procedure is employed to model the number of dengue cases and the ARIMA model is considered to describe the behaviour of the dengue cases. Model validation is carried out for the year 2015 and the estimated ARIMA model is used to forecast the future values of dengue cases for the year 2016. The result indicates the absence of seasonal variation in the dengue cases in the three states. Overall findings show that the number of dengue cases will be increasing in the future. The finding of this study would help the authority in charged to improve the decision making process in predicting the trend and in outlining prevention strategy for the number of dengue cases in Malaysia.

Keywords: dengue cases, ARIMA model, acf and pacf

IM15
Fitting Spatio-Temporal Infectious Disease Model with Different Choice of Dependence Matrices: A Case Study of Dengue in Peninsular Malaysia

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Abstract. Study in spatio-temporal disease mapping model gives a great worth in epidemiology, in describing the pattern of disease incidence across geographical space and time. This paper studies generalized linear mixed model (GLMM) for the analysis of spatial and temporal variability of dengue disease risk. The model accommodates spatially correlated random effect, temporal effect and space and time interaction effect. Spatial and temporal components are induced by using a special case of a Gaussian Markov random field (GMRF) model, known as the Leroux conditional autoregressive (CAR) and autoregressive (AR) model respectively. The focus of this paper is to compare the model with different spatial neighbourhood matrix and temporal dependence matrix, as the choice of these matrices can bring a significant impact. The model will be fitted within a hierarchical Bayesian framework using Integrated Nested Laplace Approximation (INLA) methodology. There are two main objectives of this study. First, to study the effect of different choice of dependence matrices on spatio-temporal model selection and second, to identify the effect of different dependency matrices on risk estimation. This study is applied to weekly dengue fever data in Peninsular Malaysia reported to Ministry of Health Malaysia for year 2017 by district level.

Keywords: spatio-temporal analysis, disease mapping, relative risk, bayesian estimation, INLA, dengue fever

IM16
Relative Risk Estimation of Hepatitis B and C in Peninsular Malaysia Using Poisson-Gamma Model

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Abstract. Disease mapping has been a very useful tool in epidemiology as it shows a visual representation of disease outcomes across geographical regions. This paper uses the traditional approach which is the Standardized Morbidity Ratio (SMR) for the estimation of relative risk of both Hepatitis B and C. It is defined as the ratio between the observed and expected number of cases for a particular area. However, an extreme result possibly arises especially if the condition of expectation is close to zero. An alternative method known as Empirical Bayes approach specifically Poisson-Gamma model will be used as a smoothing method towards SMR for the relative risk estimation. In this model, Poisson distribution will be used as a likelihood distribution while Gamma distribution as the prior distribution. Thus, the aim of this paper is to estimate the relative risk for Hepatitis B and C in Peninsular Malaysia using both the traditional method and the Empirical Bayes framework. The Poisson-Gamma model is expected to provide a smoother and better estimation of relative risk compared to the traditional method.

Keywords: disease mapping, relative risk, Standardized Morbidity Ratio (SMR), Poisson-Gamma model

IM17

Cluster Analysis of Spatial and Temporal Distribution of Dengue Disease in Sri Lanka from 2012 to 2017

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Abstract. Dengue is a vector borne disease that has been neglected over many years. It is the most rapidly spreading mosquito borne disease, currently present in most all tropical regions in the world. Sri Lanka is one of the worst affected countries with an increasing number of dengue cases recorded every year. In Sri Lanka, the highest number of confirmed cases in a year was reported last year, in 2017. Due to non-existence of a specific treatment or a vaccination, the controlling strategies are the only technique to reduce the dengue risk. Therefore, understanding the patterns of the dynamics that influence the dengue disease is of utmost importance to identify the effective control strategies. In this study, the current situation of dengue in Sri Lanka is analyzed in relation to the population density of each district using clustering. Through results, it is observed that there is a strong relationship between the population density and the number of dengue cases reported from 2012 to 2017 in Sri Lanka. Furthermore, every year there exist four distinct clusters when population density and dengue cases are clustered. It is also observed that the districts always belong to the same cluster, with an exception of Kurunagala and Rathnapura districts moving between adjacent clusters in 2012 and 2017. The geographical mapping of the clustered results indicate a pattern, Colombo being the center with the highest dengue intensity, around which other districts are arranged in decreasing order of the same, Jaffna being the only exception.

Keywords: modelling, dengue fever, clustering

IM18

Mathematical Modelling of the Spread of Leptospirosis

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Abstract. Leptospirosis is an infectious disease caused by bacteria belonging to genus Leptospira. Leptospirosis occurs worldwide, but is most prevalent in tropical and subtropical regions. Outbreaks can occur following excessive rainfall or flooding. The transmission of this disease is studied through mathematical model. Two case studies are discussed in this research. The first case study is a modification of simple Susceptible-Infected-Removed (SIR) model involving human and vector population whereas for the second case study, we incorporate the idea of classifying the human into two classes, namely juvenile and adult into the Leptospirosis transmission model. Two equilibrium points were found and the stability conditions for these equilibrium points were established. Numerical solutions of the model are conducted. The results of this study guide the way to decrease the disease outbreak.

Keywords: Leptospirosis, mathematical model, adult human, juvenile human

IM19
Fuzzy Conjoint Model in Describing Malaysian Undergraduates' Perceptions of Statistics Classroom Engagement

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Abstract. In recent years, introductory statistics has become a necessary course for Malaysian undergraduates, especially for those enrolled in non-mathematics oriented programmes. This is in line with the rapid growth of data science (and big data). However, most undergraduates' interest to learn statistics declined and resulted in the ineffective acquisition of statistical knowledge and skills. Classroom engagement, being the key to effective learning is also responsible to inculcate in undergraduates the interest to learn statistics. Accordingly, this paper described undergraduates' perceptions of statistics classroom engagement. A survey was conducted on 200 students taking an introductory statistics course in a Malaysian public university. The questionnaire comprised 37 attributes pertaining to 4 constructs of classroom engagement. Undergraduates' ratings on the attributes were analysed using fuzzy conjoint model. Findings revealed that undergraduates have had mixed nature of perceptions of their statistics classroom engagement. In particular, they have put effort into classroom learning (behavioural engagement); often got worried when learning new things about statistics (emotional engagement); agreed that they did just enough to get by (cognitive engagement), and never tried to work with their peers who can help in statistics (social engagement). While positive perceptions are to be sustained; the neutral and especially negative perceptions should be eradicated to ensure higher engagement. Higher engagement is essential to instilpositive perceptions and cultivate undergraduates' interest to learn statistics. Measures such as integration of technology into the fabrics of introductory statistics course can create effective learning process and thus, promotes engagement.

Keywords: perceptions, introductory statistics, statistics learning, classroom engagement, fuzzy conjoint model

ME01
An Investigation into the Teaching Effectiveness of the
Trachtenberg System of Mental Calculation

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Abstract. The Trachtenberg system developed by Jakow Trachtenberg is a rapid system of arithmetic calculations using only the human brain without the aid of any calculating device. The Trachtenberg method involves using improved and fast algorithms for performing the basic mathematical operations of addition, subtraction, division, multiplication and square roots. Educators have found that the Trachtenberg system shortens time for mathematical computations considerably and secondarily improved the confidence and performance of students in other subjects. In this study, we develop a learning module for the teaching of the Trachtenberg system and also investigate the effectiveness of the method in the teaching of Mathematics and Arithmetic in selected Nigerian Schools.

Keywords: Trachtenberg system, mental calculations, arithmetic

ME02
Learning and Facilitating the New Form 1 and Form 2 Topic of
Data Handling in Statistics Using Tinkerplots

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Abstract. The Standard Curriculum for Secondary Schools (KSSM) has been exercised in Malaysia through stages starting from 2017 to replace the Integrated Curriculum for Secondary Schools (KBSM) that was practiced for almost 3 decades. All the subjects studied by secondary school students have been modified so that the Malaysian education system is in line with the world-class education. In KBSM, the Statistics subject is taught when students are in Form 4 but under the new KSSM, this subject is now introduced to the students in Form 1 and its continuation is done in Form 2 specifically for the topic of data handling. This is a good opportunity to integrate the use of technology to students at this level. The technology chosen for this study is the computer software called TinkerPlots which is a data visualization and modeling tool developed for use by middle school through university students. The purpose of this study is to discover the effectiveness of TinkerPlots as an aid in the learning and facilitating process for the topic of data handling for Form 1 and Form 2 students. The study was done at Sekolah Menengah Kebangsaan Kulim, where 75 research samples were chosen in random from 4 classes and divided into two groups: the controlled group and the experimental group. The controlled group was taught using the traditional approach while the experimental group was taught with the use of TinkerPlots in a computer lab. The students' performances from each group are tested at the end of the learning and facilitating process to see if there is a difference between their achievements. Then, a survey was done on the experimental group to see if their interests and attitudes towards the topic of data handling and Statistics as a whole have changed.

Keywords: data handling, TinkerPlots, KSSM

ME03
Mathematics Learning Activities Using TI - Nspire in Middle Year Programme International Baccalaureate (MYP IB) Classroom

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Abstract. The aim of International Baccalaureate (IB) is to develop inquiring, knowledgeable and creative young people in international mindedness. In this session, participants will be introduced with activities that can be conducted individually or collaboratively using TI-Nspire graphing calculators. TI-Nspire graphing calculator is one of the alternative ways to make young people enjoy learning Mathematics. The topics that are selected to be discussed in this sharing session include Transformations, Motion along a straight line, Integrations, Polygons, Graph of functions and Coordinate Geometry. Those who join this session will bring back interesting useful materials that can be applied in teaching and learning session besides helping their colleagues by sharing the information via in-house training. TI-Nspire is also well-known as one of the methods to develop useful skills that can be practised in studies, workplace and real-life situation.

Keywords: graphic calculators, Texas Instruments, Mathematics activities

ME04
Dynamic Construction of a Triangle from Three Located Points

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Abstract. William Wernick (1982) tabulated a list of 139 triangle construction problems from three located points with ruler and compass. Since no solutions have been provided in the paper, constructing a triangle itself is challenging to students. In this research, we analyze and visualize each step in triangle construction using dynamic mathematical software in classroom.

Keywords: triangle, construction, mathematical software

ME05
Exploring the Effectiveness of E-Learning in Increasing Students' Achievements in Mathematics at the Primary School Level

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Abstract. The 2016 Ujian Pencapaian Sekolah Rendah (UPSR) results showed that out of the 440496 candidates who sat for the Mathematics paper, 21.6% of them failed the subject. This makes Mathematics one of the critical subjects to be mastered by the primary school students. Previous studies have shown that transforming the teaching and learning (T&L) from a teacher-centered learning to a student-centered learning can improve the performance of students academically. One of the ways to implement this is through the use of information and communication technology (ICT). The use of ICT can help strengthen the T&L process in all areas of learning especially Mathematics. In light of this, a study was done to investigate whether incorporating e-learning in T&L of mathematics can improve students' performances and also motivate them in mathematics at the primary level. The research sample consisted of 40 Year 3 students from Sekolah Kebangsaan Khir Johari, Perai. The effectiveness of e-learning was measured through a pre-test and post-test assessment method. The students were also required to answer a questionnaire to find out whether e-learning has impacted their motivations towards learning mathematics. This paper presents the result of this study.

Keywords: e-learning, UPSR, mathematics, VLE-frog

ME06
Gamification in T&L of Mathematics: Teacher's Willingness in Using Quizziz as an Additional Assessment Tool

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Abstract. Gamification in education means adding games or game-based elements in the process of teaching and learning (T&L). Gamification makes the process of T&L more attractive, interactive and engaging, thereby enhancing its quality. Quizziz is an example of gamification which can be applied in class provided that both the teacher and the students have the means to connect to the internet and the tools to participate. It is an online quiz in which the student can take part individually or by groups. This study was conducted to investigate the capabilities and the willingness of mathematics teachers in certain schools in Kedah to apply Quizziz in T&L as an additional assessment tool. 30 teachers were selected as research sample. The teachers were exposed to gamification in education and then specifically taught about Quizziz and its implementation. The teachers are then required to apply what they have learned in an actual class session with their own students. The results of their Quizziz sessions are then collected to be analyzed. A survey was also distributed to the teachers to find out their perception about Quizziz as an additional class assessment.

Keywords: gamification, online quiz, Quizziz

ME07
Technology Transform the Classroom: A Case Study of Chinese Senior School Statistics Classroom

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Abstract. With the advent of the information era, people's lives are affected and impacted by data and information. The ability to process and analyze has become a core skill. In 2016, the Ministry of Education of China issued the "Six Core Literacy for the Development of Chinese Students" to make sure students should have the necessary materials and key abilities to adapt to the development of life and society. Each discipline has mandates for teaching reform and practice as one of "the core accomplishments". In accordance with this necessary change, the reform of Chinese mathematics curriculum requires data analysis as one of the core competencies of mathematics. RDFZ Xishan School is the first official complete school for "1 to 1 Digital Learning" in China, and the only one certified as a "Apple Distinguished Program School". The International Department of this school offers an AP Program and specifically AP Statistics. As a result the environment of high tech and the international curriculum provides an opportunity for innovative educational practice about the integration of technology into instructional practice. Implementation includes integrating technology into teaching practice, using graphic calculator to help students understand the concepts of statistics and implementation of project-based learning related to statistics. Students combine statistical knowledge and technology to analyze and explain environmental, social and economic issues. Besides that, Online teaching platform provides immediate and in-time feedback. The session will demonstrate this powerful function and the positive impact on the learning process.

