ABSTRACT BOOK

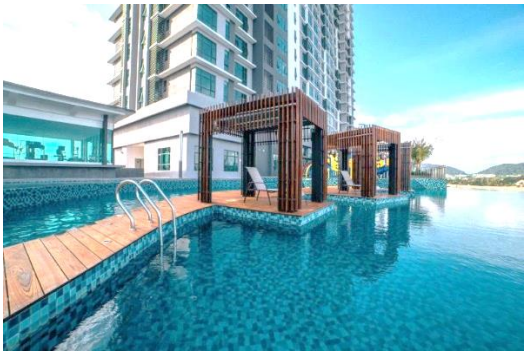
INTERNATIONAL CONFERENCE ON MATHEMATICS: COMPUTATIONAL AND THEORETICAL SCIENCES

ICMCTS 2023

Mathematics for Sustainability

Swiss-Belhotel Kuantan, Pahang,
Malaysia

8th - 10th August 2023



Main Organizer:

ICMCTS 2023

INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA
Garden of Knowledge and Virtue

KULLIYYAH OF SCIENCE

CTS COMPUTATIONAL AND THEORETICAL SCIENCES

DEPT. CTS

Table of Contents

ABSTRACT: PLENARY SPEAKER.. 1

PLENARY SPEAKER 1..... 1

PLENARY SPEAKER 2..... 4

ABSTRACT: INVITED SPEAKER... 5

INVITED SPEAKER 1..... 5

INVITED SPEAKER 2..... 6

ABSTRACT: ONSITE..... 7

ID_02 7

ID_11 8

ID_12 9

ID_16 11

ID_17 12

ID_18 13

ID_19 14

ID_20 15

ID_21 16

ID_22 18

ID_27 20

ID_28 21

ID_31 22

ID_32 23

ID_34 24

ID_35 25

ABSTRACT: VIRTUAL..... 26

ID_01 26

ID_06 27

ID_07 28

ID_08 30

ID_09 31

ID_10 32

ID_23 33

ID_24 34

ID_26 35

ID_30 37

ID_33 38

ID_36 40

ACKNOWLEDGEMENT..... 41

ICMCTS 2023 ORGANIZING COMMITTEES..... 42

ABSTRACT: PLENARY SPEAKER

PLENARY SPEAKER 1

Dynamics of Localized States in Quasi-One-Dimensional Binary Bose-Einstein Condensates Stabilized by Three-Dimensional Lee-Huang-Yang Interactions

Bakhtiyor Baizakov

Physical-Technical Institute, Uzbek Academy of Sciences, 2B, Chingiz Aytmatov str., 100084, Tashkent, Uzbekistan.

Abstract: A brief review of recent developments concerning the localized waves in two-component Bose-Einstein condensates is presented. We consider the repulsive intra-component and attractive inter-component atomic interactions. The existence, stability, and dynamics of symbiotic solitons supported by the system have been investigated. The term "symbiotic" refers to the fact that each component of the vector soliton cannot exist in isolation without the other. The model is based on the system of two coupled quasi-1D Gross-Pitaevskii equations (GPE) supplemented by the Lee-Huang-Yang (LHY) quantum fluctuations term [1, 2]. When the mean-field self-repulsion is nearly balanced by the inter-component attraction stable localized modes emerge which are similar to quantum droplets predicted for strictly one-dimensional binary condensates [3]. The essential difference here is that the quantum fluctuations term in

the strictly one-dimensional model is attractive, while in the present quasi-one-dimensional model, it is repulsive. The former model is governed by a quadratic-cubic GPE, while the latter one - by a cubic-quartic GPE.

For the symmetric case with equal atom numbers and equal self-repulsion coefficients in the components, we develop a variational approach using a super-Gaussian trial function which allows us to estimate the parameters of the localized mode. Once the stable localized state has been created, we perform numerical simulations revealing the dynamic properties of the self-bound modes of the binary condensate by observing their interactions with different external potentials. For the case of imbalanced condensate mixtures, the excitation of density modulations in the majority component induced by the motion of the minority component has been investigated.

Our work distinguishes itself from other relevant publications in two aspects. I. We consider the LHY quantum fluctuations term in the quasi-one-dimensional GPE corresponding to 3D atomic scattering processes whose validity is justified for situations when the radial harmonic oscillator length is much greater than the atomic s-wave scattering length [4, 5]. II. We explore also the particle imbalanced condensate mixtures when the number of atoms in one component is greater than in the other component. The existence of a critical value for the particle number imbalance has been revealed, above which the quantum droplet cannot sustain the greater imbalance and expels the unbound atoms of the majority component to its periphery. The proposed setting can be used to probe the superfluid phenomena in multi-component systems.

The relevance of the proposed mathematical model and selected parameter settings to experimental conditions reported in the literature has been discussed.

Keywords: binary condensate, localized mode, quantum droplet.

References:

[1] T. D. Lee, K. Huang, C. N. Yang, Eigenvalues and eigenfunctions of a bose system of hard spheres and its low temperature properties, Phys. Rev. 106, 1135 (1957).

[2] D. Petrov, Quantum mechanical stabilization of a collapsing bose-bose mixture, Phys. Rev. Lett. 115, 155302 (2015).

[3] G. Astrakharchik, B. A. Malomed, Dynamics of one-dimensional quantum droplets, Phys. Rev. A 98, 013631 (2018).

[4] P. Zin, M. Pylak, T. Wasak, M. Gajda, and Z. Idziaszek, Quantum Bose-Bose droplets at a dimensional crossover, Phys. Rev. A 98, 051603(R) (2018).

[5] T. Ilg, J. Kumlin, L. Santos, D. S. Petrov, and H. P. Buchler, Dimensional crossover for the beyond-mean-field correction in Bose gases, Phys. Rev. A 98, 051604(R) (2018).

PLENARY SPEAKER 2

Understanding Raw Data of Dynamical Systems Via Persistent Homology

Mohd Salmi Md Noorani and Mohd Sabri Ismail

Universiti Kebangsaan Malaysia

Abstract: Given a system evolving with time - a dynamical systems - one can usually measure certain aspects of the system which results in raw data technically known as a time series. One then hopes to better understand the original system by examining this raw data looking for features such as periodicity, quasiperiodicity or even chaos. In this workshop, we shall introduce to the participants the rapidly expanding field of persistent homology as an alternative way to determined the said features. We shall also discuss how persistent homology analyses bifurcations of the system which in turn can be used as a framework to propose for an early warning signals from the raw data. This workshop will have both theoretical and hands-on sessions.

Keywords: Dynamical systems, time series, persistent homology.

ABSTRACT: INVITED SPEAKER

INVITED SPEAKER 1

Classification of Fixed Points of Potts-Bethe Mapping of Degree Four on $\mathbb{Q}_5$

Mohd Ali Khameini Ahmad

Department of Mathematical Sciences, Faculty of Science, Universiti Teknologi Malaysia, 81310 Johor Bahru, Malaysia.

Abstract: The Potts-Bethe mapping is a rational function arises in the study of the Potts model on the Cayley tree (or Bethe lattice). In this article, the Potts-Bethe mapping of degree four is considered over the field of 5-adic numbers. In some regimes (a condition appear in the study of p-adic Potts model), the fixed points are found and their behaviour are classified. It is done by solving some quartic equation over $\mathbb{Q}_5$. Under certain parameters, the behaviour of the trajectories of each point under this mapping is analysed. This is the continuation of the previous work where contraction and chaos are found [1], but here other properties are realized such as minimal.

