Nigerian Mathematical Society Conference

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# 41st ANNUAL CONFERENCE OF NIGERIAN MATHEMATICAL SOCIETY

**THEME:**

*Mathematics, Artificial Intelligence & National Economy*

# BOOK OF ABSTRACTS

www.nmsconference.netlify.app

**Monday 6th – Friday 10th MAY, 2024**

**10:00am - 6:00pm Daily**

HOLDING AT
**DEPARTMENT OF MATHEMATICS**
**UNIVERSITY OF IBADAN, NIGERIA**

UNDER THE DISTINGUISHED CHAIRMANSHIP OF
**Prof. Kayode ADEBOWALE, mni, FAS**
***The Vice-Chancellor***
*University of Ibadan, Ibadan*

CHIEF HOST
**Prof. Oluwadayo Sonibare**
***Dean, Faculty of Science,***
*University of Ibadan, Ibadan*

HOST
**Dr. P.O. Arawomo**
***Acting H.O.D.***
***Department of Mathematics***
*University of Ibadan, Ibadan*

SPONSORS

# BRIEF HISTORY OF THE NMS

In February 1980, a total of sixty two (62) mathematicians from almost all the existing Nigerian universities, colleges of technology (now polytechnic and colleges of education) inaugurated the Nigerian Mathematical Society (NMS) at the University of lbadan, Nigeria. The organisation, devoted to the promotion, dissemination and application of researches in mathematics and mathematical sciences has grown over the years to be a reputable and formidable academic society recognised not only in Africa, but also all over the world. The Nigerian Mathematical Society (NMS) has reciprocity agreements with established mathematical society like the American Mathematical Society (AMS), London Mathematical Society, and others in Europe.

The aim of the society is to promote of mathematical research and application through:

i. holding of conferences, symposia, workshops, etc;
ii. publishing of Journals of the Nigerian Mathematical Society (JNMS) and other publications of high quality;
Iii. awarding of prizes for outstanding mathematical research especially to young mathematicians and
iv. cooperating/affiliating with other bodies with similar aims as those of the society.

## COUNCIL MEMBERS

| S/N | NAME | STATUS | INSTITUTION |
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| 12 | Dr. A. O. Akeju | Member |
| 13 | Dr. D. A. Dikko | Member |
| 14 | Dr. O. B. Ogunfolu | Member |
| 15 | Mr. R. A. Jokotoia | Member |
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| 4 | INTERNATIONAL CENTRE FOR APPLIED MATHEMATICAL MODELLING AND DATA ANALYTICS (ICAMMDA) | Federal University Oye-Ekiti |

# NMS 2024 PRESENTATION TABLE

| GROUP A: DIFFERENTIAL EQUATIONS & INCLUSIONS, MODELLING, NUMERICAL ANALYSIS AND THEIR APPLICATIONS | | | |
|---|---|---|---|
| TUESDAY 7 (Zoom ID: 832 8973 7527; Password: 106247) | | | |
| | 09:00 - 12:00 | Opening Ceremony at New Faculty Lecture Thearter | |
| | 12:00 - 12:40 | Keynote Speaker 1 | Mr Jubril Adeniji |
| | 12:45 - 01:00 | Brief Address | Dr Bakare Emmanuel Afolabi |
| | 01:00 - 02:00 | LUNCH BREAK | |
| | 02:00 - 02:50 | Plenary Speaker 1 | Emeritus Prof. G. O. S. Ekhaguere |
| | 03:00 - 03:45 | Keynote Speaker 2 | Mr Abayomi Adelowotan |
| PARALLEL SESSION 1 (NFLT) | | | |
| | CHAIRMEN: | | |
| S/N | TIME | PAPER CODE | TOPICS & AUTHORS |
| 1 | 04:00 - 04:15 | A01 | **Filippov Approach In One Sided Lipschitz Continuous Impulsive uantum Stochastic Differential Inclusion**<br>ABIMBOLA, Latifat Adebisi and KASALI, Kazeem B |
| 2 | 04:15 - 04:30 | A02 | **Mathematical Modelling of Crime with Police Intervention Via Fractional Operator**<br>[1] Ayuba Sanda, [2] Bashir Saidu Musa, [3]Yahaya Ajiya, [4]Ishiaku Zubairu |
| 3 | 04:30 - 04:45 | A03 | **Mathematical Modelling And Analysis Of The Effect Of Isolated-Reated Class On The Dynamical Spread Of Covid-19**<br>E. E. Laka[1], S. O. Adewale[2], K. O. Mufutau[3] |
| 4 | 04:45 - 05:00 | A04 | **Modeling The Dynamics Of Diabetes Melitus With Control**<br>Kolawole Adefemi Adeyemo |
| 5 | 05:00 - 05:15 | A05 | **Hyers-Ulam Stability Criteria for Third Order Nonlinear Differential Equations with Nonlinear Damping.**<br>Ilesanmi Fakunle[1], Peter Olutola Arawomo[2], Joesph Idowu Opadara[3] and Ezekael Abiodun Oluwafemi[4] |
| 6 | 05:15 - 05:30 | A06 | **A Nonlinear $SDC_1C_2$ Mathematical Model for the Effect of Diabetes Population on a Community**<br>Kwaghkor, L. M. |
| 7 | 05:30 - 05:45 | A07 | **Global Stability and Bifurcation Analysis of HIV/AIDS Epidemic Model with PrEP**<br>J.K. Oladejo[1*], O.A.Odebiyi[2] |
| 8 | 05:45 - 06:00 | A08 | **Analytical Approximate Solution Of Nonlinear** |

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| | | | **Fractional Order Differential Equations**<br>* B. M. Yisa, and N. A. Owolewa |
| | 07:00- | **VICE CHANCELLOR'S COCKTAIL** | |

| **GROUP A: DIFFERENTIAL EQUATIONS & INCLUSIONS, MODELLING, NUMERICAL ANALYSIS AND APPLICATIONS** | | | |
|---|---|---|---|
| **WEDNESDAY 8 (Zoom ID: 832 8973 7527; Password: 106247)** | | | |
| | **09:00 - 09:45** | **Plenary Speaker 2** | **Prof Luigi Acardi** |
| **PARALLEL SESSION 2 (NFLT)** | | | |
| **CHAIRMEN:** | | | |
| **S/N** | **TIME** | **PAPER CODE** | **TOPICS & AUTHORS** |
| 1 | 10:00 - 10:15 | A09 | **Block Methods of Equal Order for Solving Second Order Delay Differential Equations**<br>[1]Familua, A. B., [2]Adeyeye, O., [3]Areo, E. A, and [4]Omole, E. O. |
| 2 | 10:15 - 10:30 | A10 | **Fourth-derivative block methods for directly solving third-order initial value problems of ordinary differential equations.**<br>[1] Duromola M. K. [2] Momoh A. L and [3]Kusoro O. O. |
| 3 | 10:30 - 10:45 | A11 | **Analysis Of HIV/AIDS Model With Non Linear Incidence Function**<br>O. A. Odebiyi[2*], J. K. Oladejo[2], and Elijah E.O[3] |
| 4 | 10:45 - 11:00 | A12 | **Ergodic Theorems in Random Banach Spaces**<br>M.O. Ogundiran |
| 5 | 11:00 - 11:15 | A13 | **Mathematical Model Of Anti-Malarial Drug Resistance**<br>*[1]Atuji Simon Sati, [2]Omojo Blessing, [3]Dashe Naanmiap Emmanuel. |
| 6 | 11:15 - 11:30 | A14 | **Quantum computations and Quantum information Theory**<br>D.A Dikko |
| 7 | 11:30 - 11:45 | A15 | **Optimising Plasmodium falciparum Malaria Control Strategies in Nigeria**<br>Bakare Emmanuel Afolabi[1,2] |
| | **12:00 - 01:30** | **Nigerian Women in Mathematics** | |
| | **01:30-02:30** | **LUNCH BREAK** | |
| **PARALLEL SESSION 3 (NFLT)** | | | |

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|---|---|---|---|
| **CHAIRMEN:** | | | |
| 1 | 02:30 - 02:45 | A16 | **Buoyancy Driven Convective Flow Of Stratified Fluid In A Vertical Channel With Acceleration And Impulsively Started Plates Filled With Anisotropic Porous Material**<br>Muhammad. K. Musa[1*], L. K. Yusuf[2], M. Balarabe[3], A. M. Umar [4] and A. Abdulkarim[5] |
| 2 | 02:45 - 03:00 | A17 | **Block Method Coupled with the Compact Difference Schemes for the Numerical Solution of Nonlinear Burgers' Partial Differential Equations**<br>[1] B. I. Akinnukawe and [2] E. M. Atteh |
| 3 | 03:00 - 03:15 | A18 | **Analyzing Cholera Transmission Dynamics: Insights for Public Health Interventions**<br>Babatunde Gbadamosi and Olukayode Adebimpe |
| 4 | 03:15 - 03:30 | A19 | **Mathematical Modeling Of The Parasitic Transmission Dynamics Of Iroko Gall Bug (Phytolyma Lata) Walker Scott On Iroko Trees (Miliciaexcelsa) Welw C.C. Berg.**<br>Awosusi B.M[1], Arawomo P.O[2] and Obabiyi O.S[3] |
| 5 | 03:30 - 03:45 | A20 | **A Numerical Solution Of The Fractional Navier-Stokes Equation Using The Caputo-Fabrizio Aboodh Transform Method With The Reduced Differential Polynomials**<br>Abimbola A. Oyewumi[1]; Rasaq A. Oderinu[2] |
| 6 | 03:45 - 04:00 | A21 | **An Autonomous Differential Equation Model For Developing The Database Of A Face Recognition System**<br>Bamidele Oluwade |
| 7 | 04:00 - 04:15 | A22 | **New Spectral Parameter Via Secant Condition For Symmetric Nonlinear Equations**<br>Yusuf Muhammad Kufena[1*], Lukman Lawal[2], Kamaluddeen Umar Danmalam[3] And Mohammed Samaila[4] |
| 8 | 04:15 - 04:30 | A23 | **Stability Analysis And Optimal Control Of Exploited Population**<br>Davies Iyai and [+]Adiela Chukwumela |
| 9 | 04:30 - 04:45 | A24 | **Assessing the efficiency of cooling** |

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| | | | **systems utilizing tetra-hybrid nanofluid in solar powered automobiles through numerical analysis**<br>Salaudeen, K.A[1], Aselebe, L.A[2], Ogundiran, S.D[3], Farayol[a], P.I[4], Asiru, T.M[5] |
| 10 | 04:45 - 05:00 | A25 | **Comparative Analysis of the Effects of Temperature on Swelling Capacity of Acha Semolina of different mix ratio.**<br>Faniyi, Olugbade E., Okoro, Samuel I., Fatokun, Johnson O., and Evans, Patience O*. |

| **GROUP A: DIFFERENTIAL EQUATIONS & INCLUSIONS, MODELLING, NUMERICAL ANALYSIS AND APPLICATIONS** | | | |
|---|---|---|---|
| **THURSDAY 9 (Zoom ID: 832 8973 7527; Password: 106247)** | | | |
| | **09:00 - 09:45** | **Plenary Speaker 3** | **Prof Balazs Szendroi** |
| **PARALLEL SESSION 4 (NFLT)** | | | |
| **CHAIRMEN:** | | | |
| **S/N** | **TIME** | **PAPER CODE** | **TOPICS & AUTHORS** |
| 1 | 10:00 - 10:15 | A26 | **Efficiency and Economic Analysis of Intervention Strategies for Recurrent Malaria Transmission**<br>Abimbade S.F.[1*], Olaniyi S.[2], Ajala O. A.[3], Chuma F. M.[4] |
| 2 | 10:15 - 10:30 | A27 | **Impact Of Educational Strategies On The Control Of Marital Conflict: A Mathematical Modelling Approach**<br>Bako D. |
| 3 | 10:30 - 10:45 | A28 | |
| 4 | 10:45 - 11:00 | A29 | |
| 5 | 11:00 - 11:15 | A30 | |
| 6 | 11:15 - 11:30 | A31 | |
| 7 | 11:30 - 11:45 | A32 | |
| 8 | 11:45 - 12:00 | A33 | |
| 9 | 12:00 - 12:15 | A34 | |
| 10 | 12:15 - 12:30 | A35 | |
| 11 | 12:30 - 12:45 | A36 | |
| | **01:00 - 02:00** | **LUNCH BREAK** | |
| | **02:00 - 02:45** | **Plenary Speaker 3** | **Prof N. N. Youmbi** |
| **PARALLEL SESSION 5 (NFLT)** | | | |
| **CHAIRMEN** | | **Prof M. O. Ogundiran & Prof A. T. Ademola** | |
| 1 | 03:00 - 03:15 | A37 | |
| 2 | 03:15 - 03:30 | A38 | |
| 3 | 03:30 - 03:45 | A39 | |
| 4 | 03:45 - 04:00 | A40 | |
| 5 | 04:00 - 04:15 | A41 | |
| 6 | 04:15 - 04:30 | A42 | |
| 7 | 04:30 - 04:45 | A43 | |
| 8 | 04:45 - 05:00 | A44 | |

| GROUP B: FUNCTIONAL ANALYSIS, ALGEBRA WITH APPLICATIONS AND GENERALISATIONS | | | |
|---|---|---|---|
| TUESDAY 7 (Zoom ID: 832 8973 7527; Password: 106247) | | | |
| | 09:00 - 12:00 | Opening Ceremony at New Faculty Lecture Thearter | |
| | 12:00 - 12:40 | Keynote Speaker 1 | Mr Jubril Adeniji |
| | 12:45 - 01:00 | Brief Address | Dr Bakare Emmanuel Afolabi |
| | 01:00 - 02:00 | LUNCH BREAK | |
| | 02:00 - 02:50 | Plenary Speaker 1 | Emeritus Prof. G. O. S. Ekhaguere |
| | 03:00 - 03:45 | Keynote Speaker 2 | Mr Abayomi Adelowotan |
| PARALLEL SESSION 1 (MATHEMATICS LABORATORY) | | | |
| CHAIRPERSON: | | | |
| S/N | TIME | PAPER CODE | TOPICS & AUTHORS |
| 1 | 04:00 - 04:15 | B01 | **On Dirichlet Spaces of Homogeneous Type Via Heat Kernel**<br>M. E. Egwe[4] and J. I. Opadara[2] |
| 2 | 04:15 - 04:30 | B02 | **Tymoczko Codes for Row Strict Young Tableaux**<br>Felemu Olasupo[1] and Praise Adeyemo |
| 3 | 04:30 - 04:45 | B03 | **Convolution Operators on the Euclidean Motion Group.**<br>[1]U. N. Bassey and [5]U. E. Edeke, |
| 4 | 04:45 - 05:00 | B04 | **Fractional Differential Transform Method For Analyzing Arterial Blood Flow Of Fractional Order**<br>*[1]Akogwu, Omojo Blessing and [2]Ogunfiditimi, Franklin Olusodayo |
| 5 | 05:00 - 05:15 | B05 | **On Common Fixed point Theorems in ($\alpha$,$\beta$)-Complexed valued *b*-Metric Spaces**<br>Abba Auwalu[1],*, Lawan Mohammed Bulama[2], Abbas Umar Saje[3] and Hassan Hamza[4] |
| 6 | 05:15 - 05:30 | B06 | **Transfer Of Orbital Integrals**<br>U. N. Bassey[1] and R. A. Ibitowa[2] |
| 7 | 05:30 - 05:45 | B07 | **Some Notions On Picture Fuzzy MultiRelations**<br>Taiwo O. Sangodapo, |
| 8 | 05:45 - 06:00 | B08 | **Generalized Inertial Algorithm Involving Family Of Sum Of Two Monotone Mappings And Strictly Pseudocontractive Mappings**<br>B. Ali [1] and A.B. Nuhu[6] |
| | 07:00- | VICE CHANCELLOR'S COCKTAIL | |

| GROUP B: FUNCTIONAL ANALYSIS, ALGEBRA WITH APPLICATIONS AND GENERALISATIONS | | | |
|---|---|---|---|
| WEDNESDAY 8 (Zoom ID: 832 8973 7527; Password: 106247) | | | |
| | 09:00 - 09:45 | Plenary Speaker 2 | Prof Luigi Acardi |
| PARALLEL SESSION 2 (MATHEMATICS LABORATORY) | | | |
| | CHAIRMEN: | | |
| S/N | TIME | PAPER CODE | TOPICS & AUTHORS |
| 1 | 10:00 - 10:15 | B09 | **Bohr Inequality For Some Generalized Integral Operators On Simply Connected Domain**<br>Amusa I.S.[1] and Mogbademu A. A.[2] |
| 2 | 10:15 - 10:30 | B10 | **A survey on iterative fixed point theorems in modular function spaces with an application to differential equation**<br>* Hudson Akewe |
| 3 | 10:30 - 10:45 | B11 | **A Study on Soft Semigroups**<br>[1]R. U. Ndubuisi, [2]Paschal U. Offor and [3]R. B. Abubakar, |
| 4 | 10:45 - 11:00 | B12 | **Factorization in Phase-Space Finite Geometry and Weak Mutually Unbiased Bases in Finite Quantum Systems**<br>Adeshola, A.D.[1], Oladejo, S.O.[7], Abdulkareem, A.O.[8] and Ibrahim G.R.[1] |
| 5 | 11:00 - 11:15 | B13 | **On Quasimonotone Variational Inequalities**<br>Oluwatosin T. Mewomo |
| 6 | 11:15 - 11:30 | B14 | **Bregman Subgradient Extragradient Method for Solving Pseudo-monotone Variational Inequalities and Fixed Point Problems in Banach Spaces with Application**<br>M. S. Lawan |
| 7 | 11:30 - 11:45 | B15 | **$p^{th}$ - Root Characterisation Of Full Transformation Semigroup**<br>∗A. O. Adeniji, M. M. Mogbonju and A. M. Ayinde |
| | 12:00 - 01:30 | Nigerian Women in Mathematics | |
| | 01:30-02:30 | LUNCH BREAK | |
| PARALLEL SESSION 3 (MATHEMATICS LABORATORY) | | | |