Keywords: Graphic calculator, AP Statistics, project-based learning

ME08
Analysis of the Indicators of Students' Performance in Undergraduate Mathematics Program

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Abstract. This paper aims to present an analysis of the indicators of student's performance in obtaining a degree in mathematics based on actual academic records of 157 students. The obtained binary logit regression model implies that a student's general weighted average (GWA) in the first six semesters of enrolment in the university are significant indicators in earning a degree in mathematics. Other significant indicators such as student's proficiency scores in Science, Language and Mathematics are included in the model. However, student's family income, age, gender and type of high school attended before entering the university are not significant indicators. The sensitivity, specificity, and accuracy of the predictive model are shown using receiver operating characteristics (ROC) curve. A sensitivity analysis of the effect of significant indicators is also demonstrated. Moreover, results show that some prerequisite courses are redundant as suggested by the logit models.

Keywords: course prerequisites, academic performance, binary logit regression, odds ratio

ME09
Create Engaging Mathematics Class Using Graphing Calculators

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Abstract. The use of graphing calculators in mathematics classes for elective courses at the senior high school level was permitted in the year of 2018 in Taiwan. Graphing calculators provide pedagogical opportunities and offer fast access to correct mathematical working through a range of dynamical representations using numeric, symbolic, graphing, geometrical, statistical, programmable, and data collection capabilities. This workshop will focus on the pedagogical opportunities that are afforded by this technology. Graphing calculators are useful and effective tools to deepen and broaden students' understanding of mathematics and helps teachers to embrace new directions in mathematics education that include an emphasis on problem solving, active and independent learning and engagement. Basic programming and designing simple mathematical activities with TI-Nspire graphing calculators, TI-Nspire Innovator and the latest TI Rover to enhance mathematical connections will be carried in this workshop.

Keywords: graphing calculator, TI-Nspire Innovator, TI Rover

ME10
Exploring Graphs of Functions with Graphing Technology

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Abstract. Graphs of Functions plays a vital role in our everyday life and it is used to explore changing phenomena, find relationship and control it. Thus, this study explores on the experiences encountered by upper secondary students in the process of exploring the topic Graphs of Functions. Therefore, students are given great opportunity to manipulate symbolic function expressions to produce meaningful graphical representation. The use of TI 84 Plus graphing calculator was simply amazing as expressed by the students. It was such an engaging moment compared to the traditional mathematics lesson that uses the graph papers.

Keywords: engaging, higher order thinking skills, multiple representations

ME11
Developing Student's Computational Thinking Through
Graphic Calculator in STEAM Education

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Abstract. The graphic calculator (GC) is a hand-held technology. With it students visualize and understand concepts in mathematics and science better. It also allows them to make real world connections, binding together advanced graphing functionality and conceptual science, technology, engineering, arts and mathematics (STEAM). As they gain a deeper understanding of abstract concepts, they acquire the creative and critical thinking and problem solving skills they need to reach greater academic successes. In learning, GC plays several roles in increasing students' computational thinking and procedural skills. Despite being a learning tool that satisfies science and mathematics curriculum needs, the calculator often has been used as an add-on to traditional teaching methodology rather than central and in more integrated ways. This study looks into the potential of developing computational thinking skills using GC technology. The data of the study was obtained from secondary sources through a systematic review method. The study showed that GC seems to be effective tools to practice STEAM education as well as to develop students' computational thinking through analysing and decompose real problem as well as engaging in the abstraction process and developing algorithm using coding.

Keywords: graphic calculator, computational thinking, STEAM education

ME12
Demonstration of Matrix Transformation with Graphing Calculator

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Abstract. At high school, matrix transformation is quite an advanced part of mathematics for students particularly interested in math. Graphing calculators can give great help in the understanding of matrix transformation. This workshop will give a mature method to demonstrate the geometric significance with graphing calculators. Students can see intuitive pictures and animations along with the corresponding matrix algebra style. Here we involve translation, zooming, and rotation transformation in this workshop. With the best students in China, our Shanghai Experiment School makes it a conventional content in the course for all students.

Keywords: graphing calculator, graphical demonstration of matrix transformation

ME13
Cartesian Plane Exploration Using TI – Nspire in MYP IB Mathematics Classroom

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Abstract. In conjunction with Middle Year Programme International Baccalaureate (MYP IB) aim in developing a knowledge and inquiry young people, a deeper understanding on mathematical concepts is demanding nowadays. In this sharing session, participants will be shown a space exploration in interesting ways by using TI-Nspire graphing calculator as a tool kits in MYP Mathematics classroom. Suggested activities will be conducted collaboratively in order to introduce to the teachers on how to use TI-Nspire and share ideas of activities that can be practised in the classroom. With the aid of such technology, teachers have the means to help the students to nurture their curiosity, to explore the knowledge in Mathematics disciplines and engage with issues that have global significance. The session consists of a few topics such as Integration, Motion along a straight line, Transformations and Coordinate Geometry. The participants will be given extra materials as reference and hope that they can share it with their colleagues. Hence, the teachers can create educational opportunities for their students that support effective teamwork and inspire them to frame their own inquiries for their life-long learning.

Keywords: TI-Nspire, MYP IB, active learning

ME14
"Technology Embedded Self-Directed Learning" a Future of Education

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Abstract. Technology is a powerful tool in mathematics teaching and learning. Through mathematics and technology, we can unlock the potential of masses of students and teachers in the education fraternity. It is strongly believed that technology embedded learning is the future of education. Technology in the classroom and as an aid in the teaching learning process is currently the primary focus of all educator's discussion, forums, articles, periodicals and research. A demonstration on how technology can be used to enhance visualisation and support student understanding of mathematical concepts using TI-Nspire GDC Emulator and Geogebra will be presented. Next part of the presentation includes how technology can be used in mathematical modelling to derive mathematical modelling function of real life applications. Last part of the presentation is on how technology will play major role in the future of mathematics education with interactive lessons than encourages self-directed learning.

Keywords: TI-Nspire graphing calculator, geogebra, self-directed learning

MT01
Stability Analysis of Nanofluid Flow past a Moving Thin Needle Subject to Convective Surface Boundary Conditions

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Abstract. In this research, the heat transfer performance of a nanofluid past a moving thin needle in the presence of thermal boundary condition is investigated. Three different types of nanoparticles, namely copper, alumina and titania are taken into consideration. The governing partial differential equations are transformed into nonlinear ordinary differential equations by using an appropriate similarity transformation. These equations are then solved numerically using bvp4c package in MATLAB software. The effect of the involved parameters of interest, including nanoparticle volume fraction, needle size, velocity ratio and convective parameter on the velocity and temperature profiles, as well as the skin friction coefficient and the local Nusselt number are illustrated through graphs. The stability of the dual solutions obtained has been conducted to know which of the upper branch or lower branch solution is linearly stable and physically relevant. The numerical outcomes are compared with the published works in the literature and found to be in excellent agreement.

Keywords: stability analysis, dual solutions, convective boundary condition, nanofluid, thin needle

MT02
A New Information System for Prioritisation of Product Quality Improvement

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Abstract. Product quality is critical for a business organisation due to highly competitive, customer driven market. Product quality is measured by the defects created during the manufacturing processes. In a typical manufacturing environment, defects can be generated by any sources, such as design, materials, production processes, testing and handling. It is common for quality assurance, process or product engineers to carry out diagnosis to find sources of defects after they have occurred. The approach carried out by these engineers is to focus on localised issues and try to solve the problem using recent data. There is a comprehensive approach to identify sources of defects throughout the scope from design to production and testing. Historical data generated through the defect diagnosis provides an opportunity for data reuse. The data can be used to predict potential defects that could happen in the near future. This study aims to design an information system that helps to prioritise product quality improvement based on the historical data. The study will start from a high level systemic view. Data analysis and optimization will be carried out to narrow down to the potential focus areas for quality improvement. Further analysis can then be carried out to prioritise critical factors affecting specific product quality issues.

Keywords: product quality, information system, prioritisation, machine learning, data mining, predictive analytics

MT03
Interpretation of High Resolution Aeromagnetic (HRAM) Data over Chibok and Damboa Chad Basin, North Eastern Nigeria, Using Potent Modelling for Hydrocarbon Potentials and Other Minerals

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Abstract. Here we present the interpretation of high resolution aeromagnetic (HRAM) data of Chibok and Damboa areas (sheets 112 and 134), north-eastern Nigeria, using forward and inverse modelling methods on Oasis montaj 6.4.2 software. Quantitative depths estimates obtained by employing SPI (Source Parameter Imaging) have shown minimum to maximum depth to anomalous source at 72.7m to 5026.8m. The estimated depths from the forward and inverse modelling methods for profiles 1-7 are 2749, 2201, 2088, 703, 521, 927 and 481 m respectively. The respective susceptibility values of 0.20407, 0.47779, 7.8043, 0.1349, 0.0889, 0.3083 and 0.4820 SI, which indicate the presence of sedimentary intrusions (basalt or limestone), few metamorphic rocks (schist) and minerals (magnetite).

Keywords: High Resolution Aeromagnetic (HRAM), forward modelling, susceptibility

MT04
A Robust Algorithm for Computing Intervals Containing the Stabilizing Solutions of the Discrete-Time Algebraic Riccati Equations

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Abstract. Consider the discrete-time algebraic Riccati matrix equations (DAREs). The DAREs appear in important problems in science and technology, e.g., discrete-time LQ-optimal control problems and an equation in ladder networks. The solution of interest is the stabilizing solution, which is required in practical applications.The work presented in this talk addresses the problem of verified computation for the stabilizing solution, specifically, numerically computing an interval matrix which is guaranteed to contain the solution. Since the stabilizing solution is of interest, we especially concentrate on verifying that the contained solution is the stabilizing one. The algorithms by Luther, Otten and Traczinski are the pioneering work. Alternatively, they do not verify that the contained solution is the stabilizing one.Two algorithms have been proposed by Miyajima in 2017. The first and second algorithms are based on a numerical spectral decomposition and simple reformulation, respectively.These algorithms verify that the contained solution is unique and the stabilizing one. As reported in the Miyajima's paper, on the other hand, the verification for the stabilizing property in these algorithms fails in many cases. The purpose of this talk is to propose a robust verification algorithm for the stabilizing solution. This algorithm is based on estimating an upper bound for the spectral radius of a matrix utilizing the Perron-Frobenius theory. Similar to the Miyajima's algorithms, this algorithm verifies that the contained solution is unique and the stabilizing one. As shown in the numerical results, this algorithm is more successful than the Miyajima's algorithms.

Keywords: discrete-time algebraic Riccati equation, stabilizing solution, verified numerical computation, Perron-Frobenius theory

MT05
Multiplatform Dengue Management Android Mobile Application

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Abstract. Dengue is a mosquito-borne viral infection transmitted by the bite of an infected vector. In the past, dengue cases are being increased uncontrollably across the world. Due to the dynamic nature of the dengue virus, a specific treatment has not been discovered yet and controlling can be considered as the only mitigating techniques. Presently, in Sri Lanka prevention procedure of dengue is based on reactive systems rather than proactive systems. Further, there is a need of general optimum infrastructure or mechanism, in which all the sectors who are contributing for the epidemic controlling can collaborate together under efficient action plan. Pro Active Dengue Management System (ProDMS) is a multi-platform GIS-based distributed system for monitoring, forecasting and controlling the dengue epidemics. ProDMS consists of two main components, which can be introduced as Mobile Application and Web-based System. In this study, we present suitable dynamic programming techniques to develop some features of ProDMS android mobile application. The features are developed based on the dynamic programming methods rather than using existing static approaches. The features are Statistical Charts, Education Package, Alerting and Images of mosquito breeding places. All features are designed through dynamically changing menus with dynamic back end. Content pages and statistical charts are designed in a way that they can function according to real time data and dynamic ongoing changes. The developed application uses JSON files as a medium to distribute the structured data among its components. Further, ensuring the confidentiality and the security of the data, transferring JSON files are embedded within user level securely measure when they transfer through web application. Concerning the sustainability of the system like ProDMS, all the software are designed so that it can be administrated and updated by privilege users who has basic computer literacy.