Keywords: Rational function, Potts model, quartic equation

INVITED SPEAKER 2

A Class of Two-Sex Population Quadratic Stochastic Operators: b-bistochastic-Volterra

Ahmad Fadillah Bin Embong

Department of Mathematical Sciences, Faculty of Science, Universiti Teknologi Malaysia.

Abstract: The focus of this paper is to investigate the simplest non-linear Markov operators which is quadratic one. Study of quadratic stochastic operators (QSOs) is not an easy task as linear operators. Thus, researchers introduced classes of QSOs such as Volterra QSOs, strictly non-Volterra QSOs, Orthogonal preserving QSOs, Centered QSOs etc. However, all the introduced classes were not yet cover the whole set of QSOs. Therefore, we introduce a new class of QSOs, namely b-bistochastic-Volterra QSOs or simply bV-QSOs. In this paper, we describe the canonical form of bV-QSO on two-dimensional simplex. This helps understanding the dynamical behaviours of bV-QSOs.

Keywords: Quadratic operator, Markov operator; b-bistochatic, Volterra, two-sex population.

ABSTRACT: ONSITE

ID_02

Zeros of Partition Function For Z_5-Symmetric Models on Square Lattice – Special Case

Siti Fatimah Zakaria[1, b)] and Nik Aizad Nik Hasmi[1, a)]

[1] *Dynamical Systems and Their Applications Research Unit, Department of Computational and Theoretical Sciences, Kulliyyah of Science, International Islamic University Malaysia, 25200, Kuantan, Pahang Darul Makmur, Malaysia.*

[a)]Corresponding author: n.aizad99@g.mail.com
[b)]fatimahsfz@iium.edu.my

Abstract: We study a statistical mechanics model of multiple phase transition called the Z_5-symmetric model on the square lattice for five possible spin directions ($Q = 5$). Our study aims to investigate the existence of phase transition(s) and discuss the distribution of zeros of partition function on the complex-temperature plane. A special case of energy list χ will be considered where it is written in arbitrary arrangement of integer numbers (usually in decreasing value due to angle of separation). The partition functions are computed using the transfer matrix approach and their zeros are found numerically by using the Newton-Raphson method. A Monte-Carlo simulation will be also considered to study the phase transition point. The results are then compared to the previous cases.

Keywords: Z_Q-symmetric models, partition function, multiple phase transitions, critical point, specific heat.

ABSTRACT: ONSITE

ID_11

Dynamics on 3-Dimensional Lattice

Mohamad Hanif Saleh[1,a)] and Wan Nur Fairuz Alwani Wan Rozali[2,b)]

[1, 2] *Dynamical Systems and Their Application (DSTA) Research Unit, Department of Computational and Theoretical Sciences, Kulliyyah of Science, International Islamic University Malaysia, Bandar Indera Mahkota, 25200, Kuantan Campus, Kuantan, Pahang, Malaysia.*

[a)]Corresponding author: han0110if@gmail.com
[b)]fairuz_wnfawr@iium.edu.my

Abstract: The study of resonances of Hamiltonian systems with a divided phase space is a well-established area of research which attracted the interests of many researchers over the years. One can study such resonances over a discrete space. This project focuses on the rotational motion of the orbits in the 3-Dimensional lattice, $\mathbb{Z}^3$. We construct discrete maps from 2-Dimensional to 3- Dimensional. Then, we specify which transformation that gives periodicity and non-periodicity of the 3-Dimensional on a specific map. On a specific value of initial conditions and parameter alpha and beta, the orbit of the 3-Dimensional map is periodic while the rest are non-periodic. Some observations on the reduction from 3-Dimensional map to 2-Dimensional map are investigated analytically in this paper.

Keywords: Non-linear Resonances, Arithmetic Dynamics, Rotations in a 3-Dimensional Lattice

ABSTRACT: ONSITE

ID_12

The Effects of Impurities on Discrete Nonlinear Schrödinger Equation

Anis Sulaikha Samiun[1, a)], Nor Amirah Busul Aklan[2, b)] and Bakhram Umarov[3, c)]

[1,2]*Department of Computational and Theoretical Sciences, Faculty of Science, International Islamic University Malaysia, 25200 Kuantan, Pahang, Malaysia.*
[3]*Physical-Technical Institute of the Uzbek Academy of Sciences, 2-b, Bodomzor str., 100084, Tashkent, Uzbekistan.*

[a)]anissamiun@gmail.com
[b)]noramirah@iium.edu.my
[c)]bakhram25@gmail.com

Abstract: Understanding the effect that impurities may have on the soliton propagation process, particularly during the interaction process, has become a major research focus in recent years. One common mathematical framework used to study this phenomenon is the continuous system of the Nonlinear Schrödinger Equation (NLSE), which is widely recognized as a universal model that is capable of describing soliton behaviours as they interact with external impurities, i.e., external potentials in the presence of nonlinearity. This paper is going to study the phenomenon of soliton scattering when it interacts with a localized impurity of the Delta potential in the discrete case of NLSE. Using an analytical approach, i.e., the variational approximation (VA) method, we derive the equations of soliton parameters for width and center-of-mass position in order to describe the soliton evolutions throughout the scattering process. The VA method results can be validated by direct numerical simulation of Discrete NLSE, provided that the soliton is initially set far from the Delta potential. When the nonlinearity is of the cubic and quintic types, it is shown that the soliton of the Cubic-Quintic Discrete NLSE can exhibit a range of interesting behaviours in which it can be either destroyed, splitted, reflected, or transmitted by the Delta potential based on the different values of the soliton's critical velocity and potential strengths. The results suggest that the VA method is an

effective and useful approach to investigating the scattering process of Discrete NLSE on impurities.

Keywords: Soliton, nonlinear Schrödinger equation, nonlinear equations, discrete systems, partial differential equations.

ABSTRACT: ONSITE

ID_16

MHD Mixed Convective Flow of Power-law Buongiorno's Nanofluid in a Lid-driven Cavity with Solid Triangular Block in the Presence of Heat Generation/Absorption and Chemical Reaction Effects

Nor Raihan Mohamad Asimoni[1, a)], Sharidan Shafie[2, b)] and Amir Farhan Mohammad Zamri[1]

[1]*Department of Computational and Theoretical Sciences, Kulliyyah of Science, International Islamic University Malaysia, 25200 Kuantan, Pahang, Malaysia.*
[2]*Department of Mathematical Sciences, Faculty of Science, Universiti Teknologi Malaysia, 81310 UTM Johor Bahru, Johor, Malaysia.*

[a)]Corresponding author: raihanasimoni@iium.edu.my
[b)]sharidan@utm.edu.my

Abstract: In this paper, steady two-dimensional magnetohydrodynamics mixed convective flow of power-law nanofluid using Buongiorno's model with the influence of heat generation/absorption and chemical reaction is studied. The flow is examined in a cavity with a moving top wall containing isothermal solid triangular block at the center. The governing dimensional equations in a vector form are transformed into non-dimensional form. Then, the dimensionless equations are solved numerically by finite element method (FEM) using automated solution technique which is FEniCS. The effects of various parameters on velocity, temperature, and concentration profiles are presented and discussed.