| CHAIRMEN: | | | |
|---|---|---|---|
| 1 | 02:30 - 02:45 | B16 | **Hankel Determinant Of A Class Of Analytic Function Defined By Frasin Differential Operator**<br>[1]Olusola E. OPALEYE, [2]Opeyemi S. FAWALE |
| 2 | 02:45 - 03:00 | B17 | **An Equivalence In A Selected Family Of Cyclic Subsemigroups And Algorithm For Generating Systems Of Semigroup**<br>M.I. Sampson, L.E. Effiong, C.T. Madubuike and C. F. Igirig |
| 3 | 03:00 - 03:15 | B18 | **Centralizers In Transformation Semigroup Of Alternating Nonnegative Integers**<br>Adenike Olusola Adeniji |
| 4 | 03:15 - 03:30 | B19 | **Integral Inequlities Of Opial-Type With Two Parameters On Times Scales**<br>[1] Aribike Emmanuella Ehui, [2]Samuel Adamariko Aniki and [3]Rauf Kamilu |
| 5 | 03:30 - 03:45 | B20 | **On The Homology Of A Complete Flag**<br>Olufemi Sunday OLUSA |
| 6 | 03:45 - 04:00 | B21 | **New Closed Forms For A Dilogarithmic Integral, Related Integrals, And Series**<br>Abdulhafeez Ayinde Abdulsalam |
| 7 | 04:00 - 04:15 | B22 | **Coefficient estimates for certain class of univalent functions involving the modified sigmoid function.**<br>[1] Davids Esther [2] Olushola Adeyemo |
| 8 | 04:15 - 04:30 | B23 | **Algorithm For Semigroup Bases And Its Implication On The Bases Of Classes Of Semigroup**<br>Marshal I. Sampson, Akak, Eyo Offiong, |
| 9 | 04:30 - 04:45 | B24 | **Hybrid D-iteration process for equilibrium problem and fixed points of asymptotically nonexpansive mappings**<br>M. H. Harbau |
| 10 | 04:45 - 05:00 | B25 | **On Henstock-Kurzweil-Stieltjes-◇-Double Integrals Of Gronwall-Bellman Type Inequalities For Interval-Valued Functions On Time Scales**<br>AFARIOGUN David Adebisi[9], MOGBADEMU Adesanmi Alao[2] and |

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| | | | OLAOLUWA<br>Hallowed Oluwadara[3] |

| GROUP C: FUNCTIONAL ANALYSIS, ALGEBRA WITH APPLICATIONS AND GENERALISATIONS | | | |
|---|---|---|---|
| THURSDAY 9 (Zoom ID: 832 8973 7527; Password: 106247) | | | |
| | 09:00 - 09:45 | Plenary Speaker 3 | Prof Balazs Szendroi |
| PARALLEL SESSION 4 (MATHEMATICS LABORATORY) | | | |
| CHAIRMEN: | | | |
| S/N | TIME | PAPER CODE | TOPICS & AUTHORS |
| 1 | 10:00 - 10:15 | B26 | **Univalence, Starlikeness And Convexity Of A New Integral Operator**<br>M. O. Ezugorie[1] and A. F. Olubunmi[2] |
| 2 | 10:15 - 10:30 | B27 | **Intuitions around the metrical triangle inequality**<br>Hallowed O. Olaoluwa[1], Aminat O. Ige[2], and Johnson O. Olaleru[3] |
| 3 | 10:30 - 10:45 | B28 | **Attractive Point Approximation of Noncommutative Nonlinear Mappings in Hadamard Spaces**<br>Lawal Yusuf Haruna |
| 4 | 10:45 - 11:00 | B29 | **Attractive Point Approximation of Noncommutative Nonlinear Mappings in Hadamard Spaces**<br>Lawal Yusuf Haruna |
| 5 | 11:00 - 11:15 | B30 | **Geometric Properties of Univalent Functions Involving Legendre Polynomials**<br>Fatunsin Lolade Modupe[1] and Opoola T. O.[2] |
| 6 | 11:15 - 11:30 | B31 | **Solving Singular Integral Equations of the Second Kind Using Chebyshev Polynomials**<br>Vivian Ndfutu Nfor and Pascaline Liakem Ndukum |
| 7 | 11:30 - 11:45 | B32 | **On the characterization of some variants of inverse properties in conjugate loop**<br>[1]T. G. Jaiy´eola´[2] M. A. Idris (Corresponding and Presenting author) and [3] G. Akinbo |
| 8 | 11:45 - 12:00 | B33 | **On semi-symmetric $(\alpha,\beta,\gamma)$-inverse quasigroup**<br>[10] R. Ilemobade and [2]T. G. Jaiy´eo.la´ |
| 9 | 12:00 - 12:15 | B34 | **A New Class of Analytic Function Defined by Gegenbauer and Chebyshev Polynomials** |

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|---|---|---|---|
| | | | [1]O. D. Olawumi, [2*]Olubunmi A. Fadipe-Joseph |
| 10 | 12:15 - 12:30 | B35 | |
| 11 | 12:30 - 12:45 | B36 | |
| | **01:00 - 02:00** | **LUNCH BREAK** | |
| | **02:00 - 02:45** | **Plenary Speaker 3** | |
| **PARALLEL SESSION 5 (MATHEMATICS LABORATORY)** | | | |
| | **CHAIRMEN:** | | |
| 1 | 03:00 - 03:15 | B37 | |
| 2 | 03:15 - 03:30 | B38 | |
| 3 | 03:30 - 03:45 | B39 | |
| 4 | 03:45 - 04:00 | B40 | |
| 5 | 04:00 - 04:15 | B41 | |
| 6 | 04:15 - 04:30 | B42 | |
| 7 | 04:30 - 04:45 | B43 | |
| 8 | 04:45 - 05:00 | B44 | |

| GROUP C: PROBABILITY, FINANCIAL MATHEMATICS, OPERATIONS RESEARCH,STATISTICS AND APPLICABLE MATHEMATICS | | | |
|---|---|---|---|
| TUESDAY 7 (Zoom ID: 832 8973 7527; Password: 106247) | | | |
| | 09:00 - 12:00 | Opening Ceremony at New Faculty Lecture Thearter | |
| | 12:00 - 12:40 | Keynote Speaker 1 | Mr Jubril Adeniji |
| | 12:45 - 01:00 | Brief Address | Dr Bakare Emmanuel Afolabi |
| | 01:00 - 02:00 | LUNCH BREAK | |
| | 02:00 - 02:50 | Plenary Speaker 1 | Emeritus Prof. G. O. S. Ekhaguere |
| | 03:00 - 03:45 | Keynote Speaker 2 | Mr Abayomi Adelowotan |
| PARALLEL SESSION 1 (MATHEMATICS SEMINAR ROOM) | | | |
| | CHAIRMEN: | | |
| S/N | TIME | PAPER CODE | TOPICS & AUTHORS |
| 1 | 04:00 - 04:15 | C01 | **The Role Of Artificial Intelligence In Enhancing The Teaching And Learning Of Mathematics For National Development**<br>[1]Ahmed Tijjani, RABIU and [2]Saratu Galma, TANIMU |
| 2 | 04:15 - 04:30 | C02 | **Galerkin Weighted Residual Method for the Solution of Cantilever Beam Equations**<br>∗ Peter Ayoo and Gloria Habila |
| 3 | 04:30 - 04:45 | C03 | **Heat and Mass transfer in Casson MHD nanofluid flow over a horizontal plate with nonlinear thermal radiation.**<br>Gabriel Samaila |
| 4 | 04:45 - 05:00 | C04 | **Dependency of Solute Flux on Thermal Flux in Double-Diffusive Convection of Ammonia Prandtl-Eyring Nanofluid: A Predictive Study via RSM and SQLM**<br>Mojeed T. Akolade[1,11] and Amos S. Idowu[1 1] |
| 5 | 05:00 - 05:15 | C05 | **Golden Ratio Algorithms For Solving Quasimonotone Variational Inequalities**<br>V. R. Okeya[1], C. I. Nestor[1], A. A. Mebawondu[1,2], A. E. Ofem[2], And O. K. Narain[2] |
| 6 | 05:15 - 05:30 | C06 | **Artificial intelligence and Animation for Effective Teaching and Learning of Mathematics**<br>Adenegan Kehinde Emmanuel and Lawal Matthew Oluwafemi |
| 7 | 05:30 - 05:45 | C07 | **Artificial Intelligence and Mathematics Instructional Delivery for Sustainable National Economy in** |

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| | | | **Kano State, Nigeria.**<br>Hameed Ishola, SURAKAT |
| 8 | 05:45 - 06:00 | C08 | **Fraction of Design Space Plot for Examining of Second-order Orthogonal Composite Designs in Presence of Missing Observation**<br>Chibuzo Solomon Ezievuo, Abimibola Victoria Oladugba, *Ogochukwu Ifeoma Ude & Oluwagbenga T. Babatunde |
| | 07:00- | **VICE CHANCELLOR'S COCKTAIL** | |

| **GROUP C: PROBABILITY, FINANCIAL MATHEMATICS, OPERATIONS RESEARCH,STATISTICS AND APPLICABLE MATHEMATICS** | | | |
|---|---|---|---|
| **WEDNESDAY 8 (Zoom ID: 832 8973 7527; Password: 106247)** | | | |
| | **09:00 - 09:45** | **Plenary Speaker 2** | **Prof Luigi Acardi** |
| **PARALLEL SESSION 2 (MATHEMATICS SEMINAR ROOM)** | | | |
| | **CHAIRMEN:** | | |
| **S/N** | **TIME** | **PAPER CODE** | **TOPICS & AUTHORS** |
| 1 | 10:00 - 10:15 | C09 | **Regression Models for Predicting the Effect of Depth on Temperature of Three Different Lakes**<br>Okoro, Samuel I*, Ayeni, Olumide C., Evans Patience O., and Fatokun, Johnson O. |
| 2 | 10:15 - 10:30 | C10 | **Statistical Analysis for the Effect of Temperature on the Swelling Capacity of Acha Semolina**<br>[1]Ayeni, Olumide C.*, [1]Faniyi, Olugbade E., and [2]Umar, Aliyu M. |
| 3 | 10:30 - 10:45 | C11 | **A Panel Vector Autoregressive Model (Pvar) Analysis Of Impact Of Renewable Energy And Financial Development On Co2 Emission And Economic Growth In West African Region.**<br>Oluwasegun Kehinde, Olabisi, Rasheed Adeyemi |
| 4 | 10:45 - 11:00 | C12 | **Peak Value In Combined Effect Time Dependent Matrix Using Geometric Mean**<br>Dr Abidemi D. Oyalade, Dr B.O Onasanya |
| 5 | 11:00 - 11:15 | C13 | **Statistical Analysis On Monetary Policy Of Curbing Unemployment Rate In Nigeria.**<br>[1]Adewoye, Kunle Bayo*, [2]Raji, Surajudeen Tunde, [3]Salau, Ganiyat Monishola (Mrs) |
| 6 | 11:15 - 11:30 | C14 | **Bayesian Estimation of Convoluted Randomized Response Techniques** |

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|---|---|---|---|
| | | | Adeniran A. T.[1*] and Faweya, O. [2] |
| 7 | 11:30 - 11:45 | C15 | **The Advancement and Improvement of LASER Technology in a health system in Nigeria**<br>Patrick Agwu Okpara and Sunday Nwokpoku Aloke |
| | 12:00 - 01:30 | **Nigerian Women in Mathematics** | |
| | 01:30-02:30 | **LUNCH BREAK** | |
| **PARALLEL SESSION 3 (MATHEMATICS SEMINAR ROOM)** | | | |
| | **CHAIRMEN:** | | |
| 1 | 02:30 - 02:45 | C16 | **Statistical Analysis On Monetary Policy Of Curbing Unemployment Rate In Nigeria.**<br>Adewoye, Kunle Bayo* Raji, Surajudeen Tunde and Salau, Ganiyat Monishola |
| 2 | 02:45 - 03:00 | C17 | **Fraction of Design Space Plot for Examining of Second-order Orthogonal Composite Designs in Presence of Missing Observation**<br>Chibuzo Solomon Ezievuo, Abimibola Victoria Oladugba & *Ogochukwu Ifeoma Ude |
| 3 | 03:00 - 03:15 | C18 | **Elevating Nigeria's Future: Harnessing the Power of AI for Sustainable Growth and Inclusive Development**<br>Yussuf Yakubu |
| 4 | 03:15 - 03:30 | C19 | **Integration Of Stochastic Black-Scholes Model With Gauss-Levy Jump Using Euler-Maruyama Method**<br>[1] Abejide K. S. and [2] Kayode S. J. |
| 5 | 03:30 - 03:45 | C20 | **Runge-Kutta Like Method for the Solution of Optimal Control Model of Real Investment and Fish Management**<br>[1]Adamu, S., [2]Alkali, A. M. and [3]Odekunle, M. R. |
| 6 | 03:45 - 04:00 | C21 | **Application of Conjugate Gradient Parameter for Real Unconstrained Optimization Problems**<br>[1]Usman Abbas Yakubu, [2]Abubakar Bawa Zarogi, [3]Rabiu Hamisu Kankarofi |
| 7 | 04:00 - 04:15 | C22 | **Option Pricing of Dividend Paying Underlying with Discrete Investment Strategy**<br>Akeju A. O and Dekede P. O |
| 8 | 04:15 - 04:30 | C23 | **Neural Stochastic Differential Equations and Optimal Stopping Problems**<br>Ini ADINYA |

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|---|---|---|---|
| 9 | 04:30 - 04:45 | C24 | **Mathematical Modeling of Economic Dynamics in Nigeria: Integrating Artificial Intelligence for Policy Analysis and Forecasting**<br>Anthony Udo Akpan |
| 10 | 04:45 - 05:00 | C25 | **Addressing The Basic Requirements For Proficiency In Artificial Intelligence-A Study Of Difficulty Levels Of Secondary School Mathematics Topics**<br>Cletus I. Madu and Mansur Nuhu Alhassan |

| **GROUP C: PROBABILITY, FINANCIAL MATHEMATICS, OPERATIONS RESEARCH,STATISTICS AND APPLICABLE MATHEMATICS** | | | |
|---|---|---|---|
| **THURSDAY 9 (Zoom ID: 832 8973 7527; Password: 106247)** | | | |
| | **09:00 - 09:45** | **Plenary Speaker 3** | **Prof Balazs Szendroi** |
| **PARALLEL SESSION 4 (MATHEMATICS SEMINAR ROOM)** | | | |
| | **CHAIRMEN:** | | |
| **S/N** | **TIME** | **PAPER CODE** | **TOPICS & AUTHORS** |
| 1 | 10:00 - 10:15 | C26 | **Commutative Harmonic Analysis On Some Non-Commutative Nilpotent Lie Groups**<br>O. A. Ariyo[1] and M. E. Egwe[2] |
| 2 | 10:15 - 10:30 | C27 | |
| 3 | 10:30 - 10:45 | C28 | |
| 4 | 10:45 - 11:00 | C29 | |
| 5 | 11:00 - 11:15 | C30 | |
| 6 | 11:15 - 11:30 | C31 | |
| 7 | 11:30 - 11:45 | C32 | |
| 8 | 11:45 - 12:00 | C33 | |
| 9 | 12:00 - 12:15 | C34 | |
| 10 | 12:15 - 12:30 | C35 | |
| 11 | 12:30 - 12:45 | C36 | |
| | **01:00 - 02:00** | **LUNCH BREAK** | |
| | **02:00 - 02:45** | **Plenary Speaker 3** | |
| **PARALLEL SESSION 5 (MATHEMATICS SEMINAR ROOM)** | | | |
| | **CHAIRMEN:** | | |
| 1 | 03:00 - 03:15 | C37 | |
| 2 | 03:15 - 03:30 | C38 | |
| 3 | 03:30 - 03:45 | C39 | |
| 4 | 03:45 - 04:00 | C40 | |
| 5 | 04:00 - 04:15 | C41 | |
| 6 | 04:15 - 04:30 | C42 | |
| 7 | 04:30 - 04:45 | C43 | |
| 8 | 04:45 - 05:00 | C44 | |