Keywords: dynamic programming, proactive, JSON

MT06

Mathematical and Statistical Analysis for LST Trend and Variation by Using MODIS Data in the Tropical Rainforest of Hala-Bala in Narathiwat, Southern Thailand During 2002-2017

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Abstract. For MODIS satellite data, Land Surface Temperature (LST) is a radiative skin temperature that is measured in the direction of the atmosphere to the ground. This data has been used several times in climatological and environmental studies. The tropical rainforest is one of valuable area on this earth that need to be protected. It exhibits high levels of biodiversity and habitat of animal and plant species on the planet. In Thailand, a tropical rainforest can be found in Hala-Bala where is situated at the boundary of Thai-Malaysia. In mathematical analysis, cubic spline is an approximation function. It gives smooth and flexible way of fitting nonlinear models, while GEE is statistical method of parameter estimation for the correlated data from longitudinal studies at different points in time. The purpose of this study was to analyze the data of LST by using cubic spline and GEE to perceive trend and variation at Hala-Bala in Narathiwat, Southern Thailand during 2002-2017. LST data were recorded by MODIS, an important *data resource provided efficiency* information relating to the Earth, between 2002 and 2017. The result of cubic spline showed that it was fitted quite well on pattern of LST data. The LST has increased statistically significant around the center pixel. GEE showed that LST trends had changed with statistically significant over 15 years.

Keywords: LST, cubic spline, GEE

MT07
A Comparative Study on the Time Series Models for Forecasting Facebook Reactions

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Abstract. Facebook reactions were used over 300 billion times during their first year of existence. It is essential especially for the digital marketing purpose. The market needs to understand how Facebook reactions fluctuate to forecast the best period to post advertisements on Facebook that yields the highest number of reactions. In this study, several time-series models are used to forecast the number of Facebook reactions over a certain period of time for different domains. A comparative study will be evaluated on their performance from their strengths, weaknesses, and performance metrics with respect to their machine learning and statistical models.

Keywords: time-series, forecast, Facebook reactions

MT08
A New Sufficient Descent Conjugate Gradient Method with Exact Line Search

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Abstract. The seminal paper by Hestenes and Stieffel (1952) has given rise to an extensive investigation, leading to the development of effective conjugate gradient (CG) methods. In this paper, a new CG algorithm which guarantees sufficient descent using exact line search is proposed. Moreover, the initial search direction is slightly deflected from the currently used Steepest Descent (SD) method. This is to establish that the initial search could be done apart of SD method. The proposed method is compared with the existing CG methods. These methods were tested using the standard unconstrained optimization functions. Experimental results provide evidence that the proposed method is in general superior to the classical CG methods and has a potential to significantly enhance the computational efficiency and robustness of the optimization method. These algorithms have been carried out by MATLAB R2014a, Intel(R) Core™ i3-7100U CPU @ 2.40GHz RAM 4.GB PC environment.

Keywords: conjugate gradient, exact line search, unconstrained optimization, sufficient descent condition

MT09
New Coefficient of Three-Term Conjugate Gradient Method for Solving Unconstrained Optimization Problems

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Abstract. Recently, Three-Term Conjugate Gradient (TTCG) has become a research trend for solving unconstrained optimization problems. Unfortunately, the problems arise when the existing TTCG methods could only be used by inexact line search. If exact line search is applied, then the formula of TTCG will be reduced to the standard CG method. Therefore, there is a need to come out with a new coefficient of TTCG method that could be used with exact line search. Thus, this paper proposed a new coefficient of TTCG that is suitable to be used by both exact and inexact line search. The proposed formula satisfies both sufficient descent condition and global convergence properties under exact line search. Result analysis performance profile of numerical computation on the different initial point and some optimization problems had shown the robustness and efficiency of this new three term coefficient.

Keywords: Conjugate Gradient, Three Term CG method, exact line search

MT10
Numerical Study of the Evanescent Field Coupling Effect on
Two Optical Fiber Sensors

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Abstract. An evanescent field coupling effect has been studied numerically on two optical fiber aligned side by side as a multipurpose sensor. Optical rays are confined within a waveguide by total internal reflection and closely visualized at the guide cladding interface by approaching electromagnetic wave theory model. The evanescent field surrounding the core of an optical waveguide is very sensitive to refractive index changes near the core. An electromagnetic wave is incident on the boundary with refractive index n_1 and n_2, then in general, a portion of that wave is reflected and remainder transmitted. There is still a disturbance in the second medium, although all the energy in the beam is reflected when $\theta_i > \theta_c$, whose electric field amplitude decays exponentially with distance away from the boundary. This sensitivity can be exploited to form the basis for a quantitative sensor with high specificity and sensitivity. Distinct distances between optical fibers are considered for optical power loss and the sensor operation is explained in terms of these effects. The dominant loss mechanism is found to be the evanescent loss and based on this phenomenon the waveguide inside the core were numerically simulated using the beam propagation method (OptiBPM) simulator and these predictions are in quantitative agreement with the experimental results. The coupling coefficient expresses the products between the evanescent part of the field and the propagative part guided in the core. Variation of the output reading of the sensor system for different launching power is studied. As the distance of the two optical fibers were totally closed to each other explained the study of the evanescent field coupling effect on two optical fiber sensors as multipurpose sensor.

Keywords: numerical study, evanescent field coupling, optical fiber, multipurpose sensor, beam propagation method

MT11
Mathematical Modelling of Stabilizing Wave Attenuation Effects in
High-Speed Milling Process

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Abstract. Theory of chatter-suppressing wave attenuation effects in high-speed milling process is presented in this work. Finite element method was employed and mathematical model used in the analysis of natural frequency of cutting tool and wave attenuation forces. Analysis shows that the rise in natural frequency of cutting tool leads to the rise in the wave attenuating forces. This result leads to the postulation that rise in natural frequency suppresses high-speed chatter instability of milling process. The resistance of a high-speed tool to chatter stems from both structural damping and wave attenuation effects.

Keywords: chatter, high-speed machining, wave attenuation effects

MT12
Integrated Index Measure of Technological Capabilities for Technology-Based SME's

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Abstract. Technology capability plays an important role in achieving efficiency in a company's production process and degree of innovativeness. However, most of the small and medium enterprises (SMEs) cannot remain competitive because they are still practicing the traditional basic management due to lack of implementation of technological innovation. Furthermore, despite the existence of government support from the various ministries and agencies, most literature indicated that SMEs are still having a lot of challenges that hinder their development. In view of these issues, the purpose of the current research is to focus on technology capability and develops an integrated index model to quantify it which can help businesses understand their behavior and technology potentials, serving as a tool to analyze performance and support decision making. The developed model will be based on a combination of literature review, observation research (expert interviews), and analytical hierarchy process technique. The proposed model will be applied to the case of technology-based SMEs which are listed under Malaysian Technology Development Centre, a company wholly-owned by Khazanah Nasional Malaysia. The developed model is considered highly potential instrument in identifying the different technology capabilities of the companies studied and generate important information to identify bottlenecks and improvement opportunities for these companies. This, subsequently will increase business formation, expand the number of high growth and innovative firms and raise productivity.

Keywords: Technology capabilities, small and medium enterprise, index

MT13
Generating Service Choreographies from SBVR Models

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Abstract. Architecting online service applications involves the challenging coordination task of ensuring the collaboration achieves the overall business goal while adhering to the global constraints agreed between the interacting participants. We propose a declarative approach for specifying the underlying service interactions and generating the service choreography required for successful execution. The proposed approach builds on the Semantics of Business Vocabulary and Business Rules (SBVR), an Object Management Group (OMG) standard for specifying business models in structured English. Our approach can be used to verify i) whether a specific request can be realised in the given choreography, ii) the consistency of the business rules, and iii) domain-specific static constraints in the generated choreography. We describe a mapping from an SBVR model to a relational constraint solver, namely the Alloy Analyzer. The transformation of SBVR into Alloy allows to automatically generate the corresponding service choreography, hence producing an immediate instance of execution that satisfies the constraints of the specification.

Keywords: multi-party conversations, observable message exchange, computational techniques, application of mathematical methods, distributed interactions, concurrency, declarative technologies, business rules, verification, Alloy Analyzer, automated generation, complex systems

MT14
Verification Algorithms for the Matrix Lambert *W* Functions

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Abstract. For a square matrix A, matrix Lambert W functions are solutions of the matrix equation $W\exp(W) = A$. The solutions can be classified into primary and nonprimary matrix Lambert W functions, defined using the theory of primary matrix functions. Our focus here is on primary matrix Lambert W functions. The primary Lambert W functions arise in the numerical solution and stability analysis of delay differential (systems of) equations, where the functions are used to deduce properties of the stability of the system. The functions have been recently considered in a problem of quantum computing, where A is normal. The work presented in this talk addresses the problem of verified computations for the primary matrix Lambert W functions, specifically, numerically computing interval matrices which are guaranteed to contain the functions. To the author's knowledge, a verification algorithm designed specifically for the functions is not available in literature. A possible approach is to use the VERSOFT routine vermatfun. This routine is applicable not only to the matrix Lambert W function but also to other matrix functions and computes the interval matrices by enclosing all the eigenvalues and eigenvectors of A via the INTLAB routine verifyeig. This routine does not verify that the contained function is unique. It fails when A is defective and involves quadruple complexity. The purpose of this talk is to propose two iterative verification algorithms for the functions. These algorithms are based on enclosing the solution of the matrix equation and verify the uniqueness of the contained solution. The first algorithm is based on a numerical spectral decomposition and involves only cubic complexity per iteration. The second algorithm is based on a numerical Jordan decomposition and applicable even when A is defective. Numerical results show effectiveness and robustness of the algorithms.

Keywords: Lambert *W* function, primary matrix function, verified computation

MT15
Solving Partial Differential Equations Using Multi-Agent Modelling

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Abstract. Partial differential equations play important roles in science and engineering sectors. Therefore, solving them is one of the most important tasks for analysis and design of artifacts. However, they are seldom solved analytically. In order to solve partial differential numerically, following steps are necessary; 1) modelling the target phenomenon, 2) construct the mathematical model of target, 3) build the mathematical model by using mathematical expressions, 4) solving equations by numerical methods. However, even when mathematical expressions are established, solving them numerically often requires much efforts and time. For example, if the phenomenon is represented by differential equations, finite difference approximation scheme is necessary. Developing such finite difference schemes is sometimes difficult. In this article, a new computing method for solving partial differential equations is proposed. The proposed method adopts the Multi-Agent Modeling (MAM). MAM is a computing method composed of multiple autonomous software entities called agents. In MAM, each agent is assigned to the *actor* of phenomenon. Agents interact to each other and they interact with the environment if necessary. In the proposed method, space of phenomenon is divided into small cells and each agent corresponds to each cell. Each agent has several attributes to represent the physical phenomenon such as the temperature, velocity, or pressure. Agents know the rules which specify how to update the values of inner attributes. These rules usually require only local interaction. It means that no global knowledge is required. By using MAM, physical phenomenon is directly solved numerically without any mathematical expressions. Two phenomena, heat transfer and wave propagation, are solved using the proposed method and the results proved that the proposed method produces a numerical solution with sufficient precision.

Keywords: Multi Agent Modelling, Numerical Analysis, Partial Differential Equations

OR01
Modified Courant-Beltrami Penalty Function and Its Convergence

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Abstract. A Courant-Beltrami penalty function is the square of the absolute value penalty function for inequality constraints, it penalizes any violations of the constraints function 0 but does not prevent such violations. In this paper, we modified a Courant-Beltrami penalty function method for solving constrained nonlinear programming problems. The results obtained indicate that modified Courant-Beltrami (MCB) penalty function method provides the approximate optimal solutions and improved objective value using a fixed penalty parameter. Moreover, we investigate and proved MCB penalty function convergence which has been supported by some numerical test examples. Furthermore, a quasi-newton algorithm was adopted to implement the result on MATLAB2018a via routine function *fminunc* for unconstrained optimization.

Keywords: modified courant-beltrami penalty function, penalized problem, nonlinear optimization problem.

OR02
Increase the Efficiency of Car Following Parameters Through Calibration Model

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Abstract. Many previous studies show that parameter value for car following model such as maximum and minimum headway, acceleration, gap, are needed but there is a big errorfound when doing comparison between original and simulated data. Therefore, it is not appropriately applicable to determine the real driver behavior for the different traffic systems. In this study, the calibration method had being proposed to estimate the model parameterand finding the best fit to the car following model. In here, Intelligent Driver Model (IDM) have been used for simulating car behaviour and data have been collected from US highway 101 and data from Seberang Jaya (KM136.18 SB) and Juru (K148 NB), Penang, Malaysia. Simultaneous perturbation stochastic approximation algorithm (SPSAA) being use as the calibaration model and used in the system to calculate parameters. The calculation is being made using Matlab software. SPSAA proven to have a very much lower error between original and simulation data of US101, Seberang Jaya and Juru with efficiency of 80%, 78% and 91%. Furthermore, this paper investigate that such kinds of estimated parameter are more appropriate to be used in different traffic system.