Keywords: MHD, power-law nanofluid, cavity, Buongiorno, FEniCS.

ABSTRACT: ONSITE

ID_17

New Poisson Quadratic Stochastic Operator Generated by 2-Partition

Nur Alis Aqeelah Mohd Fadzullah[1, b)] and Nur Zatul Akmar Hamzah[1, 2, a)]

[1]*Department of Computational and Theoretical Sciences, Faculty of Science, International Islamic University Malaysia, Bandar Indera Mahkota, 25200, Kuantan, Pahang, Malaysia.*
[2]*Dynamical Systems and Their Applications Unit, Kulliyyah of Science, International Islamic University Malaysia, Bandar Indera Mahkota, Kuantan, Pahang, Malaysia.*

[a)]Corresponding author: zatulakmar@iium.edu.my
[b)]nuralisaqeelah2908@gmail.com

Abstract: The theory of quadratic stochastic operator (QSO) has been introduced by Bernstein in 1924 when he presented about population genetics. The research on QSO is still ongoing as there are various classes, conditions and measures that have not yet been studied by researchers. In this paper, we introduce a new class of Poisson QSO generated by 2-partition defined on set of all integers state space. We illustrate trajectory behaviour of the constructed QSO by cases. Lastly, we show that it is a regular transformation for some values of parameters.

Keywords: Quadratic stochastic operator, Poisson distribution, set of all integers, regular transformation.

Acknowledgment: This research was funded by FRGS grant from the Ministry of Education Malaysia, project code FRGS/1/2021/STG06/UIAM/02/1 with project ID FRGS21-219-0828.

ABSTRACT: ONSITE

ID_18

On Lebesgue Quadratic Stochastic Operators with Exponential Measure Generated by 3-Partition

Siti Nurlaili Karim[1, b)] Nur Zatul Akmar Hamzah[2, 3 a)]

[1]*Department of Computer Science, Faculty of Information and Communication Technology, Universiti Tunku Abdul Rahman, Jalan Universiti, Bandar Barat, 31900 Kampar, Perak, Malaysia.*
[2]*Department of Computational and Theoretical Sciences, Faculty of Science, International Islamic University Malaysia, Bandar Indera Mahkota, 25200, Kuantan, Pahang, Malaysia.*
[3]*Dynamical Systems and Their Applications Unit, Kulliyyah of Science, International Islamic University Malaysia, Bandar Indera Mahkota, Kuantan, Pahang, Malaysia.*

[a)]Corresponding author: zatulakmar@iium.edu.my
[b)]nurlaili@utar.edu.my

Abstract: Quadratic stochastic operator (QSO) is a continuously expanding topic in nonlinear operator theory due to its immense applications in various disciplines. Inspired by the notion of infinite state space as there is limited literature on the study of QSO defined on such state space, in this paper, we consider a class of QSO on continuous state space, called Lebesgue QSO with exponential measure generated by three measurable partitions with three parameters. We define two different cases of three parameters which represent by a reducible QSO. We demonstrate that such a reducible QSO can be reduced to a one-dimensional setting. Then, we analyze the dynamics of such operators by employing the Jacobian matrix method and show that the operators may have either an attracting fixed point to indicate the existence of a strong limit or a non-attracting fixed point to suggest the presence of a cycle of second-order. Corresponding to the existence of a strong limit of the sequence of the reduced QSO, such operator is a regular transformation. Meanwhile, such operator is a nonregular transformation when a second-order cycle exists.

Keywords: Quadratic stochastic operator, continuous state space, measurable partitions.

ABSTRACT: ONSITE

ID_19

Sustainable COVID-19 Control Measures: A Math Modelling Study

Amer M. Salman[a] and Mohd Hafiz Mohd[b]

School of Mathematical Sciences, Universiti Sains Malaysia, 11800 USM, Penang, Malaysia.

[a]Corresponding author: amer.zaidi96@gmail.com
[b]mohdhafizmohd@usm.my

Abstract: Mathematical modelling techniques have become essential in predicting the consequences of viral diseases outbreak and in planning sustainable preventative measures to curb their transmission dynamics. To better understand the sustainable evolution of the control measures' impacts of the COVID-19 transmissions, a reaction-diffusion system is employed to describe the epidemiological phenomenon through two processes: (i) a reaction process of SEIRS- type (Susceptible, Exposed, Infected, Recovered, and Susceptible) kinetics; (ii) a diffusion process that models local dispersal of individuals through spatial locations. Optimal control theory and numerical simulation studies are performed to examine the combined effects of reinfection, spatial dispersal process, and distinct control measures on the severity of the outbreaks. The insights from these modelling studies are beneficial to different stakeholders e.g., public health practitioners and policymakers in devising sustainable COVID-19 management plans in the preparation for endemicity and dealing with large-scale disease outbreaks in the future.

Keywords: Sustainability, optimal control, Covid-19, epidemiological modelling, numerical simulation.

ABSTRACT: ONSITE

ID_20

Analysis of Changes in Total Actuarial Liabilities using Projected Unit Credit Method

Rose Irnawaty Ibrahim[1, a)] and Ain Nurafifah Amran[2, b)]

[1, 2]*Faculty of Science and Technology, Universiti Sains Islam Malaysia, 71800 Nilai, Negeri Sembilan, Malaysia.*

[a)]Corresponding author: rose.irnawaty@usim.edu.my
[b)]ainnurafifah@raudah.usim.edu.my

Abstract: Malaysia is projected to become an ageing country by the year 2030 with the increase in population of older people to be over 15.3%. It is affecting the government expenditure in the sustainably of providing retirement benefits to older people. This study will analyse the changes of actuarial assumptions in total actuarial liabilities of a specific group of government employees. A data set is collected from a group of government employees in a Malaysian public university under service grade of N (Administration & Support). The total actuarial liability will be calculated using the Projected Unit Credit method and actuarial assumptions such as the retirement age, mortality rate, interest rate and salary growth rate will be considered. The study found that when the retirement age is increased, the total actuarial liabilities would decrease which is the aim of a sustainable pension system. Meanwhile, the decreasing mortality rate due to population ageing will cause the total actuarial liabilities to increase. Lastly, when interest rate is high and salary growth rate is lowered, the pension system is getting better. In conclusion, it is necessary for Malaysian government to take early action to sustain the Malaysian pension system due to the occurring population ageing.

Keywords: Actuarial liabilities, projected unit credit, pension, poulation ageing.