# VIRTUAL PRESENTATIONS

| MISCELLANEOUS PRESENTATIONS (VIRTUAL) | | | |
|---|---|---|---|
| TUESDAY 7 | | | |
| | 09:00 - 12:00 | **Opening Ceremony at New Faculty Lecture Thearter** | |
| | 12:00 - 12:40 | Keynote Speaker 1 | |
| | 12:45 - 01:00 | Brief Address | |
| | 01:00 - 02:00 | **LUNCH BREAK** | |
| | 02:00 - 02:50 | Plenary Speaker 1 | |
| | 03:00 - 03:45 | Keynote Speaker 2 | |
| **PARALLEL SESSION 1 (Zoom ID: 832 8973 7527; Password: 106247)** | | | |
| **S/N** | **TIME** | **PAPER CODE** | **TOPICS & AUTHORS** |
| 1 | 04:00 - 04:15 | NMS24VP01 | **$L^2$- Convergence of Wavelet Operators in the Schwartz Space S**<br>A.C. Egere[1,2], U.N. Bassey[1], and M.E. Egwe[1] |
| 2 | 04:15 - 04:30 | NMS24VP02 | **Waves on a Rotating Corrugated-Impedance boundary Material Influenced by Thermal Source and Mechanical Force**<br>Augustine Igwebuike Anya |
| 3 | 04:30 - 04:45 | NMS24VP03 | **Mathematical Modelling of Rabies in Dog Population Considering Pre- and Post-Vaccinations**<br>Abayomi Ayotunde Ayoade[1] and Paschal Achor Ikpechukwu [2] |
| 4 | 04:45 - 05:00 | NMS24VP04 | **Consumer Behaviour Analysis Via The Fusion Of Nonlinear Mathematical Modelling And Big Data Analytics**<br>K. J. Audu[1], S.A. Akande[1]; A. Abdulrahim S. O. Olubowale[1]; And O. A. Adedayo |
| 5 | 05:00 - 05:15 | NMS24VP05 | **Numerical Evaluation of Adverse Effects of Economic Fluctuations on the Investment Returns of Insurance Industry in Nigeria**<br>C. Chibuisi[1,*], M. E. Egwe[2], B. O. Osu[3] |
| 6 | 05:15 - 05:30 | NMS24VP06 | **Approximating zeros of monotone maps and fixed point of generalized nonexpanive operators in CAT(0) spaces**<br>Zuwaira Sulaiman umar[1] |
| 7 | 05:30 - 05:45 | NMS24VP07 | **Sensitivity Analysis Of Covid-19 Model With 52 Parameters Using Python Snippet Generated By The Aid Of Ai**<br>[1]U. Alwell and [2]G. C. E. Mbah |
| 8 | 05:45 - 06:00 | NMS24VP08 | **Free Convection Flow Of Viscous Dissipative Fluid Affected By Permeability And Heat Source/Sink Impacts In A Heated Superhydrophobic Microchannel**<br>Emmanuel Omokhuale[1]* and Godwin Ojemeri[2] |
| | 07:00- | **VICE CHANCELLOR'S COCKTAIL** | |

| MISCELLANEOUS PRESENTATIONS (VIRTUAL) | | | |
|---|---|---|---|
| WEDNESDAY 8 | | | |
| | 09:00 - 09:45 | Plenary Speaker 2 | |
| PARALLEL SESSION 2 (Zoom ID: 832 8973 7527; Password: 106247) | | | |
| CHAIRMEN | | G. S. Lawal & B. O. Onasanya | |
| S/N | TIME | PAPER CODE | TOPICS & AUTHORS |
| 1 | 10:00 - 10:15 | NMS24VP09 | **Unraveling The Complexity Of Hyperacusis: A Graph Theoretical Approach**<br>Ibrahim Hassan1 and Ezike, Amechi Innocent[2] |
| 2 | 10:15 - 10:30 | NMS24VP10 | **Two-point Taylor polynomial iterative linearization via Legendre nodes for exothermic diffusion model.**<br>[1]Razaq Adekola Oderinu, [2]Johnson Adekunle Owolabi , [3]Anthony Dumebi Ohaegbue, [4]Ahmed Adeyi Yahaya |
| 3 | 10:30 - 10:45 | NMS24VP11 | **Fully Developed flow of Burger's fluid in annuli: Semi-analytical approach**<br>Sani Isa[1] and Ali Musa[2] |
| 4 | 10:45 - 11:00 | NMS24VP12 | **Products of Quasi-Nipotents in the Symmetric inverse Semigroups**<br>[1,2]J. A. Agba, [2]G. U. Garba and [2]A. T. Imam |
| 5 | 11:00 - 11:15 | NMS24VP13 | **Homotopy Perturbation Method Of Magnetohydrodynamics (Mhd) Couette Flow With Viscous Dissipation And Newtonian Heating In A Vertical Channel**<br>Godwin Ojemeri[1*] and Isaac Obiajulu Onwubuya[2] |
| 6 | 11:15 - 11:30 | NMS24VP14 | **Unraveling The Complexity Of Hyperacusis: A Graph Theoretical Approach**<br>Ibrahim Hassan1 and Ezike, Amechi Innocent[2] |
| 7 | 11:30 - 11:45 | NMS24VP15 | **Analysis of Variable Properties on Ternary and Tetra Hybrid Nanofluids Using Blasius Rayleigh-Stokes Time Dependent Variable: A Model For Solar Aeronotic Engineering**<br>[12] Akintayo Oladimeji Akindele, [2]Olayinka Akeem Oladapo, [3]Amos Wale Ogunsola, [13]Olusegun Adebayo Ajala and [5]Adebowale Martins Obalalu |
| | 12:00 - 01:30 | **Nigerian Women in Mathematics** | |

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|---|---|---|---|
| | 01:30-02:30 | **LUNCH BREAK** | |
| **PARALLEL SESSION 3** | | | |
| 1 | 02:30 - 02:45 | NMS24VP16 | **Natural Convective Couette flow in a Darcy porous medium with Thermal Radiation, Variable Thermal Conductivity and Chemical Absorption Characteristics: A Finite Element Approach (FEM)**<br>Emmanuel Omokhuale1[14*], Godwin Ojemeri[15], Oreyeni Tosin[16], M. M. Altine[17] and Abdullahi Hussaini[5] |
| 2 | 02:45 - 03:00 | NMS24VP17 | **Is there any correlation between Teachers' method of teaching and the impact on Student's Academic Achievements in school? A viewpoint from Senior Secondary Mathematics in Taraba state.**<br>Itankan, Wilfred Areachot, |
| 3 | 03:00 - 03:15 | NMS24VP18 | **Analyzing the Effectiveness of Jacobi, Gauss-Seidel and Successive OverRelaxation Techniques in Solving System of Linear Equations**<br>Jacob Emmanuel[1], Olumi.T.T[2], Elizabeth O.E.[3] |
| 4 | 03:15 - 03:30 | NMS24VP19 | **Submicron particle transportation and deposition in a Pressure-Driven Couette Slip flow**<br>Hadiza Sani Nass |
| 5 | 03:30 - 03:45 | | **Exploring The Efficiency And Accuracy Of Several Numerical Methods For Solving Second-Order Nonlinear Ordinary Differential Equations Of Emdem-Fowler Type**<br>Egbuhuzor Udechukwu P[1] and Udoh Ndipmong A[2] |
| 6 | 03:45 - 04:00 | | **Asymmetric Lebesgue ($L_2^+$) Space**<br>Yusuf Ibrahim |
| 7 | 04:00 - 04:15 | | |
| 8 | 04:15 - 04:30 | | |
| 9 | 04:30 - 04:45 | | |
| 10 | 04:45 - 05:00 | | |

| MISCELLANEOUS PRESENTATIONS (VIRTUAL) | | | |
|---|---|---|---|
| THURSDAY 9 | | | |
| | **09:00 - 09:45** | **Plenary Speaker 3** | |
| **PARALLEL SESSION 4** | | | |
| **S/N** | **TIME** | **PAPER CODE** | **TOPICS & AUTHORS** |
| 1 | 10:00 - 10:15 | | |
| 2 | 10:15 - 10:30 | | |
| 3 | 10:30 - 10:45 | | |
| 4 | 10:45 - 11:00 | | |
| 5 | 11:00 - 11:15 | | |
| 6 | 11:15 - 11:30 | | |
| 7 | 11:30 - 11:45 | | |
| 8 | 11:45 - 12:00 | | |
| 9 | 12:00 - 12:15 | | |
| 10 | 12:15 - 12:30 | | |
| 11 | 12:30 - 12:45 | | |
| | **01:00 - 02:00** | **LUNCH BREAK** | |
| | **02:00 - 02:45** | **Plenary Speaker 3** | |
| **PARALLEL SESSION 4** | | | |
| 1 | 03:00 - 03:15 | | |
| 2 | 03:15 - 03:30 | | |
| 3 | 03:30 - 03:45 | | |
| 4 | 03:45 - 04:00 | | |
| 5 | 04:00 - 04:15 | | |
| 6 | 04:15 - 04:30 | | |
| 7 | 04:30 - 04:45 | | |
| 8 | 04:45 - 05:00 | | |

# NMS 2024 ABSTRACTS

# INVITED TALKS

## The Quantum decomposition of a classical random variable: Applications to Physics, Probability and Mathematical Analysis

Luigi Accardi
*University of Rome Tor Vergata*
*Italy*

Abstract. The emergence of Heisenberg commutation rule $[q,p] = i\hbar$ for position and momentum in boson quantum mechanics **(QM)**, and more generally of non–commutativity in QM, has been a mystery since the early days of this theory and has remained such for almost 100 years.

The discovery of the **Quantum decomposition of a classical random variable** gave rise to a line of research that, in little more that 25 years, has produced a natural solution to this problem, namely: *the whole quantum theory (QT) can be deduced from the combination of classical probability (CP) with the classical theory of orthogonal polynomials (OP)*.

The importance of this new approach does not lie so much in the solution of the problem mentioned above, as in the fact that QT used until now appears as a very special case of a much broader deductive theory, which shows that *every classical random variable with all moments, is canonically associated to a new QT, which reduces to the standard (boson) one in the case of gaussian random variables*.

In other words, for the first time in almost 100 years, the mathematical apparatus of QT appears in the perspective of a natural deduction and not as a strange, singular theory justified a posteriori by its enormous empirical success, but totally mysterious in its origins and meaning.

The fruitfulness of this new point of view is demonstrated by the fact that it has already led to the solution of open problems in CP, in OP theory and in physics itself, where it has provided powerful new tools for the description of natural phenomena.

I my talk I will try to illustrate some of these results in each of the fields mentioned above. But these results are only the beginning of the story: the most exciting challenge, currently only just beginning, is the following.

Since we now know that quantization is a classical probabilistic phenomenon and that every classical random variable with all moments (or process or field, since the theory applies also to infinite dimensions) canonically produces a quantum theory, it follows that every field of science in which classical probability is involved (i.e. almost all), will have to learn how to exploit the benefits of this duality between classical and quantum description.

By exploiting this more powerful mathematical formalism, the physicists have managed to produce fantastic results in the past 100 years: now this power is available to all those who use classical probability in any field of science and technology. We have to learn to use it.

1

## A K-theory of Weak Partial $O^*$-Algebras of Operators

G. O. S. Ekhaguere
Department of Mathematics, University of Ibadan
Nigeria

Abstract. K-theory is a fundamental tool in the field of operator algebras. It is vital in the study of certain invariants of large matrices. I highlight the key elements of an algebraic K-theory, which I developed recently, of arbitrary weak partial $O^*$-algebras of, in general, unbounded linear operators on a common dense subspace of some separable, complex Hilbert space. In addition to establishing several fundamental results and also introducing the new specialty of partial semigroups/groups, I prove the Bott Periodicity Theorem in this partial $*$-algebraic setting. The present formulation extends the classical K-theory of $C^*$-algebras. Beyond being of independent mathematical interest, our new algebraic K-theory facilitates the study of multiple physical invariants in axiomatic quantum field theory, where unbounded self-adjoint operators, called observables, are prevalent. To the best of our knowledge, our formulation of the K-theory of weak partial $O^*$-algebras is the very first effort in this direction.

## The projective coinvariant algebra: a construction at the crossroads of combinatorics, algebraic geometry and representation theory

Balazs Szendr¨oi
Faculty of Mathematics, University of Vienna
Austria

Abstract. The coinvariant algebra, the quotient of the polynomial ring in n variables by the ideal generated by positive degree symmetric polynomials, plays a basic role in algebraic combinatorics and the representation theory of the symmetric group, equipping its regular representation with a graded algebra structure. Based on an idea from algebraic geometry, this talk will introduce a degeneration of the coinvariant algebra, the projective coinvariant algebra. This algebra gives a bigraded structure on the regular representation of $S_n$ with interesting Frobenius character, generalising a classical result of Lusztig and Stanley. I will also explain connections to Ehrhart theory, the theory of counting lattice points in polytopes. The talk will partially be based on joint work with Praise Adeyemo, University of Ibadan.

## A Characterization of Completely Simple Topological Semihypergroups

Norbert Youmbi
Department of Mathematics, Saint Francis USA.

Abstract. Semihypergroup generalizes semigroup in many ways. The theory of semihypergroup, is studied in both an algebraic and topological approach. Unlike in the semigroup case, a topological semihypergroup, is not defined by associating a topology to an existing algebraic structure. In fact, there is no algebraic structure assumed on the base space of a topological semihypergroup. In practice, the convolution of measures defined on the vector space of Radon measures of a topological semihypergroup, is used to define an algebraic structure on the base space. In this talk we will present the characterization of a completely simple semigroup and explore how far such a result has gone in research on topological semihypegroup. We will in the process present the various orientation of studies in semihypergroups and present some open problems in the area. The theory of semihypergroup is used in probability, harmonic analysis, and naturally in algebra.

# PARALLEL SESSIONS

1

## Fractional $p$-sub-Laplacian eigenvalues and existence results for $p$-subelliptic equations with singularity on homogeneous Carnot groups

Abimbola Abolarinwa
Department of Mathematics, Faculty of Science
University of Lagos, Akoka, Nigeria
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Abstract. The study of elliptic partial differential equations involving fractional exponent (nonlocal) operators has been well developed in the context of Euclidean space for mathematical justification, and also owing to ubiquitous applications coming from various fields of applied sciences. In this paper we study nonlocal Dirichlet eigenvalue problem for $p$-sub-Laplacian on homogeneous Carnot groups, and then establish some important properties of the principal eigenvalue such as existence of the corresponding eigenfunction, strict positivity, simplicity and isolatedness. These properties are then combined with embedding result for fractional Folland-Stein-Sobolev space to derive existence results for certain subelliptic problems with singularity.
**Keywords:** Eigenvalues, $p$-Laplacian, Carnot groups, quasi-norm, Sobolev embedding.
**Mathematics Subject Classification:** 35B05; 35H20; 35P30; 47J10.

2.

## On Dirichlet Spaces of Homogeneous Type Via Heat Kernel

M. E. Egwe[1] and J. I. Opadara[2]
Department of Mathematics, University of Ibadan, Ibadan.
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Abstract. This presentation considers the properties of Dirichlet Spaces of Homogeneous type which consist of band limited functions that are nearly exponential localizations on $\mathsf{R}^k$ which is a powerful tool in harmonic analysis and it makes various spaces of functions and distributions more approachable, utilizable and providing non-zero representation of natural function spaces, such as Besov space, on $\mathsf{R}^k$. Sphere and homogeneous spaces can also admit such frames on the intervals and balls. This article presents mainly the band limited frames that are well-localized in the general setting of Dirichlet spaces of Homogeneous type which have doubling measure and a local scale-invariant Poincare inequality which generates heat kernels through the Gaussian bounds and H¨older continuity. As an application of this build-up, band limited frames are generated in the context of Lie groups which are homogeneous in nature with polynomial

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volume growth, complete Riemannian manifolds with Ricci curvature bounded from below and admits the volume doubling property, together with other settings. In this general setting, decomposition of Besov spaces was done with the new frames. **Keywords:** Dirichlet Spaces; Ricci curvature; Lie Algebra; Besov space; Poincare inequality.

3

## Tymoczko Codes for Row Strict Young Tableaux

Felemu Olasupo[1] and Praise Adeyemo [2]
Adekunle Ajasin University, Akungba Akoko Akungba, Ondo State, Nigeria olasupo.
felemu@aaua.edu.ng[1] and University of Ibadan, Ibadan [2]

Abstract. In this article, we investigate the algorithm through which permutations were associated to a set of row-strict tableaux rst. Via this algorithm, we attach a code to each rst and give some combinatorial interpretations of these codes and establish some connections between some existing results on rst and the codes.

4

## UNIVALENCE, STARLIKENESS AND CONVEXITY OF A NEW INTEGRAL OPERATOR

M. O. Ezugorie[1] and A. F. Olubunmi[2]
Department of Mathematics, University of Nigeria, Nsukka[1], Department of Mathematics, Faculty of Physical Sciences, University of Ilorin, P. M. B. 1515, Ilorin[2]

We consider a new integral operator defined by

We obtain sufficient conditions for the univalency, starlikeness and convexity of this operator defined on the space of normalized analytic function in the open unit disk. Some corollaries were obtained as special cases of our theorems.