Keywords: calibration, extracting-data, simultaneous-perturbation-stochastic-approximation

OR03
Portfolio Optimization Using Weighted Historical Return Values:
Investors View Approach

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Abstract. Most of the current portfolio optimization techniques depend only on historical data. However, in a reality, decisions may be changed due to the behavior of investors. Investor's views may depend on various external factors, such as current market stability, company performances and many factors related to government policies. However, modeling the investor's behavior patterns too complex process due to uncertainty of such patterns. This study is an attempt to discuss the how optimum allocation change with respect to investor's views. Therefore, present study focuses to finds the optimum asset allocation base on both historical data and investors' view. The raw data set is weighted using an information matrix which represents the investors view, then the weighted dataset is used to find the optimum asset allocation. The proses is done with the different sets of weights and obtain the corresponding optimum allocations. The optimum allocation is changed with respect to the weightage. For current study, five companies are selected. The historical return of closing price of the chosen companies is weighted using information matrix. Sensitivity of the assets allocation is discussed with respect to varying information. For this purpose, the information matrix is changed and thus different weightages are obtained to get different allocations.

Keywords: portfolio, information matrix, optimization

OR04
Maintenance Model in Coevolution Opinions in Adaptive Networks

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Abstract. Risk perception is always viewed as judgment on certain possibility of hazards. Information on the risk of infectious diseases given by the media or communication technologies often shaped people opinions and being shared between their social group. Even though people received the same information, the emergence of clusters and coevolution of opinions sometimes lead to underestimation of the diseases. This work present new approach of maintenance model to examine the coevolution of opinions and compared it with extended Hegselmann-Krause (HK) model on adaptive networks.

Keywords: adaptive network, opinion dynamics, risk perception

OR05
Vehicle Dynamics and Simulations of Gipp's Model Compared Malaysia Data

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Abstract. Car-following analysis is a very reliable research for any kind of traffic system which gives to the drivers more important information about roads from last sixty years. In this study, diplomatic information will be come out by using Gipp's car-following-model (GCFM). Many researchers have explored the traffic system for the car drivers by avoiding any struggle into the road. For this reason, GCFM is proven to be a very effective car-following model. For analysis of the GCFM, the authors have collected the car-following data from Seberang Jaya (KM136.18 SB), Penang and Juru (K148 NB), Penang, Malaysia. By using high resolution car-following video, TRAIS software used to extract the data in excel. The extracting data is compared with simulation data that generated from GCFM car following factor such as position, speed, gap and headway using Matlab software. Here, the simulation data results shows that Gipp's model can forecast efficiently for car following simulation with value of 95.4% of compared to original data for Seberang Jaya and 92.3% for Juru.

Keywords: Gipp's model, car-following, extracting-data, TRAIS software

OR06
Augmenting Operations Research Methods for Relatively Poor Farmers of India

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Abstract. India is a land of agriculture, and according to World Bank around 60.4% of its area is arable, second largest after USA, still the agriculture productivity is lagging behind China. Modern Operation Research methods adapt very well with big farmers, but sometimes become infeasible for poor farmers. This paper talks about Operation Research in Agriculture and how the OR methods can be augmented for poor farmers having small and distributed farmlands. Here in we take case study of Farmers of Jharkhand, one of the states with low Agriculture production in India. The state has ample resources but due to lack of management skills, agriculture here, has been low profitable and high-risk occupation. Most of the lands are not plain and rainfall is average, as a result, farmers were compelled to grow one or two crops round the year. Augmented OR methods can be applied to various aspects of agriculture like day-to-day decisions of small and poor farmers like land planning, selection of correct type of crop, cost minimization and profit maximization on an individual farm, production and shipment of final product. After the study it was found that major change in the sector had come with the selection of optimal crop rotation pattern with the help of Linear programming model. Problem to deal with nature like weather, pests, diseases etc had been catered appropriately by Game Theory. Issues related to transportation, maintenance and delivery of crops on time in the market were solved easily by the help of Waiting line theory. Effectively applying Augmented OR methods on large scale can put farmers in much better position compared to what they were ten years back.

Keywords: linear programming model, game theory, network analysis

OR07
Inventory Optimization Model Through Nonlinear Programming and Forecasting Techniques: A Case Study

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Abstract. Inventory is one of the major and costly investments of many manufacturing companies. Therefore, practicing a systematic inventory management is very important to achieve the objective of minimizing the investment in inventory while balancing supply and demand. However, there are still many manufacturing companies fail to achieve this objective. In consequence, mismanaged of inventories might result significant financial problems for a company, such as inventory glut issue or shortage of inventories. In view of these issues, the purpose of the current research is to develop an inventory control model by integrating Economic Order Quantity (EOQ), nonlinear programming, forecasting and decision tree techniques for manufacturing company. The current research is a case study in a fishery manufacturing company which produces simultaneously multi kind of seafood products from several classes of raw fish resources. The developed model is considered highly potential instrument in minimizing the wastage of seafood product due to its expiry date and hence to minimize the associated cost. This subsequently will increase business formation and improve the competitiveness of company in market.

Keywords: nonlinear programming, EOQ, forecasting, inventory control

OR08
Comparison on Queuing Performance Measures of Multi-Server Traditional and Fuzzy Queuing Model

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Abstract. In providing service or products to people, queuing system could influence the customer's satisfaction. However, queuing system used in most organization unable to explain the linguistic terms existed in nature of arrival rate and service rate. Therefore, Fuzzy Numbers is used as it can be best in describing the linguistic variables. In this study, calculation and comparison on queuing performance measures for multi-server traditional and Fuzzy Queuing model are carried out. Queuing performance measures involve in this study are average number of customers in the queue (Lq), average number of customers in the system (L), average waiting time of a customer in the queue (Wq) and average waiting time of customer in the system (W). Dong, Shah & Wong (DSW) algorithm is used to define the membership function of performance measures in fuzzy queuing model. The results show that the performance measures of traditional queuing model give a single value while for fuzzy queuing model in the set range of values. The performance measures of traditional queuing model obtained lie in the range of performance measures of fuzzy queuing model computed. Hence, the results obtained are consistent.

Keywords: Traditional Queuing Model, Fuzzy Queuing Model, Dong, Shah & Wong (DSW) Algorithm

OR09
Forecasting and Economic Order Quantity Model for Inventory Control:
A Case Study at XYZ Company

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Abstract. Materials or inventories are essential requirements for any company in order to fulfil their customers' needs and wants. This case study has cooperated with a construction firm which located at Bukit Batok area, Singapore. In this research, researcher identified the level of implementation of the inventory control system and suitable inventory control model by using the Economic Order Quantity to be implemented in XYZ company. Furthermore, researcher will estimate the suitable demand for selected materials by using forecasting techniques. The estimated demand is applied in the inventory control model to minimize the cost and maximize the net profit of XYZ company. Data is collected through interview with the targeted respondents which are general managers or core members of the managerial team or assigned persons by general manager who have good understanding of the firm especially in the inventory system. The rationale behind the choice of this company is the absence of systematic inventory management process in a fast-growing construction company. The company also lack proper forecasting techniques in predicting accurate demand which is one of the objectives to be achieved through this research. This study is expected to provide benefits in terms of business practices and the development of science which provision of ideas on inventory system for XYZ company particularly using Economic Order quantity (EOQ) and forecasting approaches. Company can apply the effective and efficient way of inventory management system for minimizing their total cost and improve the competitiveness of company in market. This indirectly creates more concern and knowledge about the importance of using an effective and efficient way for their inventory management system.

Keywords: forecasting, economic order quantity, inventory

OR10
Using the ε-Contraint Method to Solve the Multicriteria Path Planning Problem

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Abstract. A common situation in a multicriteria path planning problem is the existence of non-dominating solution paths known as the Pareto optimal solution set. As the number of Pareto optimal solutions increase with the problem size, it is hard for the decision maker to make decisions that reflect their needs without prior knowledge. A common approach that takes into account user preferences is the ε-Constraint Method, which searches for the best solution in the Pareto frontier. In this work, we test our solution method on 2-objective and 3-objective grid-based traveling salesman path problems.

Keywords: ε-Constraint Method, multiobjective, Pareto optimal, ideal point

OR11
Optimal Routing of Tanker Trucks to Petrol Stations using Excel

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Abstract. This paper considers a version of the vehicle routing problem (VRP). In this version, a set of routes between a central fuel depot and a large number of petrol stations located at various points in a road network is to be assigned to a fleet of tanker trucks for petrol replenishment. The objective is to find the shortest routing plan of the tanker trucks to cover all the petrol stations. The problem is also subjected to truck capacities and restricted journey times. We propose a binary integer programming formulation of the problem. The proposed model is implemented using Excel. Several numerical examples were created in a way to reflect real life situations and were used to analyse the feasibility and practicality of the model.

Keywords: vehicle routing problem, binary integer programme

OR12
Using Fuzzy Linear Programming to Find the Maximum Flow Point in General Networks with Application

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Abstract. The problem of maximum flow is generally at the forefront of business networking problems because of their importance in many areas, including the problems of the maximum flow planning of drinking water and sewage networks, as well as the flow of vehicles in a network of public roads. In this paper, we focus on the fuzzy maximum flow model and the fuzzy linear programming as well as the use of the rank function to remove the fuzzy from the building model which is based on the principle of optimization in maximizing the flow. It is applied to a network of roads where this network starts at a source and ends with a sink, taking into consideration the equal inflows with the outflows of any arc of each arcs (the inflow of any node that is equal to the outflow of that node) except the source flow and outflow from the sink to the maximum flow problems and reached to the following:
1- the proposed model has the ability to observe the flow of Traffic jams and find points where the fuzzy maximum flow of vehicles are concentrated and find points where the least fuzzy flow of vehicles are concentrated. It is therefore possible to identify the places where bridge construction or tunnels are needed .
2- to reach trapezoidal or ttriangular membership function belonging to a period between the morning and the afternoon.

Keywords: fuzzy maximum flow, rank function

OR13
General Mathematical Model and Scheduling Problems: Expansion and Application to Real-Time Scheduling

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Abstract. In this study, we illustrate two additional main requirements needed in a general model developed previously for scheduling problems. These two constraints are mutual constraints that can be found mostly in problems such as maritime crew scheduling, course timetabling and others related. The extended general model is then verified with seven random timetabling problems and further verified its applicability towards real problem of examination course timetabling of a public university in Malaysia. The mathematical model is tested with a specific range of preferences value that represents their preferred assignments to slots and venues. We used Mixed-Integer Linear Programming (MILP) to formulate the whole idea and results reported are analysed with Advanced Interactive Multimedia Modelling System (AIMMS) mathematical software and CPLEX as the solver. Optimised solutions were gained for the various problems, which includes the application to real problem of examination timetabling using the general model constructed. These indicate the assignments were allocated to where it is most desired. The study has proven its applicability to one of the most complicated scheduling problems. We aim for more application to other real problems thus therefore could be classified as standard model used for all type of scheduling problems.

Keywords: general mathematical model, scheduling problem, AIMMS mathematical software, real-world problems

OR14
Proposing an Effective Route for Transporting Solid Waste from Seberang Prai Industry Area Using GIS Approach

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Abstract. Transportation is one of the important elements in solid waste management. Effective transportation by selecting the shortest route can save time and cost in handling the waste. Thus, this paper presents a case study on deciding shortest waste transportation route from Seberang Prai industry area to sanitary landfill in Pulau Burung, Nibong Tebal district handled by Seberang Perai Municipal Council (MPSP). The shortest transportation distance was determined using ArcGIS software on the basis of coordinate tracking, data collection for network analysis and fuel consumption estimation. The case study focuses on municipal solid waste collection routes from Phase 1 (8 Companies), in Seberang Prai district to Pulau Burung sanitary landfilll. The study found that MPSP could save up to 25% by following the effective new routes for transporting solid waste to Pulau Burung sanitary landfill. The findings could assist MPSP saving management cost and also keep environment cleaner.

Keywords: Geographical Information System, Network Analysis, shortest routes

OR15
Crisp and Fuzzy Approaches on Staff Performance Evaluation: A Comparison

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Abstract. Selecting the best employee in an organization needs a lot of criteria and aspects to be considered especially on the contribution towards that particular organization. In order to perform this selection fairly and effectively, many organizations apply various methods that are suitable for this problem. Hamming distance method is one of the multi-criteria decision making methods that is easily to be used either in discrete or interval form. In this paper, researchers employ the method of Hamming distance to solve the staff performance evaluation by using the crisp and fuzzy approaches. Based on the numerical application, the final results showed that both approaches produce almost similar results. However, these two approaches have their own advantageous according to the desires of the decision makers.

Keywords: Hamming distance method, decision making, performance evaluation

OR16
Optimal Use of a Mixed Model for Fuzzy Programming and Integer Programming to Determine the Optimal Location for Emergency Health Services

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Abstract. Operations research is one of the most important scientific methods in the processes of strategic decision-making at various levels, especially decisions related to the drawing and planning of services necessary for human life. The main objective is to optimize the decision-making process and strategic plans. Hence the needs to develop an optimal method or model in light of which decisions are made. In this research, optimal locations for emergency health services will be identified in Najaf, Iraq. Because of the importance of these service sites to facilitate the speed of access of citizens when needed to receive those services, which are directly related to human life as soon as possible and with the lowest costs. In this research we will provide a mixed model of fuzzy programming and numerical programming in relation to the times of access to the proposed places to create health services sites being more flexible in decision making.