ABSTRACT: ONSITE

ID_21

Estimating Optimal Resource Allocation in Inpatient Department Using Simulation and Data Envelopment Analysis

Nur Fatini Binti Rasidi[1, a)], Nazhatul Sahima Mohd Yusoff[2, b)], Adibah Shuib[3, c)] and Abd Yazid Md Noh[4, d)]

[1]*Faculty of Computer and Mathematical Sciences, Universiti Teknologi MARA (UiTM) Kelantan Branch, Kota Bharu Campus, Lembah Seri, 15050 Kota Bharu, Kelantan Darul Naim, Malaysia.*
[2]*Faculty of Computer and Mathematical Sciences, Universiti Teknologi MARA (UiTM) Kelantan Branch, Machang Campus, Bukit Ilmu, 18500 Machang, Kelantan Darul Naim, Malaysia.*
[3]*Faculty of Computer and Mathematical Sciences, Universiti Teknologi MARA (UiTM) Selangor Branch, Shah Alam Campus, Jalan Ilmu, 40450 Shah Alam, Selangor, Malaysia.*
[4]*Emergency Department, Hospital Universiti Sains Malaysia (HUSM), Jalan Raja Perempuan Zainab 2, 16150 Kota Bharu, Kelantan Darul Naim, Malaysia.*

[a)]Corresponding author: fatini.rasidi9898@gmail.com
[b)]nazha237@uitm.edu.my
[c)]adibah@fskm.uitm.edu.my
[d)]abuyazid@usm.my

Abstract: Ward 7 Utara is one of the important inpatient departments at Universiti Sains Malaysia Hospital (HUSM). Ward 7 Utara encounters problems as it wrestles with patients' long waiting periods, and the shortage of nurses and beds in the management of patients. This study used the hybrid method of combining the Discrete Event Simulation (DES) and the Data Envelopment Analysis (DEA) model such as the Bi-Objective MCDEA BCC model and the Cross-Efficiency model to determine the most effective resource allocation for the current improvement in the inpatient department. The result of the simulation model has shown that the utilization of nurses and beds is relatively higher and the waiting times for patients to get their first checkup are too long. The findings of the research show the number of nurses used in the ward increased from 16 to 18, and the number of beds also increased from 36 to 38. The waiting time for patients to get their first checkup has been reduced to under 15 minutes. Lastly,

the optimum resource identified will enhance the quality of nurses, beds, and the flow of patients in the ward to meet the Key Performance Indicators (KPI) of HUSM.

Keywords: Discrete Event Simulation, Data Envelopment Analysis, Bi-Objective BCC MCDEA, Cross-Efficiency.

ABSTRACT: ONSITE

ID_22

Impact of Jigsaw IV Cooperative Learning Approach on Students' Academic Performance in Learning Mathematics: A Case Study of Hassan Usman Katsina Polytechnic, Katsina – Nigeria

Ibrahim Musa Ahmad[1, a)]

[1]*Department of Mathematics and Statistics College of Science and Technology Hassan Usman Katsina Polytechnic, Katsina.*

[a)]ibrahim.musaahmad88@gmail.com

Abstract: This study will investigate the Impact of Jigsaw IV cooperative learning approach on students' performance in learning Mathematics at Hassan Usman Katsina Polytechnic, Katsina state, Nigeria. In this study, background of the study and statement of the problem would be stated, two (2) objectives are going to be set, two (2) research questions are going to be raised and also, two (2) hypotheses would be formulated. Significance of the study, Justification of the study and scope of the study would also be stated. Review of related literature of the study would also be discussed. The research design to be adopted for this study is quasi-experimental research design, which comprised of two groups, one experimental and control groups respectively. There are 4,043 Year I students in Hassan Usman Katsina Polytechnic. Two (2) classes of 50 students each (one representing experimental group and the other one representing control group) will be selected from each school randomly. Therefore, the total sample for the study is 100 students with 50 students in the experimental group and 50 in the control group. Geometry Performance Test would be used as an instrument for collecting data. The instrument would be given to experts in Mathematics Education for validation. The reliability coefficient of the instrument will be determined using Split-half

method. The software that will be used for data analysis will be the Statistical Package for Social Sciences (SPSS).

Keywords: Jigsaw iv, cooperative learning, performance, learning, mathematics.

ABSTRACT: ONSITE

ID_27

Load-Based Constructive Heuristics for a Greener Solution of Vehicle Routing Problem

Muhammad Syarif Ghazali[1] and Norfaieqah Ahmad[1, a)]

[1]*Department of Computational and Theoretical Sciences, Kulliyyah of Science, International Islamic University Malaysia, Jalan Sultan Ahmad Shah, Bandar Indera Mahkota, 25200 Kuantan, Pahang, Malaysia.*

[a)]Corresponding author: norfaieqah@iium.edu.my

Abstract: Rising environmental concerns about transportation activities call for sustainable transport actions to be regulated in enhancing economic growth and improving accessibility. Vehicle routing problems are widely used in transportation planning. This problem could be enriched by the incorporation of terms related to fuel consumption to meet environmental issues. The main aim of this study is to adapt the load factor in the existing capacitated vehicle routing problem model to integrate the economic benefit of lowering the environmental cost through fuel consumption and CO2 minimization. The constructive heuristics namely, the nearest neighbour and the farthest insertion algorithms are modified to include the load factor in generating feasible and high-quality solutions that will impact the environment. To evaluate the effectiveness of the algorithms, computational tests are conducted using the benchmark instances of the problem. The results demonstrate that the proposed algorithms are competitive with the existing state-of-the-art algorithms in terms of solution quality and computation time.

Keywords: Green vehicle routing problem, constructive heuristics, load factor.

ABSTRACT: ONSITE

ID_28

Non-ergodic Lotka-Volterra Operator Defined on 2 Dimensional Simplex

C. H. Pah[1, a)] and Azizi Rosli[1, b)]

[1]*Department of Computational and Theoretical Sciences, Kulliyyah of Science, International Islamic University Malaysia, 25200 Kuantan, Pahang, Malaysia.*

[a)]pahchinhee@iium.edu.my
[b)]Corresponding author: azizi.rosli@live.iium.edu.my

Abstract: In the present paper, we study the dynamical systems generated by a class of Lotka-Volterra operator acting on 2-dimensional simplex. We found that such class of operator has a unique interior fixed point at the centre of the simplex. A Lyapunov function is then constructed and proved to study the asymptotic behaviour of the given operator. We show that the ω-limit set of its trajectories is infinite and lies at the boundary of the 2-dimensional simplex. A description of the path taken by the trajectories is given, and it is also proved that such class of operator has non-ergodic property, i.e. the time averages of its trajectories does not converge.

Keywords: Lotka-Volterra, non-ergodic, simplex, stochastic operator.

ABSTRACT: ONSITE

ID_31

Dynamic Modelling for Assessing the Impact of Marine Debris on the Population of Sea Turtles

Ummu Atiqah Mohd Roslan[1, 2, a)], Fatimah Noor Harun[1, b)] and Azwani Alias[1, c)]

[1]*Special Interest Group on Modelling and Data Analytics, Faculty of Ocean Engineering Technology and Informatics, Universiti Malaysia Terengganu, 21030 Kuala Nerus, Terengganu, Terengganu, Malaysia.*
[2]*Associate Research Fellow, Institute of Oceanography and Environment, Universiti Malaysia Terengganu, 21030 Kuala Nerus, Terengganu, Malaysia.*

[a)]Corresponding author: ummuatiqah@umt.edu.my
[b)]fnoor_hh@umt.edu.my
[c)]azwani.alias@umt.edu.my

Abstract: Marine debris has significant impacts on marine animals including the sea turtles, which are particularly vulnerable to the presence of waste in the marine environment. We propose a novel mathematical model with three compartments to examine this effect: the sea turtle population, the amount of marine debris inside sea turtles, and the amount of marine debris in the surrounding water. We locate the equilibrium points (also known as equilibria) for the suggested model and perform an analytical check on their stability. We also use the bifurcation analysis to examine how changing a model parameter affects the stability of the model's equilibria. Our findings demonstrated the existence of two equilibria: the sea turtles' survival equilibrium and their extinction equilibrium. The eigenvalues of the Jacobian matrix applied to the proposed model have been used to demonstrate the conditions for stability of these equilibria. The resulting bifurcation diagram demonstrates that both equilibrium points experience a transcritical bifurcation. The findings of this study can help local or national governments make decisions and educate the public about sea turtle conservation in order to sustain sea turtle populations in the future.