**Keywords:** analytic function, univalent function,integral operator, special function, starlikeness convexity.

5

## Convolution Operators on the Euclidean Motion Group.

[1]U. N. Bassey and [1]U. E. Edeke,
[1] Department of Mathematics, University ofIbadan, Ibadan, Nigeria, [2]Department of Mathematics, University of Calabar, Calabar, Nigeria.

[1] Department of Mathematics, University of Ibadan, Ibadan, murphy.egwe@ui.edu.ng

Abstract. Let G ⇒ be a Lie groupoid and D′ the space of distributions on G ⇒. In this paper we establish the space of singular distributions as source and target fibres of the Lie groupoid and the invariant groups as isotropy groups of the Lie groupoid arising from the locally convex space. We then show that the invariant (distributional) differential operators are nets of local bisections of the Lie groupoid.

Abstract. Let $G = R^2 \times T$ be the Euclidean motion group and let $\delta(t)$ be the Dirac measure on $SO(2)$ $\tilde{}$ = T, the circle group. For), the space of infinitely differentiable functions on G with compact support, it is proved that the (convolution) operator

defined as $A'f = f * T^n\delta(t)$ extends to a bounded linear operator on $L^2(G)$. Let $T \in D'(G)$, be a distribution on $G$. We also prove that the left convolution operator $L_T$ given as $L_p f = T * f$ commutes with left translation. Other notable results are also obtained.

6

## Lie Groupoid Realization of Invariant Differential Operators on Singular Distributions

N. O. Okeke[1] and M. E. Egwe [2]
[1]Physical and Mathematical Sciences, Dominican University, nickokeke@dui.edu.ng,

7

## A New Class of Analytic Function Defined by Gegenbauer and Chebyshev Polynomials

[1]O. D. Olawumi, [2*]Olubunmi A. Fadipe-Joseph
[1,2]Department of Mathematics, University of Ilorin, P.M.B. 1515, Ilorin, Nigeria
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Abstract. In this work, a new class of analytic function defined by the Gegenbauer and Chebyshev polynomials was established. The initial coefficient estimates, Fekete-Szego functional and Hankel determinant for this class were obtained.

8

## On the characterization of some variants of inverse properties in conjugate loop

[1]T. G. Jaiy´eola´[2] M. A. Idris (Corresponding and Presenting author) and [3] G. Akinbo

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Abstract. A conjugate loop is a two-sided loop that obeys the identity $x(yx^{-1}) = (xy)x^{-1}$. In this work, necessary and sufficient(s) conditions for conjugate loop to possess variants of inverse property (left, right, weak, cross, automorphic, anti-automorphic) were established

9

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In the paper, a forward-backward iterative algorithm induced by a certain dynamical system for solutions of variational inequality problem involving quasi-monotone operator is introduced and studied. Weak convergence of the sequence generated by the said algorithm is proved in the setting of real Hilbert space. Numerical examples are given to demonstrate the efficiency and workability of the algorithm. The theorem obtained augments, generalizes, improves and unifies several results announced recently.

10

## On semi-symmetric $(\alpha,\beta,\gamma)$-inverse quasigroup

[1] R. Ilemobade and [2]T. G. Jaiy´eo.la´
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Abstract. A quasigroup $(Q,\cdot)$ will be called an $(\alpha,\beta,\gamma)$-inverse quasigroup, if there exist fixed permutations $\alpha$, $\beta$ and $\gamma$ of $Q$, such that $(x \cdot y)\alpha \cdot x\beta = y\gamma \ \forall \ (x,y) \in Q \times Q$. Examples were given to illustrate that a quasigroup can have more than one $(\alpha,\beta,\gamma)$inverse property. Consequently, for a set $\Delta_Q$ of such triples, it was shown that if the semi-symmetry law holds in $(Q,\cdot)$, it induces a binary operation on $\Delta_Q$ for which $\Delta_Q$ is a group. Interestingly, this leads to an isomorphism between $\Delta_Q$ and the autotopism group of $(Q,\cdot)$.

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## Ergodic Theorems in Random Banach Spaces

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Abstract. This work is concerned with semigroup of operators in random banach spaces. The asymptotic behaviour of trajectories of random differential inclusion is established. The ergodic theorems of these operators were then established by employing their inherent semigroup properties.

**AMS Subject Classification:** 47H20, 47H25, 47C10.
**Key Words and Phrases:** random normed spaces, spectrum, resolvent, semigroup of operators.

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# Analysis of weak associativity in some hyper-algebraic structures that represent redox reactions

In this paper, some chemical systems of Americium (Am), Titanium (Ti) and Gold (Au) which are represented by hyper-algebraic structures $(S_{Am}, \oplus)$, $(S_{Ti}, \oplus)$ and $(S_{Au}, \oplus)$ were studied. The analyses of their algebraic properties and the probabilities of elements in redox reactions were carried out. It was shown that in the redox reactions, the left nuclear $(N_\lambda)$-probability, middle nuclear $(N_\mu)$-probability and right nuclear $(N_\rho)$probability for each of the hyper-algebraic structures $(S_{Am}, \oplus)$, $(S_{Ti}, \oplus)$ and $(S_{Au}, \oplus)$ is less than 1.000. This implies that, $(S_{Am}, \oplus)$, $(S_{Ti}, \oplus)$ and $(S_{Au}, \oplus)$ are non-associative hyper-algebraic structures. Also, from the results obtained for FLEX-probability, it was shown that, $(S_{Am}, \oplus)$, $(S_{Ti}, \oplus)$ and $(S_{Au}, \oplus)$ have flexible elements because the values of their FLEX-probabilities are 1.000 each. Hence, $(S_{Am}, \oplus)$, $(S_{Ti}, \oplus)$ and $(S_{Au}, \oplus)$ are flexible.

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## Approximation of solutions of Nonlinear problems in Hyperbolic spaces

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Abstract. In this paper, we introduce a new iterative algorithm for approximating a common element of the set of solutions of an attractive point of further 2-generalized hybrid mapping, equilibrium problem and a common zero of a finite family of monotone operators in hyperbolic spaces. We establish strong convergence theorem under suitable assumptions, and also give numerical example to support our main result. Our results generalize and improve many recent results in the literature.

**Keywords:** Hyperbolic space, Attractive point, equilibrium.

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## FILIPPOV APPROACH IN ONE SIDED LIPSCHITZ CONTINUOUS IMPULSIVE QUANTUM STOCHASTIC DIFFERENTIAL INCLUSION

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In this work,the authors consider the impulsive quantum stochastic

differential inclusion of the form

We relax the Lipschitz continuity of P and obtain the Fillipov type result.

AMS Subject Classification: 81S25 , 34A37

Keywords and Phrases:Impulsive quantum stochastic differential inclusion, one sided Lipschitz condition,continuous selections,Filippov theorem..

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## Attractive Point Approximation of Noncommutative Nonlinear Mappings in Hadamard Spaces

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Abstract. In this paper, we first consider the class of further 2-generalized hybrid mapping which is said to include the classes of further generalized hybrid and normally 2generalized hybrid mappings as special cases in the setting of Hadamard spaces. Also, we construct a Halpern type iterative algorithm that approximates to a common element in the solution set of attractive point of two noncommutative further 2-generalized hybrid mappings in the space. The established results improve, extend and generalize many corresponding ones announced in this direction.

**KEYWORDS:** Attractive Points, further generalized hybrid mapping, Normally 2generalized hybrid mapping, further 2-generalized hybrid mapping, Hadamard spaces.

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## Mathematical Modelling of Crime with Police Intervention Via Fractional Operator

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Abstract: to model a crime, this research considers a compartmental model approach with police intervention, via fractional operator. The total population $N(t)$ of individuals in a society is subdivided into different class at time $t$, as: susceptible population $S(t)$, population of the individual exposed to the crime $E(t)$, population of those committing the crime $D(t)$, population of individual arrested by security agents as a result of the crime committed and sentence to prison $J(t)$, population of individual acquainted by the court or those that completed their sentence period $R(t)$, while $P(t)$ is the police population. Analyses are performed for two equilibria (Crime Free Equilibrium Point CFP/$C_0$ and Crime Presence Equilibrium CPE/$C_1$ obtained in the model. The basic reproduction number $R_0$ was obtained, where the stability analysis of the CFP/ $C_0$ shows that it is locally asymptotically stable (LAS) if $R_0 < 1$ and Unstable if $R_0 > 1$, globally asymptotically stable (GAS) if $R_0 < 1$ and unstable if otherwise. For the CPE, conditions are established for unique endemic equilibrium and bi-endemic equilibrium, where the crime present equilibrium point $C_1$ is globally asymptotically stable (GAS) if $R_0 > 1$. The conventional nonlinear least squares technique is used in fitting the compartmental model, which involved obtaining the values of the unknown parameters by

utilizing the optimizer function "lsqcurvefit" and the built-in Matlab R2014a. Numerical scheme was developed using the approached in Toufit and Atangana, and the numerical simulations show the existence of endemic point and a strong positive effect of police intervention on crimes. Keywords: Mathematical modelling, crime, police, Fractional operator, Local stability, Global stability.

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## A Uniform Order Four-Step Hybrid Block Method for Numerical Solution of SIR And Growth Model

Abstract. In this research work, we derived a uniform order four step hybrid block method for the numerical solution of Susceptible-Infected-Recovered (SIR) and Growth model problems of ordinary differential equations (ODEs). A continuous linear multistep method (CLMM) with variable coefficients was developed using interpolation and collocation techniques via power series approximate solution as the basis function. This CLMM was evaluated at some selected grids points which give a class of discrete linear multistep methods (DLMMs) and was implemented as a block method. One case was considered for step numbers $k = 4$. The basic properties of the block method were investigated and found out to be of order nine, consistent, zero stable and hence convergent. MATLAB 2015 codes were written to test the numerical performance of the block method on some real-life problems of ordinary differential equation and the results showed that the four-step hybrid block method compared favorably with the existing methods in terms of accuracy and efficiency, was found to be very effective.

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## On Common Fixed point Theorems in $(\alpha,\beta)$-Complexed valued $b$-Metric Spaces

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Abstract. In this paper, we obtain sufficient conditions for the existence of common fixed points of a pair of mappings satisfying contractive type conditions as follows: ? Let $(Z,m)$ be a complete $(\alpha,\beta)$- complex valued $b$-metric space and let? $F,G : Z \longrightarrow Z$ be two mappings satisfying the rational condition

for all $y,z \in Z$

, where $\lambda_1$, $\lambda_2$ are nonnegative real numbers and $\alpha + \beta(\lambda_1 + \lambda_2) < 1$. Then $F,G$ have a unique common fixed point in $Z$.

Keywords: -complex-valued metric space; fixed point; Jaggi-contraction.
2010 Mathematics Subject Classification: 47H10, 54H25.

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## TRANSFER OF ORBITAL INTEGRALS

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Abstract. Consider real reductive groups $G$ and $G'$ such that $G$ and $G'$ are inner forms with the same quasi-split group. Langlands has shown that there is a correspondence from the set of regular points in $G$ to that of $G'$. The main theorem of this study permits the transfer of stable orbital integrals from $G$ to $G'$, and as such a correspondence between the functions of the Schwartz space G and the functions of the Schwartz space G′ is established.

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## Some Notions On Picture Fuzzy MultiRelations

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Abstract. Here, the picture fuzzy multirelation was introduced. Some basic operations and inverse of picture fuzzy multirelation together with their properties were established. Also, some operators; Arithmetic, Geometric and Harmonic mean operators were studied, and examples were given to illustrate both operations and operators of a picture fuzzy multirelation. Finally, composition of picture fuzzy multirelations was defined, an example was given and associated properties were established. Keywords: Multiset, Fuzzy multiset, Multirelation, Composite relation

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## Iterative Procedure for Common Fixed Point of Split Equality Mixed Problems (SEMEP).

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Abstract. The fact that many significant physical Problems can be modelled and transformed to Fixed Point Problem gives Fixed point Theory and Application an enviable place in Research. The Convex Feasibility Problems has undergone series of modifications and transformations. In this paper we constructed an iterative Procedure for finding a common fixed point of Split Equality Mixed Problems. By method of Mathematical Analysis, sufficient conditions for the convergence of this process to a common fixed point was proved.

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## MATHEMATICAL MODELLING AND ANALYSIS OF THE EFFECT OF ISOLATED-TREATED CLASS ON THE DYNAMICAL SPREAD OF COVID-19

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Abstract. Severe Acute Respiratory Syndrome Corona Virus 2 (SARS-CoV-2) also called Covid-19, recently became a pandemic and its ravaging still lingers on. In this paper, a new seven compartmental model incorporating isolated-treated class was formulated, to study the dynamics of the disease. The model was observed to have two equilibrium points: the Disease Free Equilibrium Point (DFEP) and the Endemic Equilibrium Point (EEP). The stability analysis of the equilibrium points showed that the DFEP is locally asymptotically stable whenever $R_0 < 1$, while the EEP is locally asymptotically stable whenever $R_0 > 1$. Sensitivity analysis of the parameters in , revealed the most sensitivity parameters to be the contact rate $R_0$, the recruitment rate and the transfer rate of exposed individuals into the symptomatic infected class. Furthermore, it was observed that an increase in the contact rate between susceptible and exposed individuals would have a negative effect on the dynamics of the disease. Additionally, good treatments could lead to more recoveries from the disease. In conclusion, Covid-19 could be controlled by reducing the contact rate between the exposed and susceptible individuals, as well as increasing the efficacy of treatments.
**Keywords**: Covid-19, Mathematical modeling, Basic reproduction number.

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## Iterative Approximation Method for a Class of Enriched Multivalued Mappings in the Setting of CAT(0) Spaces

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Abstract. The Krasnoselskii-Man type iterative algorithm for approximation of fixed points of $(\lambda,\phi)$-enriched Lipschitzian multivalued mapping in the setting of CAT(0) spaces is studied. Strong and *Delta*-convergence of this scheme under appropriate conditions are obtained. Thus, improving and unifying some existing results.
**Keywords**: $(\lambda,\phi)$-enriched Lipschitzian multivalued mapping, CAT(0) Space, KrasnoselskiiMan type iterative algorithm

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## A New Procedure for Approximation of Solution of a Multiple Split Equality Common Fixed Point Problems.

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Abstract. In this work, a new algorithm for the iterative approximation of a solution to a Multiple Split Equality Common Fixed Point Problem involving a finite families of a quasi nonexpansive maps, finite family of eta-demi-metric mappings and a finite family of linear bounded operators was constructed. Making use of the characteristics inequalities in the underlying space and some classical convergence results, strong convergence of the proposed algorithm was established under mild conditions. The result obtained improves, generalizes and unifies some important known results. The method of proof is of independent interest.

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## MODELING THE DYNAMICS OF DIABETES MELITUS WITH CONTROL

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Abstract. Mathematical model of the dynamics of diabetes melitus with control was formulated; and the model shown to be mathematically suitable for analysis. The existence of equilibrium point that was determined, shown that there is no disease free equilibrium point but there is an endemic equilibrium point (EEP) of the model. The endemic equilibrium point is proved to be locally asymptotically stable (LAS) and globally asymptotically stable (GAS).
**Keywords or Phrases**: Mathematical model, Diabetes melitus, Control, Suitable for analysis and Equilibrium point.

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## GENERALIZED INERTIAL ALGORITHM INVOLVING FAMILY OF SUM OF TWO MONOTONE MAPPINGS AND STRICTLY PSEUDOCONTRACTIVE MAPPINGS

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Abstract. In this paper, we introduce a new inertial type algorithm for approximation of a common point in the set of fixed point of strictly pseudocontractive mappings and the set

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## INTEGRATION OF STOCHASTIC BLACK-SCHOLES MODEL WITH GAUSS-LEVY JUMP USING EULER-MARUYAMA METHOD

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Abstract. This work studies the independent disturbances in the stochastic chart of Black-Scholes asset model. Aside the Wiener process, there are other notable disturbances in the market chart of the Black-Scholes asset model. This disturbances known as the Levy process is a discrete process which arises as a result of Stochastic Independent Poisson Analysis (SIPA). To study this disturbances, a one step Euler-Maruyama method was developed to handle the SIPA scenario. Mean Absolute Error(MAE) and Strong Order of Convergence was used to establish the stability of the method as well as the Region of Stability. Numerical examples was considered and the method was found to be accurate and recommended for use as a financial tool.
**Keywords:** Euler-Maruyama method, Stochastic differential equation, Ito integral, Levy process, Stochastic-independent, Poisson distributed jump, random variables, deterministic model

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## IMPACT OF EDUCATIONAL STRATEGIES ON the CONTROL of MARITAL CONFLICT: A MATHEMATICAL MODELLING APPROACH.