Keywords: fuzzy, integer programming, membership function, optimal site, ranks fortified

OR17
A Theoretical and Computational Comparison of Lower Bounds for the
Economic Lot-Sizing with Remanufacturing and Joint Setup

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Abstract. This paper investigates economic lot-sizing problem with remanufacturing and joint setup, where new and remanufactured are produced on a single production line. In each time period, the known quantities of used products are returned from customers and restored to like-new conditions. Customer demands can then be satisfied by both remanufactured and new products. As this problem falls into the NP-hard class, the optimum seeking methods are no longer practical for large problems due to their computational inefficiency. Therefore, we evaluate different approaches to obtain better lower bounds (a) two extended formulations, namely a facility location reformulation and a shortest path reformulation; and (b) a strengthened *(l,S)-like* inequalities. We provide theoretical comparisons between these techniques to prove the equivalence of the formulations. Computational experiments on a large number of test data sets available in the literature are also presented to test their effectiveness. The numerical results show that the lower bounds of the strengthened formulation outperform all other tested approaches. Finally, we suggest some directions for future research.

Keywords: lot-sizing, remanufacturing, mixed integer programming

OR18
Pursuit Game with Coordinate-Wise Integral Constraints for
System of Infinite Differential Equations

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Abstract. The present paper proposes differential game of pursuit problem described by system of infinite first order ordinary differential equations. In the game, we consider only single pursuer and single evader for which the control functions of the players are subjected to coordinate wise integral constraints. The pursuit is assumed to be completed if the pursuer brings the state of the system from one state in to another state at some time. We proved a theorem of pursuit to obtain a guaranteed pursuit time. Moreover, an explicit strategy is constructed.

Keywords: Infinite system, differential game, pursuer, evader

OR19
Reducing Server Redundancies in ATM Lines via Queue Disciplines

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Abstract. In this research, we study an M/G/2 queuing system with a fixed and a flexible server under a newly constructed service policy that reduces server redundancies. Using the supplementary variable technique, stationary analysis for customer distributions, expectations and buffer parameters for this queuing system are computed. In addition, numerical approximations for various performance measures of this queuing system and comparisons with existing models are carried out. A fundamental result of this research work is that, the flexible server installation policy introduced in this work is operationally better under light traffic. Most interestingly, servers are better utilized for any arrival rate into the system. Finally, our policy could be adopted for use at times preceding salary periods to improve server redundancies and minimize loss of investment resources.

Keywords: server redundancy, flexible service policy, cost of service, buffer

PM01
Parikh Matrices and *M*-Ambiguity Sequence

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Abstract. The Parikh matrix mapping, introduced by Mateescu et al. in 2001, is a canonical generalization of the Parikh mapping. On top of dealing with the number of occurrences of individual letters (as in the case of Parikh vectors), the Parikh matrix of a word stores information on the number of occurrences of certain subwords in that word as well. Not every word is uniquely determined by its Parikh matrix. A word is said to be *M*-ambiguous if and only if it shares the same Parikh matrix with another distinct word; otherwise it is *M*-unambiguous. In the pursuit of characterizing *M*-unambiguous words, Șerbănuță proposed a conjecture a decade ago that the duplication of any letter in an *M*-ambiguous word will result in another *M*-ambiguous word. The conjecture was however overturned recently by a counterexample from the quaternary alphabet. In this work, we will show that by duplicating certain letters in a word, it is possible to continuously change the *M*-ambiguity of the resulting words. In fact, we will see that the pattern in which the *M*-ambiguity changes can be arbitrary. Next, we represent the changes in the *M*-ambiguity of words by sequences, which are termed as *M*-ambiguity sequences. The periodicities of these sequences are then studied by employing certain system of linear inequalities.

Keywords: injectivity problem, subword, *M*-ambiguity, *M*-equivalence

PM02
Mixed Hourglass Graph and Its Mixed Energy

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Abstract. In this article we discuss a complete mixed graph called mixed hourglass graph. The adjacency of a mixed hourglass graph is directly coined from an hourglass matrix in which the matrix is obtained from quadratic interlocking factorization. Furthermore, the mixed graph obtained from an hourglass matrix is a weighted mixed hourglass graph with loops. Due to lack of consistence in direct representation of hourglass matrix to weighted mixed hourglass graph, we replace the weights of the graph with 1's to produce an unweighted mixed hourglass graph with loops and we determine the total number of arcs and edges in its graph. Lastly, we examine an unweighted mixed hourglass graph without loops or simply mixed hourglass graph and, we determine its determinant and mixed energy. Then, we conclude that the mixed energy of mixed hourglass graph equals the total number of undirected edges of the graph.

Keywords: hourglass matrix, adjacency matrix, complete graph, mixed graph, mixed energy, weighted graph

PM03
Domination Polynomial of the Commuting and Noncommuting Graphs of Some Finite Groups

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Abstract. A dominating set S of a graph is a subset of the vertex set of the graph in which the closed neighborhood of S is the whole vertex set. A domination polynomial of a graph contains coefficients that represent the number of dominating sets in the graph. A domination polynomial is usually being obtained for common types of graphs but not for graphs associated to groups. Two types of graphs associated to groups that are used in this research are the commuting graph and the noncommuting graph. The commuting graph of a group G is a graph whose vertex set contains all noncentral elements of G and any two vertices in the set are adjacent if and only if they commute in G. Meanwhile, the noncommuting graph of a group G is a graph whose vertex set contains all noncentral elements of G and any two vertices in the set are adjacent if and only if they do not commute in G. This paper establishes the domination polynomial of the commuting and noncommuting graphs for the dihedral groups, generalized quaternion groups and quasidihedral groups.

Keywords: domination polynomial, commuting graph, noncommuting graph, dihedral group, generalized quaternion group, quasidihedral group

PM04
On a Graph Related to the Conjugacy Classes of 3-Generator p-Groups

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Abstract. The conjugacy classes can be described as the partition of the elements of any group in group theory. Meanwhile, the conjugacy class graph is a graph in which the vertices of the graph are non-central conjugacy classes of the group and two vertices are adjacent if their cardinalities are not coprime. The classification of 3-generator p-groups consists of three types of groups with the given group presentation. Based on the classification, the conjugacy class graph for these groups of order p^4 are determined. The conjugacy class graph is found to be dependent of p where p is referred to as the odd prime numbers in the group presentation. The Groups, Algorithms and Programming (GAP) software is used to assist the computation of conjugacy classes of the groups.

Keywords: conjugacy class, conjugacy class graph, 3-generator p-groups

PM05
On Classification of the Genetic and Evolution Rock-Paper-Scissor Algebras

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Abstract. In recent decades in game theory, evolutionary and dynamically aspects have increased in popularity. An evolutionary zero-sum game generated by a Volterra quadratic stochastic operator V is called a Rock-Paper-Scissors (RPS) game if the operator *V* is a non-ergodic transformation. An algebra with genetic realization (*genetic algebra*) is an algebra *A* over the real numbers *R* which has a finite basis and a multiplication table is generated by the Volterra quadratic stochastic operator. An *evolution algebra* over the real numbers *R* is an algebra with a basis on which multiplication is defined by the product of distinct basis terms being zero and the square of each basis element being a linear form in basis elements. We assume that the structure constants in the linear form are defined also by Volterra operator. We consider genetic and evolution algebras generated by non-ergodic Volterra operator. It is known that a zero-sum game generated by Volterra operator be a RPS game if and only if the operator is a non-ergodic transformation. We will call the genetic (evolution) algebra generated by non-ergodic Volterra operator a RPS genetic (respectively RPS evolution) algebra. In this paper we investigate the problem of isomorphism of two RPS genetic (evolutionary) algebras and establish necessary and sufficient conditions when two such algebras will be isomorphic.

Keywords: quadratic stochastic operator, rock-paper-scissor game, genetic and evolution algebras

PM06
Some Properties of k-Step Hamiltonian Graphs

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Abstract. A graph G with n vertices is called a k-step Hamiltonian graph if the n vertices can be labelled as the sequence $v_1, v_2, \ldots, v_n$ such that $d(v_i, v_{i+1}) = d(v_1, v_n) = k$ for each $i = 1, 2, \ldots, n-1$. In this paper, we characterize k-step Hamiltonian graph G in terms of its complement, maximum degree and number of edges. We also show that bounds for the number of edges of 2-step Hamiltonian graph are sharp. We then characterize 2-step Hamiltonian graphs with independence number 2 and diameter 2.

Keywords: Hamiltonian graph, k-step Hamiltonian graph

PM07
Generalization of Class $\mathcal{U}$

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Abstract. Let $\mathcal{A}$ denote the family of all functions f analytic in the unit disc $\mathbb{D} = \{z \in \mathbb{C} : |z| < 1\}$ and satisfying the normalization $f(0) = f'(0) - 1 = 0$ and $\mathcal{S}$ be its subset consisting of functions that are univalent (one-to-one) in $\mathbb{D}$. Let $\mathcal{U}(\lambda; \mu)$ denote the subset of functions $f \in \mathcal{A}$ which satisfy

$$\left| \left(\frac{z}{f(z)} \right)^2 f'(z) - \mu \right| < \lambda, \quad z \in \mathbb{D},$$

where $0 < \lambda \leq 1$ and $|\mu| \geq \lambda$. Set $\mathcal{U} := \mathcal{U}(1,1)$. The integral representation of the functions $f \in \mathcal{U}(\lambda; \mu)$ is obtained. The suitable conditions on λ and μ is determined so that $\mathcal{U}(\lambda; \mu)$ is included in the class $\mathcal{S}$. Lastly, the radius of starlikeness and radius of convexity for the class $\mathcal{U}(\lambda; \mu)$ is obtained.

Keywords: univalent, starlike, convex

PM08
Nilpotent Groups Having a Maximal Irredundant 11-Covering with Core-Free Intersection

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Abstract. Let G be a finite group. A covering of G is a collection of proper subgroups of G whose union is equal to the entire G. If the number of proper subgroups in the covering is n, then the covering is called an n-covering. Considering that no group can be covered by two of its proper subgroups, $n \geq 3$. An n-covering is called irredundant if no proper subcollection of subgroups from the covering is able to cover G. If all members of an n-covering are maximal normal subgroups of G, then the covering is called a maximal n-covering. Let D be the intersection of all members of an n-covering. Then the covering is said to have a core-free intersection if $\bigcap_{g \in G} gDg^{-1} = \{1\}$. This paper characterizes nilpotent groups having a maximal irredundant 11-covering with a core-free intersection. It was found that a nilpotent group G has a maximal irredundant 11-covering with a core-free intersection if and only if it is isomorphic to $(C_2)^{10}$, $(C_3)^5$, $(C_3)^6$, $(C_5)^3$ or $(C_5)^4$.

Keywords: nilpotent group, group covering, core-free intersection

PM09
The Fekete-Szego Inequalities for Memomorphic Functions Associated with Quasi-Subordination

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Abstract. In this study, we introduce some classes of functions defined using the concept of quasi-subordination. Quasi-subordination is a generalization of subordination as well as majorization. There have been extensive studies on the class of analytic functions associated with quasi-subordination. But in this study, we consider two subclasses of meromorphic univalent functions f defined through quasi-subordination. We then obtain the Fekete-Szego coefficient bounds for the two subclasses. For a suitable choice of a parameter, quasi-subordination reduces to majorization and we therefore obtain the Fekete-Szego coefficient functional for each of the two classes. These results are special cases of the notion.

Keywords: Meromorphic functions, Fekete-Szego coefficient bound, quasi-subordination

PM10
Bohr's Inequality for Harmonic Mappings into a Wedge Domain

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Abstract. The Bohr's inequality, first introduced by Harald Bohr in 1914, deals with finding the largest radius r, $0 < r < 1$, such that $\sum_{n=0}^{\infty} |a_n||z|^n \leq 1$ holds whenever $|\sum_{n=0}^{\infty} a_n z^n| \leq 1$ in the open unit disk U of the complex plane. In this article we develop Bohr's inequality for the class of complex-valued harmonic mappings from open unit disk to a convex wedge domain.

Keywords: harmonic mappings, convex wedge, Bohr's inequality

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PM11
On Hamiltonian Polygonal Paths in Assembly Graph $FTTM_n$

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Abstract. Fuzzy Topographic Topological Mapping (FTTM) is a model that consists of four topological spaces that are homeomorphic to each other. A sequence of is a combination of *n* terms of FTTM. An assembly graph is a graph with all vertices have valency of one or four. A Hamiltonian path is a path that visits every vertices of a graph exactly once. In this paper, we show the existence of assembly graph in *FTTM_n*. Further, Hamiltonian polygonal paths can be generated in the assembly graph of *FTTM_n*. Several definitions and theorems are developed for the purpose.