Keywords: Dynamics model, sea turtle, marine debris, stability, bifurcation.

ABSTRACT: ONSITE

ID_32

Compactons in Spin-Orbit Coupled Nonlinear Schrödinger Lattices with Strong Nonlinearity Management

Lukhman Abdul Taib[1, a)], Muhammad Salihi Abdul Hadi[1, b)] and Bakhram Umarov[2, c)]

[1]*Department of Computational and Theoretical Sciences, Kulliyyah of Science, International Islamic University Malaysia, 25200 Kuantan, Pahang DM, Malaysia*
[2]*Physical-Technical Institute, Uzbekistan Academy of Sciences, Tashkent, Bodomzor yuli, 2-b, Uzbekistan*

[a)]Corresponding author: lukhmantaib@yahoo.com
[b)]salihi@iium.edu.my
[c)]bakhram25@gmail.com

Abstract: We demonstrate the existence of compactons in two-component discrete nonlinear Schrödinger (DNLS) equations with spin-orbit coupling (SOC) in the presence of fast periodic time modulations of the interspecies scattering length. We consider the inter-SOC case and focus on the effect of Zeeman splitting term on the existence conditions and stability of the compactons. The stability of SOC-compactons is investigated both by linear stability analysis and direct numerical integrations of DNLS equations.

Keywords: Discrete nonlinear Schrödinger equation, spin-orbit coupling, compactons, nonlinearity management.

ABSTRACT: ONSITE

ID_34

Joule Heating, Thermal Radiation and Slip Effects on Magnetohydrodynamic Flow and Heat Transfer over an Exponentially Stretching/Shrinking Sheet in Ferrofluids

Norshafira Ramli[1, a)], Ahmad Syakir Mohd Shafri[2, b)] and Nur Syazana Rosly[3, c)]

[1]*School of Mathematical Sciences, Universiti Sains Malaysia, 11800 USM, Penang.*
[2]*Department of Mathematics, Faculty of Science, Universiti Teknologi Malaysia, 81310, Johor Bahru, Johor.*
[3]*Centre of Foundation Studies, Universiti Teknologi MARA, Selangor Branch, Dengkil Campus, 43800, Selangor.*

[a)]Corresponding author: norshafiraramli@usm.my
[b)]ahmad.syakir@graduate.utm.my
[c)]syazanarosly@uitm.edu.my

Abstract: This study aims to investigate the steady two-dimensional MHD flow and heat transfer of ferrofluids over an exponentially stretching/shrinking sheet along with Joule heating, thermal radiation and slip effects. The governing partial differential equations are altered to a set of nonlinear ordinary differential equations by applying a similarity transformation, before being unraveled numerically by the shooting method. The effects of some pertinent parameters such as magnetic, radiation, mass transfer and stretching/shrinking parameters with the Eckert number on the common skin friction coefficient, local Nusselt number, velocity and temperature profiles are analysed via graphs and tables. There exist nonunique solutions (dual solutions) in a specific range of the stretching/shrinking parameter values. The numerical results indicate that the rate of heat transfer reduces with the increment of magnetic and radiation parameters, while it increases by raising the mass transfer and slip parameters.

Keywords: Ferrofluids, magnetohydrodynamic, exponentially stretching/shrinking, Joule heating, thermal radiation.

ABSTRACT: ONSITE

ID_35

Mixed Convection in a Double Lid-driven Square Cavity Filled with Hybrid Nanofluid in the Presence of Magnetic Field and Sinusoidal Heating

Amin, A. Z. M.[1, a)], Roslan, R.[1, b)] and Bakar, N. A.[2, c)]

[1]*Department of Mathematics and Statistics, Faculty of Applied Sciences and Technology, Pagoh, 84600 Muar, Johor, Malaysia.*
[2]*Department of Science and Mathematics, Centre for Diploma Studies, Universiti Tun Hussein Onn Malaysia, Pagoh, 84600 Muar, Johor, Malaysia.*

[a)]azmamin87@gmail.com
[b)]rozaini@uthm.edu.my
[c)]Corresponding author: norhaliza@uthm.edu.my

Abstract: Studies on the effects of mixed convection heat transfer, especially on energy consumption and a variety of engineering equipment, are crucial to understanding the process. In this research, the hybrid nanofluid is filled within a double lid-driven square cavity in the presence of a magnetic field, and the heat transfer and mixed convection fluid flow are studied. The top wall is heated sinusoidally, while cold temperatures are applied to the bottom wall. Side walls are handled adiabatically. The mathematical modeling is developed and solved by the finite volume method (FVM) together with the SIMPLE algorithm. Investigations have been done to determine how the hybrid nanoparticle volume fractions, directions of moving lids, and Hartmann number (*Ha*) affect the flow field while the Richardson number is kept at $\mathrm{Ri} = 1.0$. The results are graphically displayed in the form of streamlines and isotherms. The results show that the nanoparticle fraction, the direction of moving lids, and *Ha* have significant effects on the fluid flow and heat transfer processes.

Keywords: FVM, mixed convection, hybrid nanofluid, square cavity, magnetic field.

ABSTRACT: VIRTUAL

ID_01

GIS-based Trend Analysis on Renewable Energy Production and Consumption in Africa

Alhaji Abdullahi Gwani[1, a)] and Siok Kun Sek[2, b)]

[1,2]*Department of Statistics, School of Mathematical Sciences, Universiti Sains Malaysia, Penang, 11800 Malaysia.*
[1]*Department of Mathematical Sciences, Bauchi State University Gadau, Bauchi State, 751105 Nigeria.*

[a)]Corresponding author: aagwani@student.usm.my
[b)]sksek@usm.my

Abstract: In Africa, there is an increase in human activities because of technological advancements and population growth, which have led to the transformation of African villages into towns and towns into cities, increasing the region's energy demand. Adopting innovative and appropriate renewable energy technology is one of the most essential solutions to Africa's rising energy demand. Using GIS-based analysis, we will investigate the trend and transition of renewable energy production and consumption in Africa. A tool called phyton libraries was used to wrangle and explore the African country-level geodata obtained from various international data sources between 1960 and 2020 for the region's energy geospatial awareness. We observed that the production and consumption of renewable energy shifted from some central areas to decentralized subareas in Africa, which signifies growth in both sections. We sorted the 15 most productive countries and the 15 most consumed countries and initiated mapping between these countries. The results show gaps between the energy consumed and that produced in many instances. We recommend further research, as GIS statistical analysis still needs more attention in statistics.

Keywords: GIS, trend, renewable energy, consumption, production, transition.