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Abstract. The study examines the impact of different education strategies on controlling marital conflict, focusing on the effective contagion rate as an indicator of conflict spread. The analysis compares the outcomes of educating 80% of married men and 20% of married women versus educating 20% of married men and 80% of married women about the dangers of divorce. The findings reveal that the former strategy fails to reduce the effective contagion rate to zero, indicating ongoing conflict propagation within the population. In contrast, the latter approach shows a significant reduction in the effective contagion rate initially, although it starts to rise again along the trend. To achieve optimal control of marital conflicts, a balanced approach is recommended, with a 50% coverage rate of education for both genders. This balanced strategy aims to strike a gender equilibrium, ensuring a substantial portion of the population receives education on the dangers of divorce. Implementing this comprehensive education approach holds promise for minimizing conflict spread, promoting healthier marital relationships, and fostering stable family units. However, further research is needed to consider additional factors and long-term effects in understanding and addressing marriage conflict dynamics.
**Keywords:** Marital conflict, Education strategies, Mathematical model

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## THE ROLE OF ARTIFICIAL INTELLIGENCE IN ENHANCING THE TEACHING AND LEARNING OF MATHEMATICS FOR NATIONAL DEVELOPMENT

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of solutions of finite family of monotone variational inclusion problems involving generalized cocoercive mapping.
**KEYWORDS:** Generalized cocoercive mapping; fixed point; strictly pseudocontractive mapping; monotone variational inclusion problem.

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Abstract. This study investigated the role of AI towards Enhancing the Teaching and Learning of Mathematics for National Development. The study was guided by two objectives, two research questions and two null hypothesis. The teaching and learning of Mathematics in Nigeria are faced with great problems that make most student to perform poorly in the subject. This observations became a challenge and this is why the current effort is been raised. An instrument titled Perceptions of students on the role of AI towards enhancing the teaching and learning of Mathematics with twenty items was used for data collection and was analyze using chi-square. The instrument was validated by three experts. The reliability of the instrument was tested using split-half and found to be reliable with 0.76 reliability coefficient. The result shows that; AI plays a pivotal role towards enhancing the teaching and learning of Mathematics. The researcher concluded that the use of AI should be encourage among Mathematics students and researchers so as to make the best use of it toward national development and recommended that Government should fund researches on Mathematics so as to investigate more in diverse areas on AI in order to put to an end the down ward Mathematics performance among students.
**Keyword: Mathematics**, Artificial Intelligence, Teaching and Learning, Students

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Abstract. In this paper, a new iterative algorithm for the approximation of common solutions to a system of variational inequality and fixed point problems with demicontractive mapping in q-uniformly smooth real Banach spaces is constructed. We prove that the proposed algorithm has strong convergence. We apply the obtained results to solving a system of convex minimization problems coupled with fixed-point problems. Our techniques of proof are of independent interest.

**Keywords**: Nonexpansive mapping; fixed points; Inverse strongly monotone operator; Demicontractive mapping; Strong convergence.

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## Second law analysis of a MHD Jeffrey Fluid with Variable Viscosity and Nonlinear Thermal Radiation Flowing over a Stretching Sheet

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Abstract. This study rigorously explores entropy generation in the flow of and heat transfer of an electrically conducting Jeffrey fluid with non-linear thermal radiation. The fluid flows over a linearly stretching sheet with non-uniform heat source/sink. This particular model takes into consideration variable fluid viscosity and convective boundary conditions. The governing equations were derived based on the first and second law of thermodynamics, while suitable similarity transforms were deployed to non-demensionalise the equations. The effects of various thermophysical parameters on Bejan (contribution of heat transfer irreversibility), total entropy generation,

temperature and velocity profiles are scrutinized. Results for Nusselt (heat transfer rate) and skin friction coefficient are presented in a tubular form, while the other were graphically visualized. This study unequivocally depicts that increasing values of viscosity variation parameter reduces both velocity and temperature profiles. The findings reported here have significant in potential applications in material and metallurgical engineering, as well as various industrial processes where controlling heat and flow is crucial.
**Keywords:** Entropy generation, nonlinear thermal radiation, Jeffrey fluid, non-uniform heat source/sink, Runge-Kutta coupled with shooting technique.

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## On time varying inventory model for deteriorating items with exponential holding cost

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Abstract. We developed an inventory model for deteriorating items in which demand increases with respect to time while the inventory holding cost is exponentially distributed. Deterioration rate and ordering cost are all continuous functions of time. The planning horizon is finite. Shortages are completely backlogged. The optimal replenishment policy and decision rule which minimizes the total inventory cost was also determined. A numerical example is given to illustrate the derived model. Sensitivity range for the developed model was conducted.
**Keywords:** Inventory model, deterioration, time-dependent demand, exponential holding cost, shortages. **Classification:** statistics

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## BOHR INEQUALITY FOR SOME GENERALIZED INTEGRAL OPERATORS ON SIMPLY CONNECTED DOMAIN

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Abstract. We obtain the Bohr inequalities for some generalized integral operators of analytic function defined on simply connected domain. Our results are generalizations of existing results in the literature.
**Keywords:** Analytic function; $\alpha$-Cesaro operator; $\beta$-Cesaro operator; Bernadi Operator and simply connected domain.

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## Hyers-Ulam Stability Criteria for Third Order Nonlinear Differential Equations with Nonlinear Damping.

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Abstract. This paper is concerned with the Hyers-Ulam stability of third order nonlinear differential equations with non- linear damping.The third order nonlinear differential equations considered are transformed to integral inequalities before estab- lishing our results. Several new criteria for the Hyers-Ulam sta- bility are established under quite general assumptions,which im- prove and extend the known results in the literature.
**Keywords and phrases:** Nonlinear Damping, Integral inequality, New criteria, HyersUlam stability, Nonlinear differential equation.
2010 Mathematical Subject Classification: 26A46, 34C10, 11R33, 35Q31.

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## $L^2$- Convergence of Wavelet Operators in the Schwartz Space S

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Abstract. In this article, a locally convex topology on the Schwartz space S generated by the $L^2$-norm is constructed . It is shown that this $L^2$-norm topology preserves the Fr´echet space structure of S. For any function $f \in$ S, it is also shown that the wavelet operators $(P_j f)$, $(Q_j f)$, and $(S_{j,k}{}^{\sigma} f)_{j,k} \in$ Z, on $f$ all converge to $fj,k$ in this $L^2$- topology. Finally, the equivalence of this $L^2$-topology with the natural Schwartz topology is established.
**Keywords:** wavelets, scaling functions, multiresolution analysis (MRA), Calder?on- Zygmund operators.

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Abstract. This abstract seek to explore and exploit the correlation between mathematics, artificial intelligence and the national economy. Mathematics overtime has served and is still serving as the building block of AI researches and development, providing the tools and necessary structures needed for developing reliable intelligent systems. In turn, AI, has the potential of building to mightily impact the national economies, influencing various sectors like the health care, manufacturing and financial areas. This abstract examines the role of mathematics in AI and the impact of AI on national economies, and the potential implications and challenges that arise as these fields meet. mathematics and AI are intertwined fields that have a significant impact on national economies. Mathematics provides the tools and frameworks for AI development, while AI technologies have the potential to transform various sectors of the economy. However,

challenges such as ethical considerations and workforce displacement must be addressed to fully harness the transformative power of mathematics and AI for national economic growth.

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## Algorithmic approaches for solving time-fractional coupled systems of partial differential equations

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Abstract. In this paper, we introduce and apply an efficient computational algorithm utilizing the capabilities of the MAPLE 18 software, incorporating coded fractional derivatives in the Caputo and Riemann-Liouville sense. Our focus is on solving coupled systems of partial differential equations commonly encountered in engineering and mathematical physics domains, including fluid dynamics, viscoelastic materials, viscous damping, polymer physics, and seismic analysis. Our algorithm leverages various mathematical commands within the MAPLE 18 software package. We present three illustrative examples of both linear and nonlinear time-fractional coupled systems of partial differential equations. The obtained results are systematically compared with analytical solutions to assess the accuracy. These findings are presented in both tabular format and as 2D and 3D graphical representations. The proposed algorithm is characterized by its ease of use, reliability, and efficiency. It holds the potential to serve as a valuable mathematical tool for addressing a wide range of system of partial differential equation in applied mathematics.

**Keywords:** Caputo fractional derivative, MAPLE 18 software, coupled system, partial differential equations, computational algorithm, 2D and 3D plots.

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## NEW SPECTRAL PARAMETER VIA SECANT CONDITION FOR SYMMETRIC NONLINEAR EQUATIONS

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Conjugate Gradient method was proposed in order to reduce or overcome the short-comings of Newton's and Quasi-Newton's methods for solving unconstrained optimization method which was extended to Systems of Nonlinear Equations and efficient for handling large-scale problems because of its convergence properties, simple implementation and low storage requirement. Spectral gradient method was introduced so as to solve potentially large-scale unconstrained optimization problems whereby only gradient directions are used at each line search which makes the method to outperform conjugate gradient algorithms in many problems. In this research, a New Spectral Parameter (NSP) is derived via Secant Condition with two-term direction and the classical Newton's direction using similar approach used to derive Conjugate Parameter by Waziri, Kufena and Halilu (2020). The proposed method generates a descent direction using inexact line search and the global convergence of the proposed algorithm was established under appropriate conditions. The codes were written in MATLAB R2014a 7.71GB and run on a Personal Computer. Iteration stopped if the total number of iterations exceeds 1000 or the norm of the residual at the stopping point $\|F_k\| \leq 10^4$. The two methods were tested using five (5) test problems with different initial points and dimensions (n values). Numerical results for the benchmark test problems using the profiles of Dolan and More (2002), which is a tool for evaluating and comparing the performance of iterative methods, shows that our proposed method is more efficient and effective than some existing ones in the literature. For future research, this work will be applied to the experiments on the $L_1$-Norm regularization problems in compressive sensing.
**Keywords:** Descent condition, Global Convergence, Secant Condition, Spectral parameter, Symmetric Property.

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## Thermal Mechanism in Magneto Radiated [(Fe3O4?Ag) / EG]hnf with Modified Magnetic Field: Applications in Technological Processes.

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**Keywords:** Ethylene Glycol (EG), $Fe_3O_4$ – Ag, Hybrid Nanofliud, Slip Boundaries,

Casson Fluid

The rapid development of modern nanotechnology in industries and medical area have brought about the idea of mixing more than one nanoparticle in a base fluid which is called hybrid nanofluid. Hybrid nanofluid enhances the thermophysical properties of flow better compare to ordinary nanofluid. The main object of the present paper is to examine the thermal mechanism in magneto radiated [$Fe_3O_4$ –Ag/EG] casson fluid flow through a porous


medium with modified magnetic field. This lead to a mathematical flow model in terms of highly non- linear differential equations. The partial differential equations and their boundary conditions were reduced to ordinary differential equations using a suitable similarity variable. The resulting non-linear system of equations is then solved using Chebychev Collocation Method with the aid of Wolfran Mathematical software. It is found that the heat transfer rate of the hybrid nanofluid is higher as compared to the traditional nanofluid. The imposed magnetic field of high strength is a better tool to control the motion of ($Fe_3O_4$ – Ag)/EG inside the boundary layer. Thermal radiations and slip parameter are observed to be beneficial for thermal enhancement for both ($Fe_3O_4$ – Ag)/EG and $Fe_3O_4$/EG.

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## Galerkin Weighted Residual Method for the Solution of Cantilever Beam Equations

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Abstract. Cantilever beams, commonly employed in construction to support balconies, roofs, and other overhangs, constitute structures with one end fixed to a solid vertical body while the other end remains free. The equations governing cantilever beams are often higher-order differential equations with complex boundary conditions, typically addressed through numerical methods. This study explores the application of the Galerkin weighted residual method, acknowledged in literature for its efficacy, to approximate solutions for select cantilever beam equations. A comparative analysis is conducted among exact solutions, the iterative integration method, and results obtained through the Galerkin weighted residual method. The findings underscore the effectiveness of the proposed method, which consistently outperforms existing literature in yielding superior results.
**Keywords:** Cantilever beam equation, Numerical solution, Boundary value problem, Galerkin weighted residual method

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## Analytical solutions of linear two-dimensional liquid chromatography model for single component heterogeneous reaction

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In this work, we obtain analytical solutions for a two-dimensional general rate model of liquid chromatography considering a single component heterogeneous reaction. The model equations are made up of a set of coupled partial differential equations, consisting of axial and radial dispersion, together with various mass transfer kinetics that are considered. Hankel and Laplace transformations are used to obtain solutions for Danckwerts and Dirichlet boundary conditions. Various test cases are carried out considering different physical parameters that are used to analyze the chromatographic reactor. A high-resolution finite volume scheme is used to obtain approximate solutions for the governing equations of the model. Both the analytical and numerical results were compared and were in good agreement, validating the numerical results. The obtained results shows that the chromatographic reactor performs more efficiently for increased value of the heterogeneous-type first-order reaction constant.
**Keywords:** liquid chromatography, finite volume scheme, heterogeneous reaction, twodimensional general rate model.

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## Heat and Mass transfer in Casson MHD nanofluid flow over a horizontal plate with nonlinear thermal radiation.

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Abstract. This article explored the importance of highly nonlinear thermal radiation on Casson MHD nanofluid flow and heat and mass transfer over a horizontal plate. The thermal, momentum and diffusion partial slip conditions are considered are the plate surface. The partial differential equations were simplified into ordinary differential equations through a similarity procedure. The final ordinary differential equations were solved numerically through Runge-Kutta Fehlberg algorithm in Maple software. The importance of the various parameters such as Casson Parameter($\beta$), nonlinear thermal radiation parameter ($R$), Prandtl number ($Pr$), thermophoresis parameter ($Nt$), Brownian motion parameter ($Nb$), magnetic parameter ($M$), local Grashof number($Gr_x$), temperature relaxation parameter ($\sigma_e$), momentum slip parameter ($\Gamma$ ), concentration relaxation parameter( $\sigma_c$ ), thermal slip parameter( $\zeta$ ), Lewis number( Le ), diffusion slip parameter ($\varsigma$ ), density variation with temperature ($\gamma_T$ ) and density variation with concentration( $\gamma_c$ ) are fully discussed in details through tables and graphs.
**Keywords:** Casson Fluid; Nanofluid; Nonlinear thermal radiation; Partial slip; MHD

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## From phobia to fun: enhancing mathematics engagement with AI-powered tools.

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Abstract. Mathematics education often encounters challenges related to low participation rates, high levels of math phobia, diminished motivation and enjoyment among learners. Drawing on theories of motivation and engagement, this paper explores the transformative potential of integrating Artificial Intelligence (AI)- powered tools into mathematics education to address these issues. A pilot study was conducted with $N$ = 50 postgraduate students utilizing a pre-test and post-test between subject design with one group using an AI- powered assessment tool and the other using traditional assessment methods to measure changes in enjoyment, participation, and mathematics phobia. Compared to pretest, it was deduced from the findings that students in both groups showed statistically significant positive shifts in enjoyment, participation, and math phobia post-test. While no statistically significant differences were observed between the AI and traditional assessment groups, trends suggest that the AI group experienced slightly greater improvements in enjoyment and participation. These promising results warrant further research with a larger sample to confirm these findings and explore the potential benefits of AI-powered tools for fostering a more engaging math learning environment.

**Keywords:** AI-powered tools; mathematics phobia; artificial intelligence; motivation; enjoyment; assessment

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## Runge-Kutta Like Method for the Solution of Optimal Control Model of Real Investment and Fish Management

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Abstract. A one step linear multistep method with highbrid point is transformed into Runge-Kutta Like Method (RKLM) using Daftardar-Gejji and Gafari series, based on Patade and Bhalekar approach. Stability properties of the RKLM is tested and found to be stable and convergent. Forward-backward sweep algorithms for the RKLM are written, and MATLAB code for the implementation of the RKLM also written. The RKLM is used to solve physical optimal control problems on investment and fish management using the forward-backward sweep algorithms via Pontryagin's principle. The results obtained in the first problem shows that, as the investment decreases, the capital first increase in order to increase production before the capital depreciate. The result obtained in the second problem shows that, when the weight parameter of the fish is higher, the harvesting rate get to zero faster, and the total fish mass reach maximum level quicker. The results obtained show that, forward-backward sweep methods together with RKLM can effectively solve optimal control problems.
**Keyword:** First Boubaker polynomials, Fish, Investment, Model, Optimal control problem
**AMS Subject Classification:** 49N05, 65L05, 65L06, 65Z05

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## COOLING ENHANCEMENT OF A COMBUSTIBLE MATERIAL IN A VERTICAL CHANNEL: BY SUSPENSION OF ALUMINIUM OXIDE NANOPARTICLES

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**Keywords:** Combustible material, nanofluid, thermal stability, SCWRM

Abstract. Combustible materials pose a risk of self-ignition and subsequent explosions, leading to significant property damage and loss of lives. The Beirut Lebanon explosion in August 2020 serves as a tragic example, causing numerous fatalities, injuries, displacements, and destruction of infrastructure due to the ignition of an abandoned cargo ship carrying Ammonium nitrate. To tackle this issue, this study focuses on improving cooling of a combustible material during combustion by suspending Aluminum oxide nanoparticles within the material. The approach involves developing a mathematical model describing the behavior as heat transfer of a reactive nanofluid in a vertical channel. The governing equations of the problem are solved using spectral collocation weighted residual method (SCWRM), a numerical technique. The method's efficiency is validated by comparing the obtained results with existing findings. The influence of thermophysical parameters, such as nanoparticle concentration, convective heat loss, as well as thermal stability of the system are comprehensively analyzed. The findings of this study can potentially have practical implications for improving safety measures and preventing property damages and loss of lives.