Keywords: FTTM, Assembly Graph, Hamiltonian polygonal paths

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PM12
On the Diophantine Equation $x_1^a + x_2^a + \cdots + x_m^a = p^k y^b$

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Abstract. In this paper, we consider the Diophantine equation $x_1^a + x_2^a + \cdots + x_m^a = p^k y^b$, where a, b and k are positive integers, $\gcd(a, b) = 1$, m and p are prime numbers and $x_1, x_2, \ldots, x_m, y$ are integers for the case $x_1 = x_2 = \cdots = x_m$. We solve this equation parametrically by considering two different cases when $m = p$ or $m \neq p$.

Keywords: Diophantine equation, congruence, Fundamental Theorem of Arithmetic

PM13
The Decomposition of Electroencephalography Signals During Epileptic Seizure

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Abstract. This paper describes how elementary electroencephalography (EEG) signals can be decomposed by using Jordan-Chevalley decomposition theorem. Recorded EEG signals on a patient during seizure were transformed into a set of matrices. Each of these matrices were decomposed into its elementary components through Krohn-Rhodes decomposition theorem. Finally, these components are decomposed further into their respective semisimple and nilpotent parts. These parts are the extended building blocks of the elementary EEG signals.

Keywords: Krohn-Rhodes decomposition, Jordan-Chevalley decomposition, electroencephalography

PM14
Some Properties of Regular Continued Fraction Expansions Related to Certain Sequence of Integers and its Applications in Elliptic Curve Cryptography

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Abstract. In this paper, we consider the sequence of integers r_i, s_i and t_i of regular continued fraction (RCF) expansions which generated from the extended Euclidean algorithm. These sequences always satisfy $r_i = s_i a + t_i b$ where r_i is a remainder whereas s_i and t_i arising from the extended Euclidean algorithm are equal, up to sign, to the convergent of the continued fraction expansion of a/b. We discuss the behaviour of these sequences and provide the full proof with their numerical evidences in detail. Throughout this works, we deal with the concept of Euclidean algorithm and extended Euclidean algorithm together with continued fraction algorithm. These algorithms involve in the improvement of computational efficiency of the elliptic curve cryptography (ECC). Henceforth, from that we tend to associate these sequences in ECC. Last but not least, we found that the value of integers (r_i, s_i, t_i) satisfy various properties in RCF which then used to solve the shortest vector problem in representing point multiplications in ECC, namely the Gallant, Lambert and Vanstone (GLV) integer decomposition method and the integer sub decomposition (ISD) method.

Keywords: elliptic curve cryptography, extended Euclidean algorithm, GLV integer decomposition method, ISD method, regular continued fraction, shortest vector problem

PM15
A Pursuit Differential Game in a Convex Set

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Abstract. A pursuit differential game of many pursuers and one evader in a nonempty closed bounded convex subset of $\mathbb{R}^n$ is studied. Each player is subjected to geometric constraint and each player moves are bounded within the convex set at all time. First, we construct strategies for pursuers to complete the pursuit where movement of the evader can be any. A similar pursuit problem in an n-dimensional cube is first studied. Our strategy method used includes selecting planes on which each pursuer moves using parallel strategy. Afterwards, the problem is extended to a nonempty closed bounded convex subset of $\mathbb{R}^n$ by using fictitious pursuers. Finally, we show an improved guaranteed pursuit time of the game in comparison to Alias et al. (2015).

Keywords: pursuit, geometric constraint, strategy, guaranteed pursuit time

PM16
Quasiminimizer and Its Roles in Improving Variational Principle in the Calculus of Variations

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Abstract. The direct method in the calculus of variations is a powerful abstract method for proving the existence of minimizers for variational problems and followed by proving the regularity of the minimizer. However, the function involved can be complicated and hence seeking a minimizer and proving its regularity using the direct method may not be fruitful. In our study, we seek to improve on the variational principle by the use of quasiminimizer due to its natural existence in different problems and global higher integrability. It is known that a minimizer of a variational problem is also a quasiminimizer of the p-Dirichlet integral (or energy function). Since the latter is a weaker condition as compared to the former, the converse is only true for some special functions.

Keywords: quasiminimizer, calculus of variations, variational principle, p-Dirichlet integral

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PM17

Chaoticity of Potts-Bethe Maps of Degree Four over Q_p

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Abstract. We give the full descriptions of the dynamical structures of the special class of rational maps so-called *Potts-Bethe maps* of degree four over the field Q_p of p-adic numbers. For $a, b \in Q_p$, the *Potts-Bethe maps* is written as follows

$$f_{a,b}(x) = \left(\frac{ax + b}{x + a + b - 1} \right)^4.$$

When $|a - 1|_p < |b + 1|_p < 1$, there exists a subsystem $\boldsymbol{J}$ that is topologically conjugate to the full shift dynamics on two or four symbols which is chaotic. It is known that the full shift dynamic has periodic orbits of any periods $m \in N$. We also show that except for the pre-images of the point $x = 1 - a - b$, for any $x \in Q_p \backslash \boldsymbol{J}$ converges to the unique attracting fixed point. This class of maps appeared in the study of p-adic Gibbs measures of the q-state Potts model on Cayley tree of order four. We study the special type of p-adic Gibbs measures called H_m-*periodic p-adic Gibbs measures* where this kind of measures are associated to the periodic orbit of period m of the corresponding *Potts-Bethe map*. The result enables us to show the vastness of the set of p-adic Gibbs measures.

Keywords: rational maps, p-adic dynamical systems, p-adic Gibbs measures

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PM18

Enumeration of Tilings of Holey Squares with Straight Polyominoes

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Abstract. Counting the number of ways to tile a specific region with a prescribed set of polyominoes provides a good source of intriguing problems in enumerative combinatorics. Let $H(k, m)$ denote the holey square obtained by removing an $m \times m$ square from the center of a $k \times k$ square. This paper proposes a method for enumerating the tilings of $H(k, k - 2n)$ with straight polyominoes of order n.

Keywords: holey squares, tiling, straight polyominoes

Combination of Graphs with Pseudo Degree Zero Generated by $FTTM_n^k$

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Abstract. Fuzzy topological topographic mapping ($FTTM$) is a set of topological spaces and algorithms which is applied in solving neuromagnetic inverse problem. The special characteristic of $FTTM$, namely the homeomorphisms among its components, allow the construction of new $FTTM$ from components of different version of $FTTM$s. These generated $FTTM$s can be represented in the form of a pseudo graph. A pseudo graph of degree zero is a special type of pseudo graph where each of the $FTTM$ components version differ to components adjacent to it. Previous study has investigated combinations of graphs with pseudo degree zero for n number of components and k number of versions by using a computer algorithm. In this paper two conjectures from the previous study are proven analytically by using new definitions of $FTTM$ namely $FTTM$ path.

Keywords: graph theory, combinatorics, fuzzy topographic topological mapping

Taxonomy of Tournament in Relation to Autocatalytic Set

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Abstract. A round robin tournament is a competition in which every player plays against every other player exactly once. The result of a round robin tournament can be depicted by a directed graph called a tournament graph. Tournament graphs can be divided into two classes, which are transitive and intransitive. A transitive tournament graph is acyclic. In other words, a transitive tournament graph contains no cycle. In contrast, an intransitive tournament graph can be illustrated by a cycle. In graph theory, an autocatalytic set is defined as a directed graph where each vertex has an incoming link. This paper describes the tournament graph as well as establishing its relation to the autocatalytic set. Finally, tournament graphs are classified according to their transitivity and property of autocatalytic set.

Keywords: tournament, autocatalytic set, weak autocatalytic set

PM21
On Orthogonality Preserving Cubic Stochastic Operator Defined on
1-Dimensional Simplex

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Abstract. In this paper, we consider the cubic stochastic operator (CSO) defined on 1 dimensional simplex. We provide a full description of orthogonal preserving (OP) cubic stochastic operators on the 1-dimensional simplex. We provide full description of the fixed points subject to two different parameters. In the last section we described the behaviour of each fixed point.

PM22
New Cryptanalytic Results upon Prime Power Moduli $N = p^r q$

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Abstract. In this paper we propose three attacks on the prime power modulus $N = p^r q$ for $r \geq 2$. The first attack is based on the equation $eX - NY + (q^r + p^r u)Y = Z$ for suitable positive integer u. Using continued fraction, we show that $\frac{y}{x}$ can be recovered among the convergent of the continued fraction expansion of $\frac{e}{N}$. Also, we show that the number of such exponents is at least $N^{\frac{5r-7}{6(r+1)}-\varepsilon}$ where $\varepsilon \geq 0$ is arbitrarily small for large N. Hence one can factor the prime power modulus $N = p^r q$ in polynomial time. The second and third attacks work when k RSA public keys (N, e) are such that there exist k relations of the form $e_i x - N_i y_i + (q_i^r + p_i^r u)y_i = z_i$ or of the shape $e_i x_i - N_i y + (q_i^r + p_i^r u)y = z_i$ where the parameters x, x_i, y, y_i, z_i are suitably small in terms of the prime factors of the moduli. Based on LLL algorithm we show that our attack enables us to simultaneously factor the k prime power RSA moduli N_i.

PM23
Chromatic Uniqueness of a Type of 6-Bridge Graph

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Abstract. Suppose G and H are two graphs and $P(G, \lambda)$ and $P(H, \lambda)$ denote the chromatic polynomial of graph G and H, respectively. Graphs G and H are said to be chromatically equivalent (or simply χ-equivalent), denoted by $G \sim H$, if $P(G, \lambda) = P(H, \lambda)$. A graph G is said to be chromatically unique (or simply χ-unique) if for any graph H such that $G \sim H$, we have $H \cong G$, that is, H is isomorphic to G. In this paper, the chromatic uniqueness of a family of 6-bridge graphs in the form $\theta(a,a,b,c,c,c)$ will be investigated.

Keywords: chromatic polynomial, chromatic uniqueness, 6-bridge graph

ST01
Stairboxplot and the Visual Analysis of Univariate Datasets

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Abstract. The classical boxplot methods utilize three robust quartile estimates of a univariate dataset to facilitate visual identification of location, spread and outlying observations. Also, among the most popular functionality of a boxplot is batch comparison of datasets. Visualization of single or multiple batch of datasets with boxplot has limited capacity to display useful distributional information mostly required by data analyst. Stairboxplot is a proposed boxplot enhancement that account for display of individual data points according to measure of outlyingness and display of distributional shape using range levels. We illustrate the advantages of the stairboxplot using simulation and real-life datasets.

Keywords: boxplot, univariate dataset, outliers

ST02
Side-Sensitive Group Runs Chart for Detecting Mean Shifts Using Auxiliary Information

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Abstract. In recent studies, auxiliary information technique in control charts have shown superior run length performances to control charts developed without using it. This paper proposes a side-sensitive group runs chart for detecting mean shifts using auxiliary information (SSGR-AI), where its charting characteristics require information from the study and auxiliary variables to efficiently monitor the process shifts. The control chart statistic, optimal design of parameters and implementation of the proposed SSGR-AI chart are explained. The performance of the SSGR-AI chart is evaluated using the average run length (ARL) and expected average run length (EARL) criteria. The ARL and EARL performances of the SSGR-AI chart are compared with that of the synthetic chart with auxiliary information (Syn-AI) and exponentially weighted moving average chart with auxiliary information (EWMA-AI). The results show that the SSGR-AI chart outperforms the (i) Syn-AI chart for all shifts sizes and correlation coefficient values, and (ii) EWMA-AI chart except for small shifts and small values of correlation coefficient. An illustrative example is also presented to demonstrate the implementation of the SSGR-AI chart.

Keywords: Study variable, auxiliary variable, auxiliary information (AI), average run length (ARL), expected average run length (EARL)

ST03

Group Chain Acceptance Sampling Plans for Truncated Life Test by Using Minimum Angle Method

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Abstract: Acceptance sampling is a fundamental statistical quality control procedure widely used in industries to decide whether or not to accept a product lot. Currently, the development of acceptance sampling plans focuses on the group chain acceptance sampling plans (GChSP) since the plans have many advantages compared to the established plans. However, the development of GChSP only focuses on the consumer's risk and the researchers overlook at the other risk associated with the acceptance sampling, which is producer's risk. Therefore, this paper introduces GChSP for truncated life test at a pre-assumed time by using minimum angle method. The proposed method is an approach, where both risks associated with acceptance sampling namely consumer's and producer's are considered. There are four phases needed in order to develop the proposed plans, which are (i) identifying the design parameters, (ii) developing the operating steps, (iii) deriving the probability of lot acceptance, and (iv) measuring the performance. The results show that the number of optimal groups obtained satisfies both parties, consumer and producer, compared to the established plan, where the number of groups only satisfies the consumer, not the producer. Practically, the plans should offer alternatives to industrial practitioners. Among suitable applications are (but not limited to) electronic components of transportation electronics system, wireless devices, global positioning systems and computer aided and integrated manufacturing systems.