ABSTRACT: VIRTUAL

ID_06

Examining the Effectiveness of Monetary Policy in Asia4: The pre- and post-crisis 1997 Analysis

Rong Wei Soon[1, a)] Yi Xuan Tan[1, b)], Siok Kun Sek[1, c)], and Khang Yi Sim[1, d)]

[1]*School of Mathematical Sciences, Universiti Sains Malaysia, 11800 Minden, Penang, Malaysia.*

[a)]edwardsoon0625@gmail.com
[b)]tyxusm@gmail.com
[c)]Corresponding author: sksek@usm.my
[d)]khangzyisim@gmail.com

Abstract: One of the main changes experienced by Asia countries due to the hit of 1997 Asian financial crisis is the shift in the monetary policy to inflation targeting and the released from rigid exchange rate to flexible exchange rate regime. This study is focused on four main Asia countries (Indonesia, Korea, Philippines, and Thailand) that experienced such monetary policy changes. The main objectives is to evaluate the effectiveness of monetary policy in Asia4 before and after the shift in the monetary policy. This study also seeks to examine the behavior of economic variables (output growth and inflation) in response to the monetary policy stances between the two regimes. The study applies the data ranging from Jan 1990 to Dec 1996 (pre-crisis period) and July 1999 to Dec 2020 (post-crisis period). A structural vector autoregressive (SVAR) model is applied in examining the performance of monetary policy using the two sub-periods of data. The results reveal new insights about the influences of monetary policy on macroeconomic variables. The results provide useful information for the policymaker in policy decision-making and economic planning.

Keywords: Monetary policy, Asian financial crisis, inflation, impulse shocks, exchange rate.

ABSTRACT: VIRTUAL

ID_07

GIS-Based and Geospatial Analysis: Mapping and Visualizing the Trend of Covid-19 Data in Asia

Jium Guan Wong[1, a)], Min Jun Lim[1, b)], Siok Kun Sek[1, c)], and Khang Yi Sim[1, d)]

[1]*School of Mathematical Sciences, Universiti Sains Malaysia, 11800 Minden, Penang, Malaysia.*

[a)]wongjiunguan@student.usm.my
[b)]minjunlim@student.usm.my
[c)]Corresponding author: sksek@usm.my
[d)]khangzyisim@gmail.com

Abstract: The outbreak of Covid-19 has caused many losses, unprecedented threats and the change of life in many ways. The daily records of cases and other related data contain important information to reflect the severity, trend and risk level of each country over time. Thus, this study aims to examine the trend, severity and the change of pandemic situation in Asia under five periods. In this study, the data are collected from 48 Asia countries. The five periods are selected to represent different stages of outbreak, which are based on the daily records for comparisons. The five periods are 6th January 2020, 6th July 2020, 6th January 2021, 6th July 2021 and 6th June 2022. The data include the daily record of confirmed cases, number of death, number of vaccination and number of recovery. Besides, this study also examines the accumulated cases up to 6th July 2022. The accumulated data include the four data mentioned and the severity index. The Local Indicators of Spatial Association (LISA) is applied to detect the clustering pattern and hotspots area as well as the existence of spatial effect in the data. The GIS mapping reveal the most severe condition in Period 1 was China. However, the pandemic is spreading rapidly and broadly around Asian region from Period 2 to Period 4. The severe condition (high fatality, confirmed cases and vaccination) is clustering around West Asia and Southeast Asia. Nevertheless, the condition is getting better in Period 5, except China.

Keywords: Covid-19, GIS, spatial effect, clustering, Asia, severity.

ABSTRACT: VIRTUAL

ID_08

Impact Analysis of the Malaysia's Economy on the Palm Oil Stock Returns in Malaysia, Singapore and Indonesia Through NARDL Model

Beh Woan-Lin[1, a)] and Tok Hui-Mei[1, b)]

[1]*Faculty of Science, Universiti Tunku Abdul Rahman, 31900 Kampar, Perak, Malaysia.*

[a)]Corresponding author: behwl@utar.edu.my
[b)]u7671484@gmail.com

Abstract: The palm oil industry has a significant impact on the global economy, and palm oil companies' stock returns are subject to various macroeconomic factors. Therefore, this study examines the impact of Malaysia's economic conditions, such as gold prices, crude oil prices, palm oil prices, and exports, as well as other macroeconomic variables like inflation and exchange rates, on the returns of the palm oil stock index, which includes stocks from Malaysia, Singapore, and Indonesia. This study also seeks to develop a predictive model that can accurately forecast future palm oil stock returns based in the significant macroeconomic factors. Non-Linear Autoregressive Distributed Lag (NARDL) model is proposed to analysis the linkage between the factors mentioned and stock index return. Monthly data collected from January 2012 to April 2022 revealed that the stock index return is indeed influenced by the price of crude oil price, gold price, the inflation rate and exchange rate. As a result, it demonstrates that the palm oil industry is volatile as it may be affected by fluctuations in other industries such as gold and crude oil. In conclusion, when developing investment strategies, investors and stakeholders should consider not changes in the palm oil industry but also the overall state of Malaysia's economy.

Keywords: Nonlinear ARDL, palm oil stock index returns, Malaysia, gold, crude oil.

ABSTRACT: VIRTUAL

ID_09

Predicting Haze Phenomenon using Chaos Theory

Hazlina Darman[1, a)] and Nor Zila Abd Hamid[1, b)]

[1]*Universiti Pendidikan Sultan Idris*

[a)]hazlinadarman@gmail.com
[b)]nor.zila@fsmt.upsi.edu.my

Abstract: Predicting the occurrence of haze is of great importance due to its negative impact on human health, the environment, and the economy. This study aims to develop a model for predicting haze using chaos theory. The data taken from an industrial area, Perai, Pulau Pinang during southwest monsoon. The model is trained using historical data on haze occurrences and atmospheric parameters, and the accuracy of the prediction is evaluated using a testing dataset. Three models of chaos, namely local mean approximation method (LMAM), local linear approximation method (LLAM), and improved local linear approximation method (ILLAM) will be used to predict the haze phenomenon. Results of these three methods will be compared to determine which model gives better performance. Results show that the chaos-based approach is effective in forecasting the onset and duration of haze events. The predicting model can provide early warnings for policymakers and relevant authorities, enabling them to take proactive measures to mitigate the effects of haze on public health and the environment. The model also presents a promising alternative to traditional forecasting techniques and highlights the potential of chaos theory in atmospheric science.

Keywords: Forecasting, haze, chaotic approach, Cao method, Sustainability Development Goals.

ABSTRACT: VIRTUAL

ID_10

Performance Comparison of Haze Prediction using Chaos Theory and Multiple Linear Regression

Hazlina Darman[1, a)] and Nor Zila Abd Hamid[1, b)]

[1]*Universiti Pendidikan Sultan Idris*

[a)]hazlinadarman@gmail.com
[b)]nor.zila@fsmt.upsi.edu.my

Abstract: Predicting haze is crucial for protecting public health, the environment, and the economy. It helps authorities take proactive measures to mitigate the negative impact of haze events and increase the resilience of communities to the effects of air pollution. This study aims to develop a model for predicting haze using two methods, namely chaotic approach and multiple linear regression. Chaotic approach trained using historical data on haze occurrences and atmospheric parameter, and the accuracy of the prediction is evaluated using a testing dataset. Meanwhile, multiple linear regression method use several independent variables; ambient temperature, wind speed, ozone, nitrogen dioxide, and sulfur dioxide to predict the haze. This method can also be used to identify the predictors that have the most significant impact on haze levels. In this study, data will be taken from an industrial area, Ipoh, Perak during southwest monsoon. Results of these two models will be compared to determine which model gives better performance. With this predictive models, policymakers and relevant authorities can receive timely alerts, allowing them to implement preventive measures that can reduce the impact of haze on public health and the environment.