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## Perturbed Collocation Methods for the Solution of Higher Order Fractional Integro-differential Equations Boundary Value Problems

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Abstract. In this article, two orthogonal polynomial approximate solutions were used to obtain the numerical solution of higher-order fractional integro-differential equation boundary value problems. The perturbed collocation method is introduced to convert the perturbed fractional integro-differential equations into systems of algebraic equations using standard collocation points. The system of algebraic equations using Newton Raphsons method was implemented using MAPLE 18 software. Some numerical examples are presented to illustrate the accuracy and reliability of this approach. The results demonstrate the accuracy and efficiency of the present method. Finally, the results obtained by our new method are accurate and performed better than the results obtained in the literature obtained using the Homotopy Analysis Method.
**Keywords:** Boundary value problems, Chebyshev polynomials, Fractional derivatives, Perturbation term, Power series polynomials, Perturbed Collocation Method, Newton Raphson method.

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## A survey on iterative fixed point theorems in modular function spaces with an application to differential equation

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Abstract. This research presents complementary results with wider appli- cations on convergence and rate of convergence of classical fixed point theory in Banach spaces to the world of the theory of fixed points of mappings de- fined in classes of spaces of measurable functions, known in the literature as modular function spaces. The study gives a comprehensive survey of various iterative fixed point results for the classes of multivalued $\rho$-contractive-like, $\rho$-quasi-contractive-like, $\rho$-quasi-contractive, $\rho$-Zamfirescu and $\rho$-contraction mappings in the framework of modular function spaces. An example is presented to demonstrate the applicability of the implicit-type iterative schemes to system of ordinary differential equations. Furthermore, numerical examples are given to show the rate of convergence of the various explicit Kirk-type and implicit Kirk-type iterative schemes under consideration. Our results complement the results obtained on normed and metric spaces in the literature. Also, our methods of proofs serve as guide to obtain several similar improved results for nonexpansive, pseudo-contractive and accretive type mappings.
**Keywords and Phrases:** Convergence results, explicit Kirk-type iter- ative schemes, fixed point, implicit Kirk-type iterative schemes, multivalued mappings.
2020 AMS Subject Classification: 47H09, 47H10 hakewe@unilag.edu.ng

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## Dependency of Solute Flux on Thermal Flux in Double-Diffusive Convection of Ammonia Prandtl-Eyring Nanofluid: A Predictive Study via RSM and SQLM

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Abstract. Efficient management of heat and mass heating/cooling for mixture exhibiting different diffusivities with thermal and mass transfer enhancement remain eminent across engineering and biomedical designs. As such, this report presents the kinetic liquid (Prandtl-Eyring Fluid, PEF) conveying Ammonia-PE () nanofluid over an inclined semiinfinite vertical plate. Mathematically, a generalized nanofluid model (Buongiorno?s) incorporating dissipative heat and the Dufour effect is modeled to enhance mixed convection dynamics in the inclined geometry. To investigate the model solution, a robust and efficient numerical scheme, Spectral Quasi Linearization Method (SQLM) is utilized, while statistical analysis, Response Surface Methodology (RSM) is employed to predict and model the flow formation, with special consideration given to the dual-parameter interaction. The choice of Ammonia nanoparticle finds it application in many biological processes and serve as a precursor for amino acid and nucleotide synthesis. The parameters of interest include, the (thermal Biot number), (Eckert number), (PEF constant), and (inclination angle). Results identified that, higher values of , , , and lower levels of best predict higher resistance between the solid surface and the fluid particles.

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## ALGEBRAIC MODEL FOR PREDICTING ECONOMIC GROWTH IN NIGERIA: A DATA-DRIVEN APPROACH

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Abstract. This paper proposes an innovative algebraic model for forecasting economic growth in Nigeria. Leveraging historical economic data and employing advanced mathematical techniques, the model aims to provide accurate predictions and insights into the factors driving economic development in the country. The study contributes to the field of economic modeling by offering a novel framework tailored to the specific context of the Nigerian economy.
**Keywords:** Algebraic model, Economic growth, Nigeria, Data-driven approach, Forecasting, Mathematical modeling

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## The Artificial Intelligence-based Tools in Teaching and Learning of Physics

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Abstract. The traditional teaching methods has a challenge of being ineffective in helping leaners to comprehend some complex concepts in physics. However, the artificial intelligence (AI) based tools appeared to be promising in tackling some the challenges within the physics education sector. Therefore, this research aims at exploring the available AI-based tools that can be effective in solving the current glitches in the field of physics education. The study will further identify and discuss the benefits and challenges of implementing AI-based tools in the teaching and learning of physics in the Nigerian education system. A systematic Literature review will be conducted through the most recognized academic data bases to obtain relevant information for this research. **Keywords:** Artificial intelligence-based tools, Physics education, Effective teaching and learning, Nigerian Education system.

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## THE STABILITY ANALYSIS OF MULTIPLE ORDER RATIONAL INTEGRATORS FOR THE SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS.

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Abstract. In this research, we implement the basic formulas of the multiple order rational integrators for the solution of ordinary differential equations. The Region of Absolute Stability (RAS) of the various order of the rational integrator is examined. The stability analysis of the method was carried with the use of MAPLE-18 and MATLAB softwares to obtain the Jordan Curves. It was discovered that the various methods are all A-Stable, and that the regions of absolute stability of the different integrators are in the entire left - half of the complex plane.
Keywords and Phrases: Rational integrator, stiff, singular and oscillatory problems, stability function and Region of Absolute Stability (RAS)

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## Prediction Variance-Based Efficiency Criteria for Exploration of Variations of Partially Replicated Response Surface Designs

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Abstract. Partial replications of the cube (factorial) or the star (axial) components in the exploration of regression-based response surface designs, especially the central composite designs (CCD) improve the quality of the designs for experimental purposes. To minimize the prediction variance (PV) of the design, the G- and V-efficiency criteria are the efficiency criteria of choice. By replicating the factorial component of the CCD times and the axial component, times, , this study presents new computational techniques for the G- and V-efficiency criteria for spherical and cuboidal regions of the CCD. Partial replications the factorial and axial portions of the CCD give a new configuration of the extended design matrix, , thereby modifying the dispersion matrix, and the corresponding inverse, for a k-factor CCD. The matrix algebra of gives the prediction variances, which are scaled by N and divided by to obtain the G-efficiency criterion, $N$ = number of runs, $p$ = number of model parameters. Normalizing the integrated scaled prediction variance using the volume of the design space, , gives the V-efficiency for partially replicated CCD. For $k$ = 3−10 factors, numerical results are presented for different placements of the star points.
Keywords: design space, matrix algebra; prediction variance; replication; star point

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## GOLDEN RATIO ALGORITHMS FOR SOLVING QUASIMONOTONE VARIATIONAL INEQUALITIES

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Abstract. In order to solve quasimonotone variational inequality problems in the framework of Hilbert spaces without the knowledge of the Lipschitz constant, we propose the golden ratio technique in collaboration with the subgradient extragradient technique. The approach employs a novel non-monotone step-size rule. A weak convergence result of the proposed method is obtained under some mild conditions on the control parameters. condition. Finally, we apply the result obtained to image restoration problems and we compare our proposed iterative algorithm with alternative algorithms in the literature. Keywords: Golden Ratio; variational inequality problem, subgradient extragradient method and quasimono- tone operator.

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## DERIVATION OF AN APPROXIMATE FORMULA FOR FRACTIONAL DERIVATIVES USING CHEBYSHEV SERIES EXPANSION

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Abstract. This paper presents the approximate formula derivation for fractional derivatives. The Caputo sense of the fractional derivative is described by using Chebyshev Series Expansion. The process reduces a system of fractional derivatives (SFDs) to an algebraic equation system by using the properties of Chebyshev polynomials. This approach is based on Chebyshev approximations. A particular focus is on analyzing the convergence and estimating the error of the method that is being described. The techniques present a potentially useful tool for resolving numerous linear and non-linear fractional derivative problems. some numerical and analytical examples are provided to show the applicability of the suggested approach.
**Keywords: Shebyshev Aproximation, Fractional derivatives, Caputo fractional derivative, Linear and non-linear fractional derivatives.**

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## Waves on a Rotating Corrugated-Impedance boundary Material Influenced by Thermal Source and Mechanical Force

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Abstract. The current work envisages on the Mathematical modeling of surface waves on a rotating homogeneous fibre-reinforced half?space influenced by thermal source, magnetic field and mechanical force whilst having the boundary of the solid as a corrugatedimpedance surface. Analytically, the dynamical equations for the rotating corrugated solid half space under the influence of the considered physical phenomena of thermal source, magnetic field and mechanical force are derived. The harmonic approach of wave analysis is conceptualized and utilized. This gave rise to the development of the components of displacements and stresses on the material after employing dimensionless parameters in the equations of motion and in hitherto the Green-Lindsay theory of thermo-elasticity where two thermal relaxation time parameters are inculcated in the heat conduction equation. We observed that these parameters of the physical phenomena have various effects on the displacements of the surface waves on the material. Hence, this study should be of great value in examinations involving seismic models and solutions for surface wave generation in grooved-impedance

boundary of a magneto-thermo-fibre-reinforced medium. Keywords: Magneto-thermo-elasticity, homogeneous material, rotation, grooved-impedance boundary, mechanical force.

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## Elevating Nigeria's Future: Harnessing the Power of AI for Sustainable Growth and Inclusive Development

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Abstract. The Nigerian economy and society could undergo significant transformations in severalareas as a result of the cutting-edge technology known as artificial intelligence (AI). Security, energy, healthcare, education, and agriculture are among the industries that stand to gain greatly from the use of AI. However, the adoption and application of AI in Nigeria are not without serious risks and obstacles in addition to its promise. This essay seeks to examine how Nigeria might successfully use artificial intelligence (AI) to attain equitable and sustainable growth while managing the potential and problems that come with its application. This study examines Nigeria's present level of AI development and application while identifying the main factors promoting and impeding AI adoption. It also proposes a comprehensive structure for AI governance and policy that guarantees a balance between accountability and innovation. Acknowledging the ethical, legal, social, and technical ramifications of artificial intelligence, the article underscores the significance of tackling these issues to foster confidence and establish a conducive atmosphere for AI's flourishing. This article also includes case studies of successful AI implementations in Nigeria and other nations, along with several best practices. These illustrations show how AI may support equitable growth and advance national development goals. Through the utilization of these findings, Nigeria can modify and execute customized AI tactics that correspond with itssocio-economic environment. Finally, this study offers suggestions and recommendations for future directions for AI practice and research in Nigeria. It highlights the necessity of developing industrial, government, and academic cooperation, as well as building capability and creating an infrastructure that will facilitate the implementation of AI. Nigeria may fully realize the potential of AI by adopting it ethically and strategically, thereby influencing the course of inclusive progress and sustainable development in the future.

**Keywords: Artificial Intelligence, AI Adoption, AI Governance, Sustainable Growth, Inclusive Development, Nigeria.**

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## FRACTIONAL EPIDEMIC MODEL OF EBOLA VIRUS VIA CAPUTO-ORDER DERIVATIVE

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Abstract. Many new definitions of fractional order derivatives have been proposed and used to develop and analyze mathematical models for a wide variety of real-life problems. The advantages of memory, history, or nonlocal effects of fractional order derivatives motivated this research work. Therefore, in this paper, we extended mathematical models that were based on integer order derivatives to fractional order derivatives, we formulate and analyzed a fractional mathematical modelling of dynamics of Ebola epidemic which includes both vaccination and quarantine via Caputo sense. The existence and uniqueness of the solution of proposed FODE are established through the fixed-point theory. The numerical results and simulations of the extended fractional order mathematical model where explored in Caputo sense.

. **Keywords:** Caputo fractional order derivative; fractional differential equation; Ebola Virus; fixed point theory.

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## ON SOLUTION OF SCALAR FIRST ORDER STOCHASTIC DIFFERENTIAL EQUATIONS VIA SEMI-IMPLICIT MILSTEIN METHOD

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Abstract. This paper examined the solution of scalar first order stochastic differential equations (SDEs) with regard to Balck-Scholes option price model (BSOPM) commonly used in financial setting. Two forms of this model have been considered; they include the form where the drift function is greater than diffusion function and the form where the diffusion function is greater than drift function. The numerical solutions of the SDEs were calculated using semi-implicit Milstein method. Having calculated the exact and numerical solutions of the models, the absolute errors were determined. The performance of the method was compared using mean absolute error (MAE) criteria. The strong order of convergence (SOC) for the method was also calculated to determine its accuracy. To know how best the method approximates the SDEs, the SOC obtained was compared with that of the existing methods such as explicit Euler-Maruyama, Milstein and strong order one Runge-Kutta Methods. Graphical solutions were obtained for the method using two step-sizes.
**Keywords:** Scalar First Order Stochastic Differential Equations, Black-Scholes Option Price Model, Euler-Maruyama Method, Milstein Method, Semi-Implicit Milstein Method, Explicit strong order one Runge-Kutta Method, Mean Absolute Error, Strong Order of Convergence, Graphical Solution.
Mathematics Subject Classification: (2020): 65C30, 65L05, 65L06.

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## Extragradient-type algorithm for zeros and fixed point problems in Banach spaces

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Abstract. In this paper, we introduce a new hybrid extragradient-type algorithm for approximating an element in the set of common solutions of equilibrium problems and common fixed points of family of Bregman demigeneralized mappings which is also a common zero of the sum of maximal monotone and Bregman inverse strongly monotone operators in the setting of reflexie Banach space. Strong convergence of the proposed algorithm to a solutions of the said problems is established which improves and generalizes many recently announced results in the literature.
**Keywords:** Equilibrium problem, Maximal monotone operator, Bregman inverse strongly monotone operator, Bregman demigeneralized mapping.

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## The Effect of Non-Isothermal Flow in a Cylindrical Channel

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Abstract. The analytical solution of Non-Isothermal flow in a cylindrical channel was considered herein. The channel flow was taken to be axi-symmetric. In this study, the velocity temperature of the flow had no-ship boundary condition, whereas the mass concentration had non-zero position constants on the boundary. The flow problem in a cylindrical channel adopted the method of Frobenius and method of Undetermined Coefficient to obtain the three analytical solutions for velocity, temperature and mass concentrations. Finally, the analytical solutions were analyzed graphically to study the effectiveness of Non-Isothermal flow in a Newtonian fluid within the cylindrical channel.
**Keywords:** Velocity, temperature, concentration, cylindrical and non-isothermal.

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## INTEGRATING ARTIFICIAL INTELLIGENCE AND DIGITAL ECONOMY CONCEPTS INTO MATHEMATICS EDUCATION: A SYNERGISTIC APPROACH FOR FUTURE-READY SKILLS

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Abstract. This paper explores the integration of artificial intelligence (AI) and digital economy concepts within mathematics education, aiming to equip students with futureready skills. Traditional mathematics education is enhanced by incorporating AI algorithms, data analysis, and digital economic principles. The paper discusses the pedagogical strategies, challenges, and opportunities associated with this integration. It emphasizes the importance of fostering a seamless connection between mathematical reasoning, AI technologies, and digital economic frameworks to prepare students for the evolving demands of the workforce. Case studies and practical implementations in educational settings are presented to demonstrate the effectiveness of this synergistic approach. The paper concludes with implications for curriculum development and the broader impact on shaping a workforce adept at navigating the complexities of a digitally-driven economy. **Keywords:** Mathematics Education, Artificial Intelligence, Digital Economy, FutureReady Skills, Pedagogical Strategies, Curriculum Development, Data Analysis, Workforce Preparedness.

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## Amortization Strategy and Effect on Annuity Contracts in a Defined Contribution (DC) Pension Scheme during the Wealth Generation Stage

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Abstract. A policy on Pension Annuity contracts in a DC scheme, during the wealth generation process is developed. The fund investor invested in a stock (a risky asset), modeled with C.E.V process and Money in the account (a riskless asset), modeled with constant interest rate. Here, the Pension Fund Administrator (P.F.A) considered and investigated the relevance/ significance of extra stochastic contribution, as a form of amortization fund to his investment. The constrained optimization program was developed and transformed into a nonlinear partial differential equation, using the associated Hamilton Jacobi Bellman (H.J.B) equation. The explicit solution of the constant relative risk aversion (C.R.R.A) is obtained, using Legendre transform, dual theory, and change of variable methods. Theorems are constructed and proved on the pension wealth investment strategy and the optimal utility function. It is established herein, with the optimal utility function that the extra stochastic contribution is of no physical significance to the satisfaction of the investor, due to its absence in the optimal utility function at the terminal stage.
?**Key words:** Amortization, Annuity, C.R.R.A; D.C; C.E.V, Wealth Generation

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## LATTICE-BASED CRYPTOGRAPHIC SCHEME FOR SECURE BLOCKCHAIN DEVELOPMENT AND FINANCIAL SYSTEMS IN NIGERIA

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Abstract. This research proposes the adoption of lattice-based cryptographic schemes for enhancing the security and resilience of blockchain development and financial systems in Nigeria. Lattice-based cryptography offers robust protection against quantum attacks and can address emerging security challenges faced by traditional cryptographic algorithms in the context of blockchain technology. This paper explores the potential benefits, challenges, and implications of integrating lattice-based cryptographic techniques into the Nigerian blockchain ecosystem, with a focus on improving security, scalability, and trust in financial transactions. Keywords: Lattice-based cryptography, Blockchain technology,
Financial systems, Security, Quantum resistance, Nigeria

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## Games Theory and its Application to Real Life Situation:A Case Study of Delta State Police Divisional Head Quarters, Abraka.