Keywords: group chain acceptance sampling plans, minimum angle method, consumer's risk, producer's risk

ST04
Survival Analysis in Insurance Attrition

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Abstract. Attrition is a situation where a policyholder stops paying the insurance premium which will cause their policy to be terminated. There are several factors that contribute to attrition which are core customer status, information changes, premium increase and competitive advantage. Attrition give large effect to the company profit and market share. Basically, insurance can be classified into life insurance and non-life insurance. This study focuses on attrition cases occur in life insurance policy where the main target is to determine the policyholder profile that are likely to terminate their life insurance policy. The data used for this study is provided by insurance agent in Malaysia consist of policy holder profile from year 2012 until 2015. For data analysis purpose, this study applies Kaplan-Meier estimators, log-rank test and Cox model. This study concludes that the marital status is the only covariate that influences the attrition while age, gender and salary have no effect on attrition cases.

Keywords: insurance attrition, Kaplan-Meier estimators, log-rank test and cox model

ST05
R Package FURI for Fractional Unit Root Integral (FURI) and ARFURIMA Models

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Abstract. This paper introduces the R package FURI for Interminable Long Memory (ILM) time series that exhibits strong hyperbolic decay autocorrelations function and large spectrum at zero frequency. The package has facilities for Auto Regressive Fractional Integral Moving Average (ARFIMA) and Auto Regressive Fractional Unit Root Integral Moving Average (ARFURIMA) modelling of the mean of a Long Memory (LM) process. The mean of this LM process can be described in ARFIMA and ARFURIMA models with fractional differencing values of $0<d<1$ and $1<d<2$ respectively. The arfurima.sim, furi, arfurimaFit and arfurimaFit.forecast are the main functions of the package. The first function simulates the ILM series for d such that $1<d<2$ so the simulated series has the form of ARFURIMA (p,d,q). The second function fractionally differenced ILM time series and returns FURI series. The third function estimates ARFIMA or ARFURIMA model while the fourth function undertakes the forecasts. Finally, several examples based on financial, economic and meteorological data are used to illustrate the usage of the package.

Keywords: strong hyperbolic decay, FURI, R, fractional differencing and ARFURIMA model

ST06
Bootstrap Confidence Intervals for Circular Regression Model

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Abstract. In many years, researchers have shown very strong interest in the subject of the confidence interval. In this paper, the confidence interval for circular regression model will be assessed. The method used is bootstrap confidence interval where the parameters in the model estimated using minimum sum and polyroot methods. There are two parts of the parameter estimation, one is for angular and slope parameters estimation and another one is for concentration parameter estimation. Meanwhile, the variance-covariance matrix for parameters is estimated using Fisher information matrix. First and second partial derivative of the variance-covariance matrix is derived from the model log-likelihood function. Finally, the efficiency of the estimated confidence intervals was investigated by simulation study with two performance indicators that are coverage probability and expected length. From the results, the increasing pattern can be seen. When the number of sample sizes and the true value of concentration parameter increased, the coverage probability approaching the nominal probability 0.95 and the value of expected length is getting smaller. A practical example of real data will be estimated using Humberside wind direction data.

Keywords: confidence interval, circular regression model, minimum sum, polyroot, simulation study

ST07
Forecasting Indonesian Mortality Rates Using the First Generalized Cairns-Blake-Dowd Model

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Abstract. The mortality rate pattern and trend are the main important subject for any country to maintain a good aspect in several areas, such as social wellness and economy in the next projection years. The declining in mortality trend gives a good impression of what a government has done towards the citizen in such nation. One of the models that has been acknowledged by the actuarial science community in forecasting mortality rate is the Cairns-Blake-Dowd (CBD) model. There are three generalizations of the CBD model. This paper presents the first generalized CBD model that is used to calculate and forecast the mortality rate of Indonesian population with supported by the Auto Regressive Integrated Moving Average (ARIMA) method. The mortality rate data of Indonesia population are considered and indexed by the age and the year of death from the period of 1950 to 2015. The forecasting process is implemented using software R. The final result of this study is forecasting mortality rate in Indonesia for the next five years.

Keywords: ARIMA method, first generalized Cairns-Blake-Dowd model, mortality rate

ST08

Examining Time-varying Economic Impacts on Tourism Demand for Malaysia: a Kalman Filter Approach

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Abstract. Due to the economic importance of tourism industry, this study examines the time varying economic impact on tourism demand for Malaysia. The data utilized in this study are the number of international tourist arrivals, exchange rate, relative price level and substitute relative price level covering the period from January 1999 to December 2016. The results showed that Kalman filter (KF) technique produced estimates that are clearly varying over the sample period rather than constant as implied in the ordinary least square (OLS) model. The Kalman filter estimation also showed that the speed of adjustment to long-run equilibrium following short-term deviation is faster during the first half of the sample period. In other words, the Kalman filter is found to be better mirror the short-run dynamic between tourism demand and the selected economic variables as the Kalman filter technique is able to produce time-varying and reliable estimates corresponding to the real economic and financial situations. To improve growth for Malaysia as holiday destination, government and related tourism authorities need to be sensitive to changes in global economic situations and as such tourism policies need to be continually revised.

Keywords: tourism demand, Kalman filter, time varying coefficient

ST09

Threshold Effects of CO2 and Energy Use on Economic Growth in Oil Importing and Exporting Countries

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Abstract. This study investigates the threshold effects of environmental degradation and energy consumption level on economic growth, covering the period of 1975 to 2013 for a panel of 13 oil importing countries and 11 oil exporting countries. All the variables in both countries are integrated at levels, $I(0)$. The empirical findings on CO2 and energy consumption have triggered a single threshold effect on economic growth in oil exporting countries, but no threshold effect is detected in oil importing countries. The thresholds values for CO2 and energy consumption are 2.261 and 8.5268 respectively. The regression estimates indicate that both thresholds effects are significant. Therefore, we can suggest that the amount of CO2 emissions and energy used need to be paid attention accordingly by decision makers to achieve sustainable growth.

Keywords: CO2, energy use, threshold

ST10
A Population-Averaged Model for Analyzing Longitudinal Binary Data

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Abstract. This paper applies the Generalized Estimating Equations (GEE) technique in a study that analyzes a set of longitudinal data on 81 type-2 diabetic patients at a healthcare centre of one of the higher-learning institutions. The study aims to model the association between a binary response variable, which is the glycated haemoglobin (HbA1c) level of the diabetic patients and a set of covariates which are gender, race, working status, counseling, body mass index (BMI), high density lipid (HDL) level, triglycerides (TG) level, creatinine level and blood pressure of the patients. Although the population-averaged approach of the GEE is known to be robust to the misspecification of the correlation structure of the repeated measurements (responses), a correct specification will however, produce more efficient parameter estimates. Hence, four different working correlation structures were fitted to model the interdependence of the repeated measurements (responses) and a comparison of the results shows that an exchangeable correlation structure produces the best-fitting model. The result also shows that race, working status, counseling, HDL level and TG level of patients are significantly associated with their HbA1c level.

Keywords: Generalized Estimating Equations, population-averaged approach, correlation structure, conditional and marginal probabilities

ST11
The Spatial Effects of Neighbours on the Trading Activities of COMESA Countries

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Abstract. Obtaining accurate geospatial information provides researchers with various means through which they can examine the effects of the interactions of economic observations on the trading activities of the Common Market for Eastern and Southern Africa (COMESA) countries. With the aim of examining the process by which the interaction of spatial and economic observations affects the trading of COMESA, this article describes the spatial panel models for the trading activities of COMESA countries and chooses between spatial fixed or random effects by using the robust Hausman test. Results indicated that the spatial Durbin model with fixed effects specification should be tested and considered in most cases of this study. After that, the direct and indirect effects among COMESA regions were assessed, and the role of indirect spatial effects in estimating imports and exports was empirically demonstrated. Regarding originality and research value, and to the best of the authors' knowledge, this article is the first participation that can draw a comprehensive picture of COMESA regional trade; however, we take the idea of spatial dependence through spatial panel models using XSMLE, which is a new command for spatial analysis using STATA. The results confirm that there are variables that have direct and indirect effects on the COMESA trade.

Keywords: spatial effects, spatial models, spatial autocorrelation

ST12
The Effect of Free Food Scheme on UUM Students Financial Management

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Abstract. Cost of living is the amount of money to purchase goods and services to sustain a certain level of living. In perspective of education, students' costs of living are spending on study fees, food, books and others. Previous studies have shown that students do not have enough money to buy food and face hunger which can jeopardise their health and education. This has led to the existence of free food scheme in many universities including Universiti Utara Malaysia (UUM). Is the free food scheme beneficial or detrimental to the students? Thus, the aim of this study is to investigate the effect of free food scheme on UUM students' financial management. Observational study was conducted to obtain actual food prices at selected cafeterias in UUM. Survey was implemented by distributing questionnaire randomly in understanding the students spending behaviour and opinion on free food scheme. Exploratory data analysis and inferential statistics techniques were used to analyse the data. The findings discovered the cost of food in UUM is affordable thus students have no problem to buy food with their study loan or scholarship if they manage their money well. The findings also reveal that 25% of UUM students are taking free food. However, half of them with poor family background struggling financially due to saving money either to help family or for future internship usage. While the other half spend their money less on food but more on clothing, postpaid/prepaid (top up), smartphone and entertainment. Thus, the existence of free food scheme has good effect on under privileged students but has adverse effect on nurturing future bad financial manager. Hence the free food scheme should be revised by focussing on strategical and systematic process of implementation.

Keywords: free food, spending behaviour, financial management

ST13
Modified LASSO as Efficient Phase in Standard Operating Procedure in Multiple Regression

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Abstract. Two types of analyses are done based on real data analysis and on simulation in which real data of per second is collected by using dryer to reduce the moisture content from 92.68% to 35.0% with four parameters that had been identified. The same parameters are generated in simulation from exponential distribution after observing the pattern of variables from real data. In this paper, LASSO regression is proposed as a subset of variable selection. Result shows that LASSO is able to find the important variables after skipping insignificant variables from the designed model. The results are compared with the usual multiple regression technique where multicollinerity is observed from different variables.

Keywords: sparse regression analysis, subset selection, LASSO regression, multicollinearity

ST14
Using Survival Analysis to Assess Bankruptcies in Malaysia

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Abstract. In this study, survival analysis is employed to determine the trends of profile analysis and evaluate the survival rate of bankruptcies in Malaysia from years 2005 to 2015. Recent report states a total of 94,408 people involved in bankruptcy cases from year 2013 until August 2017; about 97% of these bankruptcies are caused by inability to repay installments for financial products. The rise in the number of companies that went bankrupt causes a decline in the number of listed companies in Malaysia. Therefore, this study was conducted to evaluate the survival analysis about the bankruptcies in Malaysia and uncover some trends. The results show a sharp rise in the number of bankruptcies and a slight drop in the number of listed companies in Malaysia in the interval year 2005-2015 as proved by the probability distribution function and survival function respectively. Meanwhile, Kaplan–Meier estimator shows a slight drop in the number of listed companies for Malaysia in the interval year 2005-2014. This indicates that, despite the increased number of bankruptcies in Malaysia which may be caused by the global financial crisis in years 2007-2008, 75% of the listed companies in Malaysia still survive. Suggestions for future work are also briefly discussed.

Keywords: bankruptcies, survival analysis, Kaplan-Meier

ST15
A FURI Approach in Modeling and Forecasting Tapis Crude Oil Price

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Abstract. Deterministic trend, gradual decay in Auto Correlation Function (ACF) and fractional differencing value greater than unity are attributes to strong dependence and high long memory in time series. In this paper, a modified Fractional Unit Root Integral (FURI) and Auto Regressive Fractional Unit Root Integral Moving Average (ARFURIMA) model were used to improve the modeling and forecasting of daily Malaysian Tapis Crude Oil Price (MTCOP). The significance of FURI lies in its strength to eliminate excess noise signal in crude oil prices. In addition, the ARFURIMA model has significance degree of accuracy and therefore stands as a new prediction method in financial and energy time series. The goodness of fits and dependence tests as well the accuracy measurement indicates that ARFURIMA model is superior in forecasting Tapis Crude Oil Price.

Keywords: long memory, fractional differencing, FURI and ARFURIMA model

ST16
**Ordinal Logistic Regression Modeling of Dental Caries Status Among
Preschool Children in Bachok District, Kelantan, Malaysia**

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Abstract. Ordinal logistic regression is a statistical technique used to model a categorical response variable of which the outcome consists of multiple categories having natural order or rank. Modelling in ordinal regression is to calculate cumulative probabilities of the response variable, which considers the probability of a particular category and all others above it in the ordinal ranking. A common approach used in ordinal logistic regression models is to assume that the cumulative probabilities have the same slopes, the assumption of proportional odds. In the proportional odds model, the effect of a predictor variable on the odds of an event occurring in every subsequent category is the same for every category. This study used ordinal logistic regression to model dental caries status of preschool children in the area of Bachok, Kelantan based on the children's demographic profiles, the families' sociodemographic profiles and parent's awareness on dental care. Early childhood caries is one of the most common chronic disease. It affects the quality of life of young children as it causes anxiety, eating impairment, children's poor concentration in learning and financial burden to their families. The results indicated that high level of dental caries is related to body mass index, mother's education and parent's awareness score. The odds of high level of dental caries is higher among underweight children, children whose mothers had no formal education, and parent's with low practice, low knowledge and low attitude scores on dental care.