Keywords: Forecasting, haze, chaotic approach, multiple linear regression, Sustainability Development Goals

ABSTRACT: VIRTUAL

ID_23

Subclasses of Analytic Functions of Complex Order with Application of q-Derivative Operator

Aini Janteng[1, a)], Desmond Lee Ching Yiing[2, b)] Yong Enn Lun[1, c)], Jaludin Janteng[3,d)], Lee See Keong[4, e)], Rashidah Omar[5, f)], and Andy Liew Pik Hern[1,g)]

[1]*Universiti Malaysia Sabah Faculty of Science and Natural Resources Universiti Malaysia Sabah, 88400 Kota Kinabalu, Sabah, Malaysia*
[2]*Universiti Teknologi Malaysia Faculty of Science Faculty of Science, Universiti Teknologi Malaysia, 81310 Johor Bahru, Johor, Malaysia.*
[3]*Universiti Malaysia Sabah Labuan Faculty of International Finance Universiti Malaysia Sabah, 88400 Kota Kinabalu, Sabah, Malaysia.*
[4]*Universiti Sains Malaysia School of Mathematical Sciences Universiti Sains Malaysia, 11800 USM, Penang, Malaysia.*
[5]*Universiti Teknologi Mara Cawangan Sabah Faculty of Computer and Mathematical Sciences Universiti Teknologi Mara Cawangan Sabah, 88997 Kota Kinabalu, Sabah, Malaysia.*

[a)]Corresponding author: aini_jg@ums.edu.my
[b)]desmondleeching@graduate.utm.my
[c)]yongel@ums.edu.my
[d)]jaludin@ums.edu.my
[e)]sklee@usm.my
[f)]rashidaho@uitm.edu.my
[g)]andyliew1992@yahoo.com

Abstract: In this article, we represent A to be the class of analytic functions in the open unit disk. Further, we generate new subclasses of analytic functions of complex order utilising q-derivative operator. The subclasses are symbolized by $H_{q,b}(\varphi)$ and $I_{q,b}(\varphi)$. Additionally, we discover the Fekete-Szegö inequalities for these classes of functions.

Keywords: Analytic, q-derivative operator, Fekete-Szegö Inequality.

ABSTRACT: VIRTUAL

ID_24

A Subclass of Bi-univalent Functions by Applying Sălăgean q-Differential Operator

Aini Janteng[1, a)] and Dayana Chang[1, b)]

[1]*Faculty of Science and Natural Resources, Universiti Malaysia Sabah, 88400 Kota Kinabalu, Sabah, Malaysia*

[a)]Corresponding author: aini_jg@ums.edu.my
[b)]dayanachang123@gmail.com

Abstract: Throughout this study, we propose a new subclass of bi-univalent functions by applying Sălăgean q-differential operator and denoted as $\mathcal{L}\sum_q^k(\lambda,\phi)$. Further, we acquired the values of the initial coefficients $|a_2|$ and $|a_3|$ for functions $f \in \mathcal{L}\sum_q^k(\lambda,\phi)$ which yield to this study's preliminary result. Subsequently, the preliminary result was applied to obtain the upper bound of Fekete-Szegö inequality, $|a_3 - \rho a_2^2|$ for functions $f \in \mathcal{L}\sum_q^k(\lambda,\phi)$.

Keywords: Fekete-Szegö inequality, bi-univalent functions, Sălăgean q-differential operator.

ABSTRACT: VIRTUAL

ID_26

Non-ergodic Quadratic Stochastic Operators with Countable State Space

Nasir Ganikhodjaev[1, a)], Obidjon Anorov[2,b)], and Pah Chin Hee[3, c)]

[1]*Institute of Mathematics Academy of Sciences Uzbekistan, 100178, Tashkent*
[2]*Tashkent State Transport University, 100167, Tashkent.*
[3]*Department of Computational and Theoretical Sciences, Faculty of Science, International Islamic University Malaysia, Bandar Indera Mahkota, 25200 Kuantan, Pahang Darul Makmur, Malaysia.*

[a)]Corresponding author: nasirganikhodjaev@gmail.com
[b)]anorovobidjon6@gmail.com
[c)]pahchinhee@gmail.com

Abstract: In statistical mechanics the ergodic hypothesis proposes a connection between dynamics and statistics. In the classical ergodic theory the assumption was made that the average time spent in any region of phase space is proportional to the volume of the region in terms of the invariant measure, more generally, that time averages may be replaced by space averages. For nonlinear dynamical systems Ulam suggested as analogue of measure-theoretic ergodicity, following ergodic hypothesis: A quadratic stochastic operator (qso) $V: S^{m-1} \to S^{m-1}$ defined on finite-dimensional simplex S^{m-1} is called ergodic if the limit $\lim_{n\to\infty} \frac{1}{n}\sum_{i=0}^{n-1} V^i(x)$ exists for any $x \in S^{m-1}$. On the basis of numerical calculations for special type of nonlinear transformations, namely, so- called quadratic stochastic operators (q.s.o.), Ulam conjectured that the ergodic theorem holds for any qso V. In 1977 Zakharevich proved that this conjecture is false in general and presented an example of non-ergodic qso defined on $S2$ Below we consider a qso defined on infinite- dimensional simplex.

Let $Z_+ = \{0,1, \dots\}$ is a set of nonnegative integers and

$$S^{Z_+} = \left\{x = (x_0, x_1, \dots): x_i \geq 0 \ \forall i \in Z_+ \text{ and } \sum_{i=0}^{\infty} x_i = 1\right\}$$

is a set of probability measure on Z_+. We consider quadratic stochastic operator (qso) $V: S^{Z_+} \to S^{Z_+}$ defined on countable state space as follows: for arbitrary $n \in Z_+$

$$(Vx)_{2n} = x_{2n}^2 + 2x_{2n}\sum_{i=n}^{\infty} x_{2i+1},$$

$$(Vx)_{2n+1} = x_{2n+1}^2 + 2x_{2n+1}\sum_{i=n+1}^{\infty} x_{2i}.$$

We show that this operator is a natural generalization of well-known non-ergodic qso defined on finite state space S^{m-1} and prove that it is also non-ergodic transformation.

Keywords: Quadratic stochastic operator, ergodic transformation, countable state space, probability measure, simplex.

ABSTRACT: VIRTUAL

ID_30

Hyperstability Results for The General Linear Functional Equation in Non-Archimedean 2-Banach Spaces

Shujauddin Shuja[1, a)], Ahmad Fadillah Embong[1, b)] and Nor Muhainiah Mohd Ali[1,c)]

[1]*Department of Mathematical Sciences, Faculty of Science, Universiti Teknologi Malaysia, 81310 UTM Johor Bahru, Malaysia*

[a)]Corresponding author: Shuja.ghory@yahoo.com
[b)]ahmadfadillah.90@gmail.com
[c)]normuhainiah@utm.my

Abstract: Let E be a vector space, and r, s, R, S be non-zero real or complex numbers. In this paper, a short preface of non-Archimedean 2-Banach spaces is stated. Then, we reformulate Brzdek fixed point theorem in non-Archimedean 2-Banach spaces. Using Brzdek method, we prove hyperstability results for the general linear functional equation

$$f(rx + sy) = Rf(x) + Sf(y), \qquad x, y \in E$$

in non-Archimedean 2-Banach spaces.

Keywords: Non-Archimedean 2-Banach spaces, general linear functional equation, hyperstability, fixed point method.