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Abstract. This paper discussed Games Theory and its application to real life situation. Emphasis was on the application of Games Theory to check some unlawful practice and even suspects under investigation such as multiple (or false) confession from suspects, use of physical violence during investigation and wrong conviction of suspects. This paper uses the prisoner?s dilemma method, a situation where two suspects apprehended for a crime are held in separate rooms and cannot communicate with each other. Also, quantitative method was employed to examine the research problem effectively. Data collection that aided this research were sourced through systematic sampling from previously existing works from authors. This research was developed to check some sharp unlawful Police practice and even from suspect under investigation as well as employing the technique of Game Theory as a way of obtaining truth from suspects, administering justice speedily and a strong avenue for prison decongestion due to the alarming conditions in most Nigerian Prisons. Keywords: Game theory, Quantitative technique method, prisoner dilemma method, systematic sampling.

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## ALGORITHMS FOR APPROXIMATION OF FIXED POINTS OF SET-VALUED PSEUDOCONTRACTIVE MAPPINGS.

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## GEOMETRICAL STRUCTURE OF ABELIAN GROUP ON ELLIPTIC CURVES

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Abstract. An elliptic curve is a cubic polynomial in two variables in which there is at least one rational solution. The set of all rational solutions to an elliptic curve is known to be an abelian group which is finitely generated. An essential tool in the study of an elliptic curve is the fact that there exists a composition law on the set of rational points on , which gives a group structure. The concept points addition on elliptic curve was used to established the group structure on the sets of points on an elliptic curve. It was shown that these points addition forms an abelian group.

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## A Nonlinear $SDC_1C_2$ Mathematical Model for the Effect of Diabetes Population on a Community

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Abstract. This work presents a susceptible, diabetes without complications, diabetes with minor and major complications mathematical model to study the effect of the diabetes population on the population dynamics of a community. The model is a system of four linear differential equations of first order. The solutions of the model were found to exist and are positive by positivity analysis. The diabetes-free and diabetes-endemic equilibrium points are found to be locally stable using the Routh-Hurwitz Stability Criterion for a degree n-polynomial. The numerical simulation of the model was carried out using various scenarios, and the results were presented. The results show that the diabetes population in a community has a great effect on the population dynamics of the community.
**Keywords:** Diabetes, Mathematical Model, Stability, Simulation

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Abstract. In this paper, it is our purpose to study implicit and explicit iterative algorithm for approximation of fixed point of multivalued pseudo- contractive mappings in the setting of uniformly smooth real Banach space. Strong convergence of the sequences generated by these iterative algorithms are proved. The theorems obtained generalize and improve related results of several authors. Our method of proof is of independent interest.

## Algebraic Study of the Variant of Trioids

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Abstract. A trioid, is a nonempty set equipped with three binary operations (resp. left, right and middle products) satisfying 8 axioms. Let , be a trioid and . Define a binary operation on by for all , the ordered pair is called the variant of the trioid. Over the years the algebraic study of trioid has remain profound with application in related structures such as semigroups, dialgebra and trialgebras. In this work, we considered a variant semigroup analogue of trioid and explore some interesting algebraic properties.

**Keywords:** Semigroup, Dimonoid, Trioid, Variant, products, binary operations, Trialgebra

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## An Economic Order Quantity Model for Repaired Non-Instantaneous Deteriorating Items with Two-phase Demand Rates and Time-dependent Linear Holding Cost

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Abstract. In this research, an EOQ model for repaired non-instantaneous deteriorating item with two components demand rates and time-dependent linear time holding cost has been established. The demand rate is assumed to be time dependent quadratic before deterioration sets in after which it is considered as constant. Optimal cycle length and order quantity are determined so as to minimise total variable cost. The necessary and sufficient conditions for the existence and uniqueness of the optimal solutions are provided. Numerical examples are given to demonstrate the application of the model. Finally, sensitivity analysis of some model parameters on the decision variables have been carried out and the implications are discussed. In the discussions, suggestions toward minimizing the total variable cost of the inventory system are given. Keywords: Economic Order Quantity, Repaired Non- instantaneous deteriorating item, Two-phase demand rates, Linear Holding.

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## A Study on Soft Semigroups

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Abstract. Hybrid algebraic structures especially fuzzy semigroups and rough semigroups attracted interest of various researchers in recent years. In this paper, we study another type of hybrid algebraic structure viz soft semigroups. The paper open up some new tools to study semigroups.

**Keywords:** Soft sets, soft semigroups, soft morphisms, soft regular semigroups

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## EFFICIENT HYBRID BLOCK NUMERICAL METHOD FOR THE SOLUTION OF STIFF INITIAL VALUE PROBLEMS AND OSCILLATORY DIFFERENTIAL EQUATIONS

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Abstract. A highly effective hybrid block technique has been devised for numerically integrating first-order stiff ordinary differential equations in initial value problems, as well as for handling oscillatory differential equations. This method computes two solution approximations alongside two off-step points at each integration step, achieving remarkable sixth-order accuracy. By adjusting a parameter ? within the range (-1, 1), various sets of formulas can be derived from this method. Upon selecting a specific value for ?, the method's consistency, zero stability, and convergence are confirmed. The absolute stability region is depicted graphically, illustrating that the method is A-stable. Through comparative numerical experiments, the efficiency of this novel method is demonstrated when compared with certain existing implicit numerical block methods. Notably, the developed approach exhibits superior accuracy over certain existing algorithms while remaining competitive in terms of execution time.

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## Geometric Properties of Univalent Functions Involving Legendre Polynomials

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Abstract. Legendre polynomials, which are orthogonal polynomials that arise in the solution of many physical and mathematical problems with some other special functions, have recently gained increased importance in the study of geometric function theory. The aim of this paper is to derive the coefficient estimates and investigate the Fekete - Szego problem for a new subclass of univalent functions associated with Legendre polynomials.

**Keywords:** Univalent Function, Coefficient Estimates, Fekete - Szego Inequalities, Legendre Polynomials.

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## Artificial intelligence and Animation for Effective Teaching and Learning of Mathematics

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Abstract. The paper explores the integration of artificial intelligence (AI) and animation to enhance the teaching and learning of Mathematics. It delves into using animation through Artificial intelligence to teach primary and secondary Mathematics in Nigerian schools. The literature review provides a comprehensive overview of the existing research on artificial

intelligence and its applications in Mathematics education. The methodology outlines animation, data coding, and analysis techniques used to categorize application domains, sample groups, research methods, roles of AI, adopted algorithms, and research issues in artificial intelligence for Mathematics education. The discussion analyzes the findings from the study. It emphasizes the need to encourage Mathematics education researchers to leverage AI technology in their studies. The paper suggests leveraging AI applications for personalized guidance in Mathematics education. It recommends exploring Educational Data Mining (EDM) to understand factors affecting student learning outcomes. Additionally, it proposes adopting modern AI technologies like deep learning and animation for teaching for enhanced teaching and learning of Mathematics.
**Keywords:** Artificial Intelligence (AI), Animation. Mathematics, Teaching, Learning, Algorithm

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## INVESTIGATING STOCK MARKET VOLATILITY AND OTHER VOLATILITY SOURCES USING STOCHASTIC VOLATILITY MODELS.

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Abstract. The stock market is exposed to risk due to the movements in market variable such as volatility. Economic recession, monetary policy, pandemic etc can induce volatility in the market. The Heston and Black Scholes models are used in predicting the stock prices with some studies deriving a closed form solution. However, this current study focuses on predicting the values of portfolio with a combination of recession Free State and recession non-free state based on the prevailing economic condition. A comparison was made between the models having volatility with a recession free state and a recession non free state. Result shows that the Heston model which is a Stochastic Volatility Model captures volatility better than the Black ?Scholes model. Therefore, forecasting future stock price volatility provides vital information to the investors and enables decision making. Numerical illustrations were shown in concrete setting.
**Keywords:** Volatility, Heston, Black- Scholes, Stochastic Volatility Model

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## Global Stability and Bifurcation Analysis of HIV/AIDS Epidemic Model with PrEP

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Abstract. This study presents the global asymptotic stability and bifurcation analysis of a six com- partmental HIV/AIDS model with constant inflow of infected immigrants and the introduction of Pre-Exposure Prophylaxis (PrEP) for individuals at substantial risk of acquiring the infection. we consider the global asymptotic stability using the Volterra type Lyapunov functions and the bifurcation analysis using the centre manifold theorem. Analysis shows that the model exhibit a forward bifurcation and a small influx of infected persons makes the disease endemic in the population. **Keywords:** Bifurcation, Immigrants,Lyapunov functions, Pre-Exposure Prophylaxis (PrEP),Volterra type.

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## ITERATIVE APPROXIMATION OF THE RANDOM FIXED POINT OF SOME GENERALIZED RANDOM OPERATORS WITH APPLICATIONS

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Abstract. The purpose of this study is to develop some novel fixed point iteration processes to approximate the random fixed point of certain generalized random operators in probability spaces. We construct some numerical examples to validate our results. Furthermore, we apply our results in solving some nonlinear integral equations of Hammerstein type. Our results represents a generalization of some deterministic fixed point results.

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## On the Dynamical Model and Analysis of Cholera Disease Transmission and Its Seasonality

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Abstract. We proposed a deterministic model to capture the transmission dynamics of Cholera disease in this work. We further modified the model to incorporate control strategies like hygiene consciousness and awareness. Also, the seasonality behaviour of the disease was captured to make the model more realistic. Dynamical analysis was conducted on the proposed model via stability analysis of the fixed points with respect to the Reproduction Number R0. We were able to show that the disease free equilibrium is locally and globally asymptotically stable if R0¡1. The analytical solution of the model was obtained using Homotopy Perturbation Method (HPM) and the simulations of the model show that, the combination of control measures like hygiene and vaccine (double dose) is the most effective way to combat the scourge of Cholera.
**Keywords:** Awareness, Cholera, Hygiene Consciousness, Vaccine, Reproduction Number

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## ANALYTICAL APPROXIMATE SOLUTION OF NONLINEAR FRACTIONAL ORDER DIFFERENTIAL EQUATIONS

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Abstract. In this paper, Shehu Transform Homotopy Analysis Method (STHAM) is proposed for the solution of non-linear fractional order ordinary and partial differential equations. The interpretation of fractional order derivative is done in Caputo sense, while the non-linearities encountered are handled by exploiting the homotopy derivatives. The approach reduces the volume of computations unlike some other methods in the literature. The proposed method produces exact solution when such exists in closed form. Keywords: Shehu Transform, Caputo Derivative, Homotopy Derivative, Control Parameter, Embedding Parameter, Deformation Equations.

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## SOME FIXED POINT RESULTS FOR CONTRACTION MAPPINGS IN MODULAR METRIC SPACES

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Abstract. The purpose of this paper is to study the existence of ?xed points for contractivetype maps in the setting of modular metric spaces. The notion of a modular metric on an arbitrary set and the corresponding modular spaces, generalizing classical modular over linear spaces like Orlicz spaces, were recently introduced. In this paper we investigate the existence of ?xed points for modular contractive mappings in modular metrics paces.
**Keywords:** ?xed point; modular metric spaces; contraction mapping

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## Factorization in Phase-Space Finite Geometry and Weak Mutually Unbiased Bases in Finite Quantum Systems

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Abstract. Factorization in phase-space of a finite geometry with variables in integer modulo m is discussed. Using Chinese remainders theorem, lines in the geometry are factorized as products of its sublines. Large dimensional finite geometry $G(m)$ is expressed as products of its subgeometries . For $k \mid m$, $Z_m$ is a ring, hence, an existence of a partial ordered relation is found with $Z_k$ as partial ordered. A subsystem is embedded in a finite quantum system A non-prime-dimensional finite geometry has its duality with bases in finite Hilbert space of a quantum system. It is confirmed that the union and intersection of any (at least) two prime factors geometry form a lattice.
**Keywords:** Non-near-linear Finite Geometry, Partial Ordering, Factorization.

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## Block Methods of Equal Order for Solving Second Order Delay Differential Equations

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Abstract. Block methods have been developed over the years to obtain the numerical solution of various types of differential equations, including delay differential equations. However, when computing the order of these block methods, the introduction of off-grid points may result in a certain block method having same order as one developed using grid points only. This article investigates the effect of using grid and off-grid points to develop block methods on the accuracy in terms of absolute error, stability and check if there is significant impact on the computational time and function evaluations. Thus, the more optimal approach of both methods is presented in this article for the solution of second order delay differential equations.

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## A STUDY ON GENERALIZED JORDAN REVERSE DERIVATIONS AND TRIPLE REVERSE DERIVATIONS OF SEMIPRIME RINGS

In this paper,represent a semiprime ring.: An additive mapping is called left reverse centralizer of if and also is said to be left triple reverse centralizer of if for all A mapping is called Jordan triple reverse derivation, if for all Using the above proposed definitions, we prove that a generalized reverse derivation is a generalized derivation and a generalized Jordan triple reverse derivation is generalized triple reverse derivation. We also give some new examples in order to justify some conditions.

**KEYWORDS:** Semiprime ring, derivation, generalized reverse derivation, generalized Jordan triple derivation, left centralizer.

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## Dynamics of a Lotka-Volterra Prey-Predator Model Using Intrinsic Lyapunov Method

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Abstract. This paper investigates a Lotka-Volterra prey-predator model incorporating prey refuge and predator cannibalism. A new method, called the intrinsic method, is proposed in this study to derive suitable Lyapunov functions for a certain class of non-linear system expressed in state variables and parameters defining the dynamic characteristics of the prey and predators species as two first-order nonlinear differ- ential equations which possess a functional relationship to the differential equations under study. Suitable hide out for prey and moderate cannibalism among preda- tors can lead to the coexistence of both species in a stable state. Otherwise, one of the two could be driven to a permanent extermination. Simulation results are given to support our findings on the dynamic behaviours of the system.
**Key words:** Prey, Predator, Intrinsic Lyapunov Method, Lotka-Volterra Model, Stability
2000 Mathematics Subject Classification: 34C27, 34D23, 34C25.

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Abstract. The triangle inequality plays an important role in the characterization of metrics and other metric-types in literature. The simple idea of substituting addition with a binary operation gives birth to interesting concepts in analysis and calculus. In this talk, we discuss some new metric-types, the topologies they induce, polygon inequalities, and some applications in optimization, geometry, and the theory of fixed points and generalized series.
**Keywords:** O-metric spaces; polygon inequalities; generalized series; Banach Con- traction Principle.

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## Intuitions around the metrical triangle inequality

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## STRONG AND WEAK CONVERGENCE THEOREMS FOR SOLUTIONS OF EQUATIONS OF HAMMERSTEIN-TYPE

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Abstract. In this paper, it is our aim to introduce a new iterative algorithm for approximation of a solution of an equation of Hammerstein-type. The pro- posed scheme does not involve computation of inverse of operators under study; it does not involve passing through computation of a certain set that must con- tain a solution of the equation of Hammerstein-type before convergence takes place. The proposed scheme requires only one parameter satisfying verifiable mild conditions. Moreover, the mappings involved are neither defined on com- pact subset of the space under study, nor assumed to be angle bounded. Our theorems complement several results that have been obtained in this direction.

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## Is there any correlation between Teachers' method of teaching and the impact on Student's Academic Achievements in school? A viewpoint from Senior Secondary Mathematics in Taraba state.

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This study examined the correlation between teacher?s method of teaching and the impact on Student‘s Academic Achievements in Senior Secondary School Mathematics in Taraba state. Nigeria. The study adopted simple survey design. A review of related literature to the study was carried out. Data collected and collated were based on a set of Scales in the Questionnaire Mathematics-Teachers-Method of Teaching- Related Scales (MTMTRS) consisting of twenty four (24) items and was administered to eighteen (18) public schools across the State; three LGA from each senatorial zone of the State, consisting of nine (9) LGAs with sample size of 900 students. These instruments were validated and found to be reliable at 0.89 and 0.91 respectively. One hypothesis were generated and tested at 0.05 significant level and Data were analyst using Chi-square and Pearson product moment correlational Statistical Method through SPSS statistical Software computer package. The Null hypothesis was rejected and the alternative upheld. Findings revealed that there is significant strong positive correlation between teachers? methods of teaching and the impact on Students Achievement in senior secondary school Mathematics. Hence from the findings made, the researcher recommend among others that; the school Authorities, industrialists, parent?s Government and private individuals should encourage the teachers with good teaching methods that would promote learning in schools; Curriculum planners should make the employment of teachers with good method of teaching in schools compulsory at all levels of education to enhances students performances

**KEYWORDS:** Questionnaire, Student‘s Achievements, Method of teaching, Pearson product moment correlation, Chi-square, SPSS.