Keywords: ordinal, cumulative probabilities, proportional odds

ST17
E-Commerce Usage and the Buying Behaviour of Generation Y in Malaysia

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Abstract. E-commerce is getting the spotlight in recent years, especially in Malaysia. People are now looking at a new way of shopping experience which is to shop online rather than sticking to old traditional way of stepping out from home and wasting time travelling to get supplies or products. This study explored the main factors that affect the likes of Generation Y in Malaysia in using online shopping/e-commerce. Besides that, their buying behaviour and selection of products are also being investigated so that it can be understand that how Generation Y in Malaysia make their choices on products right now. This survey was carried out by taking a convenient sample with distributing 80 questionnaires to student of Universiti Sains Malaysia. Logistic regression model was employed to find out the important factors that affect their liking. The results obtained reveal that the advertisement viewed by Generation Y has a significant contribution to their liking of using e-commerce. Their buying behaviour changes with the categories of product that they purchased as well.

Keywords: logistics regression model, convenient sampling, questionnaires

ST18
Forecast the Moisture Ratio Removal during Seaweed Drying Process Using Solar Drier

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Abstract. Carrageenan was utilized in food and non-food industry such as emulsifier, pharmaceuticals, cosmetics, printing and textile formulations. However, there are underutilized efforts to develop model using mathematical and statistical techniques; the present paper explains the forecast The Moisture Ratio Removal of Seaweed Drying in v-Groove Hybrid Solar Drier under the climatic conditions of Malaysia. This study examined the effects of the interaction between the main factors. Five variables were considered in this study in which it has been divided into two types of variables which are dependent and independent variables. Four independent variables were considered in this study namely X_1 (temperature chamber), X_2 (humidity chamber), X_3 (solar radiation) and X_4 (collector efficiency). Multiple regression models in this study involve the interaction up to the third level and considering 32 potential models. Each model is tested with multicollinearity test and test coefficient with the objective of removing variables that were not significant. It is concluded from our work that mathematical modelling using Eight Selection Criteria (8SC) would improve economic profitability of hybrid solar drier.

Keywords: multiple regression, eight selection criteria, fourth-order interaction, best model, pilot scale drier, moisture ratio

ST19
Generalized Linear Models for Insurance Claim

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Abstract. Generalized linear models are widely used in actuarial framework. A dataset which consists of categorical and quantitative variables is considered. Instead of using ordinary multiple linear regression model, generalized linear model is used to fit the data. This paper aims to provide a robust framework on how the best model is chosen and used for predicting the insurance claim.

Keywords: generalized linear model, insurance claim, prediction

ST20
Estimation of Precipitation Data by Using Deterministic Interpolation Methods to Study Landslide: A Case Study in Penang Island, Malaysia

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Abstract. Heavy rainfall events can make slopes become unstable and consequently lead to terrestrial landslide which caused damage to properties and loss of life. However, the precipitation data of high-risk landslide hazard area cannot be obtained due to difficulty in placement of rain gauge at mountainous or hilly areas. Hence, the aim of this study is to find out which deterministic method is suitable for estimating the precipitation value of landslide hazard area in Penang Island. Precipitation data of rainfall stations at Penang Island are secondary data that was collected from Department of Irrigation and Drainage (JPS). Four different deterministic methods include old normal ratio method (ONRM), inverse distance weighting method (IDW), modified normal ratio based on square root distance method (MNRT) and modified old normal ratio with inverse distance method (ONRIDW) are studied to estimate the precipitation data of the target station. It is found that the target station better locates at the centre of the surrounding stations. Besides, the optimal distances from the target station to the surrounding stations are within radius of 10 kilometres. The performance of all the estimation methods are investigated using mean absolute error (MAE), similarity index (S-index) and coefficient of correlation (R). It is found that IDW with the power parameter p equals to 1 and ONRIDW are found to perform better on precipitation estimation in Penang Island. Hence, IDW with p equals to 1 and ONRIDW can be used for estimating precipitation data of high-risk landslide in mountainous area such as in Penang Island.

Keywords: Inverse distance weighting method, modified old normal ratio with inverse distance method, mean absolute error, similarity index, landslide, coefficient of correlation

ST21
CARMA Processes with Stochastic Speed of Mean Reversion

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Abstract. For this paper we generalize the continuous-time autoregressive moving average (CARMA) driven by Levy process to allow the speed of mean reversion to be stochastic. To solve the stochastic of speed of mean reversion we apply Malliavin calculus theory. Then, we also show that the generalized CARMA process with stochastic mean of reversion is stationary. To show that the use of the generalized CARMA processes, an example was shown for temperature futures.

Keywords: mean reversion, CARMA, Malliavin calculus

ST22
Spatial Distribution Patterns and Influencing Factors of Poverty

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Abstract. Poverty is not having access to monies, food, healthcare, education and other factors of a person or a household which usually measure by level of household income. Despite the fact that various actions have been taken to handle the poverty problem, most countries still having challenges facing this problem. So it becomes a necessity to know the pattern of poverty as well as identify the factors that influence it to enable the responsible agency for understanding the actual situation of the poverty status. The objective of this study is to analyze the spatial cluster patterns of poverty in Peninsular Malaysia by using the exploratory spatial data analysis (ESDA). In this paper, spatial autocorrelation (cluster), Moran's I index and spatial regression model were used to analyse the patterns and factors of spatial poverty distribution. As a result, the hypothesis of spatial randomness was rejected indicating cluster effect existed in the study area. The findings reveal that poverty was distributed nonrandomly, suggestive of positive spatial autocorrelation.

Keywords: poverty, Moran's *I* index, spatial regression

ST23
Stock Market Forecasting using Empirical Mode Decomposition with Holt-Winter

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Abstract. The aim of this study is to apply a hybrid method based on Empirical Mode Decomposition and Holt-Winter (EMD-HW) to forecast the stock market. First, the stock market data are decomposed by EMD method into Intrinsic Mode Functions (IMFs) and residual components. Then, all components are forecasted by HW technique. Finally, forecasting values are summed together to get the forecasting value of stock market data. Empirical results showed that the EMD-HW outperform individual forecasting models. The daily stock market time series data for Belgium, Finland, Lithuania, and Netherlands are applied to show the forecasting performance of the proposed EMD-HW. The strength of this EMD-HW lies in its ability to forecast non-stationary and non-linear time series without a need to use any transformation method. Moreover, EMD-HW has a relatively high accuracy comparing with eight existing forecasting methods based on the five forecast error measures.

Keywords: Holt-Winter, empirical mode decomposition, forecasting

ST24
A Statistical Study of Employment Insurance Scheme (EIS)

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Abstract. Unemployment is generally defined as for a person who is unable to find any work to earn one's livelihood. In year 2017, the unemployment rate of Malaysia is 3.4% which hits the peak for the past five years. Malaysian government officially commenced the unemployment insurance scheme on 1st January 2018, which is known as Employment Insurance Scheme (EIS). This paper aims to study the unemployment rate in Malaysia with Burr distribution, and the important statistical properties will also be discussed. Maximum likelihood estimation is used to estimate the parameters. Further, equivalence principle is applied to calculate the unemployment insurance premium. Comparison among the Burr distribution and the continuous counterparts has been done to show the superiority of the Burr distribution. A real data set taken from 2003-2015 of the unemployment rate in Malaysia will be considered for illustration purposes.

Keywords: Unemployment rate, EIS, Burr distribution

ST25
The Classical and Bayesian Modelling on the Covariates Influencing the Psychological Disorder "Depressive Syndrome" Among the Child Patients in Hospitals of Kolkata

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Abstract. The study was based on the clinical data of children who attended the psychiatry clinics of three different hospitals in Kolkata, India. The aim is not only to throw light about the deep-rooted problem of Depression in children and adolescents but also to investigate about the different factors that are affecting the child brain. A sample of 150 patients was taken and considered 64 types of mental disorders. The effects of different cofactors such as age, parental features (i.e. any psychiatric disorder, separation among parents or any case of suicide among parents, etc), gender, structure of the family (joint or a nuclear family etc) were investigated. In this project, noting its presence in more than 70% of the sample, the psychiatric disorder "Depressive Syndrome" is chosen and the analysis is also based on the doctor's way of thinking about the detection of the intensity of disorders in the form of latent distribution. The data was analyzed using both classical and Bayesian approaches. In an attempt to compare the two approaches, we have used probit link in either case. The classical approach fits a categorical response regression model using maximum likelihood, and inferences about the model are based on the associated asymptotic theory. On the other hand, exact Bayesian methods for modeling categorical response data are developed using the idea of data augmentation. In conclusion, it was observed that there are other causes apart from the ones considered which lead to Depression in children. Female children and children in adolescence and post adolescence, also those having disturbed parental features and those coming from nuclear family have a higher tendency of suffering from Depression than the others.

Keywords: depressive syndrome, adolescence, children, bayesian analysis, statistical analysis, categorical, psychiatry, probit model, latent distribution, Gaussian, Gibb's sampler, multivariate normal distribution

ST26
Monitoring Dengue Scenario in Malaysia Using Survival Analysis

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Abstract. Dengue is growing most rapidly in tropical and subtropical countries where majority of the world's population reside and increasing health and economic burden. It has become endemic in Malaysia since 1971 and reported cases have increased in over 6-fold over the past decade. This paper demonstrates how survival analysis techniques are used to compare the outcomes of dengue that occur over time between each region of states within years. The real data set consist of 3900 observations which represent the number of weekly reported dengue cases and its associated deaths in years 2010-2014 are divided into four zones: Northern, East Coast, Central and East Malaysia. Kaplan-Meier survival curve is used to estimate the survival function. East Malaysia had the highest survival function of dengue cases for most years, while the central region the lowest. The log-rank test shows significance between regions in most years. Meanwhile, the analysis of deaths reveals varying trends and lack of significant differences among regions.

Keywords: dengue, survival analysis, epidemiology

ST27
Robust Inference in the Presence of Heteroscedasticity and High Leverage Points

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Abstract. Heteroscedasticity-consistent covariance matrix estimators are used as consistent estimates of variances of the parameters in linear regression. Different estimators known as HC0, HC3, HC4 and HC5 among others, were proposed in the literature as substitutes to the usual regression parameters' standard error, in order to alleviate the effect of the heteroscedastic variances. Although, most of these estimators were designed to also take care of the problem of high leverage points, nevertheless weighted version of these estimators were also proposed to further overcome the high leverage points. This article builds up from one existing weighted estimator, and proposed new weighting methods. We have tested their performance and found them useful on HC4 and HC5.

Keywords: Heteroscedasticity, High leverage points, Quasi-*t* test

ST28
The Impact of Social Factors on Tourism Demand for Malaysia and the Neighbouring Countries

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Abstract. For the past decades, tourism industry has become one of the important sectors in Malaysia. However, the growth in the number of tourist arrivals has reduced in recent years. Due to the economic importance of the industry, this study examines the relationship between tourism demand and exchange rate, income level, relative price and substitute relative price by using static (nonstationary) panel data. This study also looks into the impact of social factors such as political stability and corruption on tourism demand for Malaysia and the neighbouring countries. Based on Hausman test statistic, fixed effect estimator model is preferred. Robustness checking is applied to solve for autocorrelation and heteroskedasticity problems. Generally, exchange rate and income level have expected positive sign while relative price and substitute relative price have a mixture of positive and negative sign. As expected, both the political stability and corruption level have positive impact on the number of tourist arrivals to Malaysia and the three neighbouring countries while terrorism did not have the expected negative impact. While leprosy has a significant impact on the number of tourist arrivals, surprisingly, the finding also revealed that malaria does not have a significant impact on the number of tourist arrivals to Malaysia and the three neighbouring countries.

Keywords: tourism demand, social factors, fixed and random effect

ST29
Dietary Habits and Caloric Intake Among Shah Alam Residents Based on Income and Gender

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Abstract. Unhealthy diet is a primary cause of most chronic diseases. Lack of knowledge on healthy dietary habits makes us less productive and more susceptible to chronic diseases regardless of level of income and gender. In this study, a sample of 166 respondents in Shah Alam was taken as the case study. The objectives are to determine whether the respondents tend to practice healthy or unhealthy dietary habits, and to evaluate the differences in daily caloric intake of the respondents based on their monthly income and gender. Descriptive analysis, Chi-square test, analysis of variance, and independent sample t-test were employed to analyze the data. The findings of this study revealed that the large majority of respondents (81.3%) practiced unhealthy dietary habits. Although most Shah Alam residents are well educated, they are less aware of the healthy diet. However, those with high incomes are more likely to practice healthy dietary habits than those with low incomes. This study also found that there were no significant differences in daily caloric intake between male and female respondents.

Keywords: dietary habits, caloric intake, Chi-Square test, analysis of variance, independent sample *t*-test

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ACKNOWLEDGEMENTS

We, the organizing committee of the International Conference on Mathematical Sciences and Technology 2018, would like to extend our heartfelt thanks to the following agencies for their support and contribution:

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