ABSTRACT: VIRTUAL

ID_33

Learning Analytic Framework for Students' Academic Performance and Critical Learning Pathways

Jessica Yen Lyn, Tan[1, a)], Yong Kheng, Goh[2, b)] and Yoke Meng, Ngeow[3, c)]

[a)]Corresponding author: tanyenlyn97@gmail.com
[b)]goh.yongkheng@gmail.com
[c)]ngeowym@utar.edu.my

Abstract: Learning analytic framework serves as a systematic and structured approach to leverage educational data. Such framework uses data-driven methodologies to acquire insights into students' critical learning pathway and informed instructional practices. This study proposes a unified framework that can be implemented by any educational institution to analyse, prescribe and predict students' academic performance and critical learning pathways. The proposed framework offers distinct features that captures the overall performance of students by considering multiple dimensions - grades, Grade Point Average (GPA), sequence of courses or subjects taken throughout the semesters or years of study. Its incorporation of a collective network graph 1) showcases the relationships and dependencies between courses, 2) highlights the emergence of specific pathways within an academic program, 3) analyse network centrality, 4) identifies critical nodes, 5) sheds light on influential courses that significantly impact overall student performance and learning outcomes. The proposed framework methodology encompasses several key steps which start with a standardized data collection and data preprocessing process. Next, dimensionality reduction techniques such as Principal Component Analysis (PCA) and Non-negative matrix factorization (NMF) are applied to capture the most influential course components and grade information. The reduced dataset is then subjected to clustering algorithms, including partition-based clustering (K-means), hierarchical clustering, and density-based clustering (DBSCAN). These algorithms group

students based on their academic performance and course profiles, allowing us to identify clusters of students with similar characteristics and academic trajectories. Furthermore, the critical learning pathways of the students are explored through the construction of a course network graph. This graph represents the sequence of courses taken by students and highlights the emergence of learning pathways within each program.

In this case study, we focus on a sample of 3550 undergraduate students enrolled in three different programs at a private university in Malaysia. The dataset includes information such as student IDs, program of study, course names, total marks, grades, and session intakes. By leveraging the proposed learning analytic framework, we aim to gain valuable insights into the students' academic journeys and identify factors that contribute to their success.

Keywords: Learning analytic framework, unsupervised learning, Principal Component Analysis (PCA), Non-negative Matrix Factorization (NMF), educational data mining (EDM).

ABSTRACT: VIRTUAL

ID_36

The Effect of a Magnetic Field on the Process of Mixed Convection Heat Transfer in a Square Cavity with Sinusoidal Heating

Nur Zafirah Mohd Sidek[1, a)] and Norhaliza Abu Bakar[2, b)]

[1]*Faculty of Science, Technology and Human Development, Universiti Tun Hussein Onn Malaysia, Pagoh, 84600 Muar, Johor, Malaysia.*
[2]*Department of Science and Mathematics, Centre for Diploma Studies, Universiti Tun Hussein Onn Malaysia, Pagoh, 84600 Muar, Johor, Malaysia.*

[a)]hw200012@student.uthm.edu.my
[b)]norhaliza@uthm.edu.my
[c)]Corresponding author: norhaliza@uthm.edu.my

Abstract: A numerical study on the fluid flow and heat transfer with sinusoidal heating on the top lid of a two-dimensional (2D) square cavity in the presence of a magnetic field is investigated. The top lid is heated sinusoidally, while the bottom wall is maintained at a cold temperature. Meanwhile, the vertical walls are insulated. The finite volume method and SIMPLE algorithm are employed to solve the dimensionless governing equations. The influence of Hartmann numbers (Ha) (0, 10, 30, and 60) on fluid flow and heat transfer is investigated by utilizing the discretized equations in the FORTRAN programming language. The Reynolds number and Prandtl number are fixed. Finally, the solutions are discussed using a graphical approach. It is found that the Ha has a significant effect on the fluid flow structure and temperature field. As Ha increases, the flow of convection is attenuated, and therefore the heat transfer rate decreases.

Keywords: Finite volume method, magnetic field, mixed convection, sinusoidal temperature, square cavity.

ACKNOWLEDGEMENT

We would like to express our warmest appreciation to our sponsors:

McDonald's Indera Mahkota

Dumex Kuantan

Kindi Khawarizmi Enterprise

Kindi Khawarizmi Enterprise

Pahang Tourism

ICMCTS 2023 ORGANIZING COMMITTEES

PATRON
Prof. Emeritus Tan Sri Dato' Dzulkifli Abdul Razak,
Rector of IIUM

ADVISOR
Assoc. Prof. Dr. Zarina Zainuddin
Dean,
Kulliyyah of Science

CHAIRMAN
Assoc. Prof. Dr. Pah Chin Hee
Computational and Theoretical Sciences Department,
Kulliyyah of Science

SECRETARIAT COMMITTEE

Program Manager	:	Dr. Nur Zatul Akmar Hamzah
Secretary	:	Assoc. Prof. Dr. Mimi Hafizah Abdullah Sr. Anis Sulaikha Samiun
Financial Controller	:	Dr. Siti Fatimah Zakaria
Publicity and Multimedia	:	Dr. Norfaieqah Ahmad Sr. Norsyahidah Zulkarnain Br. Muhammad Syarif Ghazali Br. Lukman Abdul Taib
Sponsorship, Hospitality, and Catering	:	Dr. Nor Amirah Mohd Busul Aklan Dr. Siti Marponga Tolos Sr. Nur Alis Aqeelah Mohd Fadzullah
Programme Book & Publication	:	Dr. Wan Nur Fairuz Alwani Wan Rozali Br. Azizi Rosli Br. Muhammad Fahem Musa
Registration	:	Dr. Zulmaryan Embong Dr. Wan Malissa Wan Mohd Aminuddin Dr. Nor Raihan Mohamad Asimoni (Scientific Committee) Br. Aqil Danish Jusoh
Special Task	:	Dr. Nurul Najihah Mohamad Sr. Norfarhana Binti Md Khalidi Sr. Nur Bazila Zainol Sr. Yusrina Ilyas Rifai
Preparation & Technical Bureau	:	Dr. Mohd Hirzie Mohd Rodzhan Dr. Muhammad Salihi Abdul Hadi Dr. Supian Mat Salleh Br. Mohd Ikhwan Azmy Br. Muhamad Mazuan Mansor Br. Nik Aizad Nik Hasmi Br. Amir Farhan Mohammad Zamri

Coordinator of Technical Committee	:	Dr. Nur Zatul Akmar Hamzah Dr. Wan Nur Fairuz Alwani Wan Rozali Dr. Nor Raihan Mohamad Asimoni
Technical Committee	:	Assoc. Prof. Dr. Pah Chin Hee (Applied Mathematics) Assoc. Prof. Dr Mimi Hafizah Abdullah (Financial Mathematics) Dr. Siti Fatimah Zakaria (Pure Mathematics) Dr. Muhammad Salihi Abdul Hadi (Applied Mathematics) Dr. Nurul Najihah Mohamad (Statistics) Dr. Norfaieqah Ahmad (Operational Research) Dr. Ummu Atiqah Mohd Roslan (Pure Mathematics)

Kindi Khawarizmi Enterprise

ICMCTS 2023

KULLIYYAH OF SCIENCE

DEPT. CTS