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## On Henstock-Kurzweil-Stieltjes-◇-Double Integrals of Gronwall-Bellman Type Inequalities for Interval-Valued Functions on Time Scales

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Abstract. We present some results for Gronwall type inequalities of interval-valued functions on time scales. Some of the properties of Henstock-Kurzweil-Stieltjes integrals and Gronwall-Bellman in- equalities are extended to the concept of interval-valued functions on double time scales. These results are applicable in the study of uniqueness of solution of interval-valued integro-differential equations.

**Keywords:** Double integral, Henstock-Kurzweil integral, Gronwall inequality, Time scales, interval-valued functions 2020 MSC: 26A39; 35A05; 26D15; 34N05.

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## Managing Infectious Diseases Under Quiescence

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In this work, quiescence is added to the Susceptible-Infectious-Recovered (SIR) model with demography. In order to investigate consequences of quiescence in the infection process in more depth, we use stochastic simulations on the stochastic version of model that we built. This method provides a more accurate picture of the dynamics of infectious diseases by taking into consideration the inherent randomness in the disease processes. We examine the effects of quiescence on the number of infected people using simulations. The results, presented in histograms depicting the distribution of infected individuals, reveal a notable trend: the mean

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number of infected individuals is higher when quiescence is incorporated into the dynamics. These finding emphasizes the dynamic influence of quiescence on infectious disease spread. The higher mean number of infections during periods of quiescence highlights the need for public health strategies that are flexible enough to focused interventions during these times to reduce the possibility of an increase in infections.

**Keywords** Parasite quiescence; Managing; Model; Stochasticity; Public Health; Prevention.

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## Asset Value Function and its Rate of Returns on the Analysis of Capital Market Investments

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Abstract. This study considered the wealth of corporate investors with the application of stochastic systems. The resulting problem was solved analytically by adopting ito?s Lemma. The sufficient and necessary conditions were obtained to measure independently the asset values of corporate investors. However, the impression on each investment solution of investors was analyzed as it affects financial markets. Also, the effects of significant parameters of stochastic variables were discussed in accordance with each corporate investors

**Keywords:** Asset values, stock market, investors, stochastic analysis and Finance.

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## STABILITY ANALYSIS AND OPTIMAL CONTROL OF EXPLOITED POPULATION

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In this paper, a model for controlling predation among interacting species is formulated, stability analysis of the model was examined and four steady states which are locally stable under some conditions were obtained by using eigenvalue analysis. The optimal control strategies were then established by using the Pontryagin?s maximum principle. The simulations output result shows that when control is applied to the model, the amount of predation was reduced and the maximum sustainable yield was actualized for both prey and predator populations.

**Keywords:** Stability, Optimal control, Predation, Pontryagin?s maximum principle, Eigenvalues

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## Optimized Hybrid One-Step Method for Direct Integration of Second-Order Initial Value Problems

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Abstract. This paper presents a novel optimized hybrid one-step method for efficiently solving second-order initial value problems (IVPs). The proposed method combines the advantages of both classical one-step methods and implicit multistep methods, resulting in high accuracy and efficiency. The key feature lies in the optimized selection of hybrid point within the integration step, where a combination of interpolation and collocation techniques is employed to approximate the solution and its derivatives. The core contribution of this work is the optimization process, which minimizes the local truncation error of the method. This optimization is achieved through a carefully designed algorithm that iteratively adjusts the hybrid point based on specific error criteria. This optimization process ensures that the method achieves a desired level of accuracy while maintaining computational efficiency. The proposed method is rigorously analyzed for its convergence, stability, and order of accuracy. Numerical experiments demonstrate the effectiveness of the method by comparing it with existing one-step and multistep methods on various benchmark problems. The results showcase the superior performance of the optimized hybrid method, achieving higher accuracy with fewer integration steps compared to conventional approaches. This work provides a valuable contribution to the field of numerical integration by offering a new, efficient, and accurate method for solving second-order IVPs. The optimized hybrid approach has the potential to be applied to a wide range of applications in science, engineering, and other disciplines.

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## Mathematical Modelling of Rabies in Dog Population Considering Pre- and Post-Vaccinations

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A dynamic mathematical model is constructed to examine possible scenarios for the spread of rabies in dog population. The model mimics two possible scenarios the first is an outbreak of rabies in a population that has not been vaccinated be- fore the beginning of the disease outbreak; and the second scenario is an outbreak of rabies against which the population has been pre-vaccinated. Rabies parameters are derived from epidemiological data by propagating uncertainty in epidemiological parameters onto model predictions using Markov Chain Monte Carlo based sampling methods. It is establihed that if the basic reproduction number is less than unit then the epidemic will pass. Furthermore, the control reproduction number is found to be less than the basic reproduction number (i.e., $R_\phi < R_0$), since $0 < \sigma < 1$, where $\sigma$ is the effectivity factor of vaccine. Also, numerical simulations of the rabies model are carried out and threshold conditions for the eradication of the disease are established.
AMS 2010 Subject Classification: 92B05, 92D30, 34D20

**Keywords:** Mathematical model, Rabies, Vaccination, Reproduction number, Simulation

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## CONSUMER BEHAVIOUR ANALYSIS VIA THE FUSION OF NONLINEAR MATHEMATICAL MODELLING AND BIG DATA ANALYTICS

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Abstract. This study focuses on developing a mathematical model to predict consumer behaviour on social media platforms using big data analytics. It addresses limitations of previous linear model-based approaches by introducing a nonlinear mathematical model with an exponential transformation. The methodology involves collecting data from various social media platforms and cleaning it for quality. Machine learning models such as linear regression, decision tree regression, and random forest regression are employed and evaluated for predictive accuracy using metrics like root mean square error (RMSE) and model comparison. The results show significant differences in consumer behaviour metrics across social media platforms, highlighting the multifaceted nature of user engagement. The integration of nonlinear models, particularly with Decision Tree (RMSE: 1929.1020, Accuracy: 0.99377808) and Random Forest Regressors (RMSE: 2122.0389, Accuracy: 0.993234067), improves predictive accuracy compared to Linear Regression (RMSE: 6373.38372, Accuracy: 0.8682727). The study concludes that advanced predictive models, such as nonlinear models, better capture the complexities of consumer behaviour on social media. It emphasizes the need for evolving methodologies and sophisticated modelling techniques to accurately predict and understand consumer behaviour in digital contexts.

**Keywords:** Prediction, Consumers? Behaviour, Non-Linear Mathematical Modelling and Big Data Analytics

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## Approximation of solutions of Nonlinear problems in Hyperbolic spaces

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Abstract. In this paper, we introduce a new iterative algorithm for approximating a com- mon element of the set of solutions of an attractive point of further 2-generalized 1 hybrid mapping, equilibrium problem and a common zero of a finite family of monotone operators in hyperbolic spaces. We establish strong convergence the- orem under suitable assumptions, and also give numerical example to support our main result. Our results generalize and improve many recent results in the literature.

**Keywords:** Hyperbolic space, Attractive point, equilibrium.

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# Assessing the efficiency of cooling systems utilizing tetra-hybrid nanofluid in solar powered automobiles through numerical analysis

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Abstract. In the situation of escalating concerns over energy reduction, the study presents a comprehensive numerical investigation on the utilization of tetra-hybrid nanofluids, (a novel class of nanofluid comprising four distinct metallic nanoparticles) to enhance cooling performance in solar- powered automobiles. A system of governing partial differential equations incorporating magnetic field and radiation effects within a porous medium is formulated. To facilitate computational analysis, the PDEs are transformed into a system of ordinary differential equations using a similarity transformation approach. The resulted system ODEs were solved numerically using Galerkin method. The result analyses the effect of thermophysical parameters on velocity and temperature profiles. Furthermore, the significant of magnetic field and radiation on skin friction and Nusselt number were analysis. The numerical results demonstrate that tetra-hybrid nanofluids exhibit a substantial enhancement in cooling efficiency compared to conventional coolants. By strategically optimizing these parameters, this innovative technology offers a promising, sustainable solution to the prevailing energy crisis, potentially reducing operational costs and promoting the widespread adoption of solar-powered automobiles.

**Keywords:** Solar-powered automobiles, Tetra-hybrid nanofluid, Galerkin method, magnetic field, radiation.

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## Numerical Evaluation of Adverse Effects of Economic Fluctuations on the Investment Returns of Insurance Industry in Nigeria

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Abstract. The investment landscape in Nigeria is inherently influenced by economic fluctuations that pose substantial challenges and opportunities for investors and policyholders. This paper aims to investigate and provide solutions to the adverse effects of economic fluctuations on the investment returns of Insurance Industry in Nigeria through a numerical evaluation. These adverse effects are capable of resulting into future delay and volatility-noise in the financial market which influences the investment returns of Insurance Industry. These adverse effects are modeled as Advanced Stochastic Delay Differential Equation (ASDDE). The modeled equation is solved using a two-step Hybrid Block Adams Moulton Methods (2HBAMM) with the newly developed mathematical expressions for the evaluations of the delay term and noise term. Numerically, through mathematical demonstration, these adverse effects are expressed by solving some examples of the modeled equation which revealed its financial and economic implications. **Keywords:** ASDDE; HBAMM; Absolute Random Error; Economic Fluctuations; Investment Returns; Insurance Industry
Mathematics Subject Classification 2010: 34K28; 65F30; 90C30; 90C26.

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## Artificial Intelligence and Mathematics Instructional Delivery for Sustainable National Economy in Kano State, Nigeria.

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Abstract. Educators across the globe are assiduously seeking ways to improve instructional delivery methods in order to meet up with needs of this century in general and in particular to promote sustainable development of their respective economy. Without any doubt, incorporation of Artificial Intelligence (AI) is one of the promising approaches in mathematics instruction. This phenomenon has shown great potential to enhance learning outcomes by providing personalized and adaptive learning experiences. Hence, this paper, attempts to examine the impact of AI on mathematics teachers? instructional delivery and techniques to be adopted as well as its potential role in promoting sustainable economic growth. Similarly, the paper will give insights on the possible challenges and opportunities that come with the integration of AI into instructional practices and provide recommendations for future researches in the field. The results of this study will expose how practically AI based mathematics instruction can significantly improve students? achievement and foaster a more sustainable economy in Kano State, Nigeria. Keywords: Artificial Intelligence (AI), Sustainable National Economy, Mathematics Instructional Delivery, development, Mathematics Teachers Awareness and Mathematics Teachers Readiness.

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## Application of Conjugate Gradient Parameter for Real Unconstrained Optimization Problems

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Abstract. Conjugate gradient (CG) method have been utilised to solve nonlinear unconstrained optimization problems due to less storage locations and fewer computational cost in dealing with large-scale problems. In this paper, we present a real life application of spectral PRP CG method in regression analysis, the proposed method is suitably derived from the CG search direction without secant condition. Some benchmark functions with several variables have been use to prove the global convergence properties and satisfies sufficient descent condition. The numerical results are certified by exact line search techniques; the method outperform the prominent least square method.
**Keywords:** Spectral CG Global convergence property; Exact line search; Regression analysis.

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## ON QUASIMONOTONE VARIATIONAL INEQUALITIES

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Abstract. In this talk, we give a brief introduction to fixed point problem (FPP) and varia- tional inequality problem (VIP). Moreover, we introduce a new fixed point iterative method based on golden ratio technique to approximate the solution of VIP with quasimonotone cost operator. Some numerical experiments with performance profile are presented to compare our method with some related methods in the literature. This is joint work with Victor A. Uzor (My PhD student).

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## Order and Convergence Analysis of the New Fixed Coefficient 3-Point Diagonally Implicit Block Backward Differentiation Formula for the Numerical Treatment of Stiff Ordinary Differential Equations

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Abstract. This research explores the utilization of the new fixed coefficient diagonally implicit block backward differentiation formula for solving stiff initial value problems. The study encompasses the determination of the order of accuracy with error constant of the method. The necessary and sufficient conditions for the convergence of the method, namely zero stability and consistency are both met, ensuring the method?s effectiveness. Through a comparative analysis of numerical and theoretical solutions for chosen stiff initial value problems, the impact of convergence criteria becomes evident. Notably, the method

demonstrates improved accuracy as the step length approaches zero. **Keywords:** Fixed coefficient, Stiff IVPs, Order of the method, Convergence analysis, Zero stability and Consistency.

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## Attractive Point Approximation of Noncommutative Nonlinear Mappings in Hadamard Spaces

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In this paper, we first consider the class of further 2-generalized hybrid mapping which is said to include the classes of further generalized hybrid and normally 2generalized hybrid mappings as special cases in the setting of Hadamard spaces. Also, we construct a Halpern type iterative algorithm that approximates to a common element in the solution set of attractive point of two noncommutative further 2-generalized hybrid mappings in the space. The established results improve, extend and generalize many corresponding ones announced in this direction.
**KEYWORDS:** Attractive Points, further generalized hybrid mapping, Nor- mally 2generalized hybrid mapping, further 2-generalized hybrid mapping, Hadamard spaces.

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## Fourth-derivative block methods for directly solving third-order initial value problems of ordinary differential equations.

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Abstract. A new method termed Fourth-derivative Five-step Block Method (FFBM) has been developed, analysed and applied to solve numerical examples. This method helps to solve problems in fluid dynamics, engineering, and other sciences.The FFBM was derived using collocation and interpolation techniques on a power series approximation. Fourth -derivative terms were added at each of the collocating points to create a block method that has a higher degree of accuracy. It was observed that the order of the block method increased with the number of fourth derivative terms introduced into the integration interval. Numerical experiments were conducted to test the FFBM on various numerical examples, including non-linear homogeneous thin film flow (NHTFF) problems and two non-linear initial value problems (IVPs).The results of the experiments confirmed the effectiveness of adding the fourth-derivative term, which helped to improve the order of accuracy of the derived FFBM. The experiments demonstrated that the FFBM method minimized the error and agreed with analytical solutions up to at least seven decimal places. Therefore, this method is essential to use in non-linear numerical computations. **Keywords:** fourth-derivative, power series, non-linear homogeneous, interpolation and collocation
AMS Subject classification: 65L05, 65L06

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## Effect of Nonlinear Buoyancy on Variability in Viscosity and Thermal Conductivity on Steady Mixed Convection Couette Flow and Heat Transfer

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Abstract. In this paper, we investigated effect of nonlinear buoyancy on variability in viscosity and thermal conductivity. The dimensionless governing equations describing the different flow situations have been formulated and solved analytically using Homotopy perturbation method. The influences of the dimensionless flow parameter have been plotted graphically and discussed. During the course of computation, it was found that an increasing viscosity corresponds to the increasing resistance to flow which suppresses the velocity of the working fluid, but decreasing the viscosity triggers a decrease in the temperature of the working fluid. It was also discovered that the momentum boundary layer thickness increased due to the corresponding strengthening of the convection currents caused by increase in the thermal

conductivity and flow velocity increases as well. An increased in mixed convection increases the reverse flow region and the critical value of the mixed convection leading to the flow reversal. Keywords: Couette flow; thermal conductivity; variable viscosity; Homotopy perturbation method; pressure gradient.

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## On Products of $F_h$-convex interval-valued functions for Hermite-Hadamard type Inequalities on time scales

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Abstract. In this paper, some integral inequalities of Hermite-Hadamard type are established and ex- tended for products of $F_h$-convex interval-valued functions on time scales. The results are as well applied to variational calculus on time scales. **Keywords:** Time scales; Hermite-Hadamard; Interval-valued functions; $F_h$-convex; $(F_h(\lambda))s$ -functional.
2020 MSC: 26A39; 35A05; 26D15; 34N05.
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## A Review of some Methods for Handling Singularity Problems in Linear Discriminant Analysis

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Linear Discriminant Analysis is an aspect of Discriminant Analysis that is applicable when the interest is to describe group separation or predict group membership. But for LDA to perform well, some underlying assumptions are expected to be met by the data being treated. When any of these assumptions are not met, LDA will fail to perform. In an attempt to ensure the performance of LDA irrespective of the failure of these assumptions, researchers have been able to propose methods that are robust to the violation of such assumptions. One of such assumption is that the within class scatter matrix should be nonsingular. In this paper, we categorize some methods that have been proposed to handle the singularity problem with a view to elucidate some of their advantages and disadvantages
. **Keywords:** Linear Discriminant Analysis, Violation of Assumptions, Singularity Problems, Robustness, Classification.

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## GENERAL SPLIT EQUILIBRIUM PROBLEMS FOR COUNTABLE FAMILY OF BREGMAN QUASI ASYMPTOTICALLY-NONEXPANSIVE MAPPINGS

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Abstract. Let C be a nonempty, closed and convex subset of a Banach space $E$, we introduce the notion of general split equilibrium problems for an equilibrium bi-functional $\Psi : C \times C \longrightarrow R$ as: find $x^* \in Fix(T)$ with $\Psi(x^*,x) \geq 0$, $\forall\, x \in C$ such that $f(x^*) = 0$, where $f : E \longrightarrow R$ is a non-negative, convex, lower semi-continuous functional and $T : E \longrightarrow E$ is quasi asymptotically-nonexpansive nonexpansive mapping. We study a new iterative scheme for common solution of equilibrium problem, min- imization of a convex function and fixed point of countable family of Bregman quasi-nonexpansive mappings in uniformly smooth and uniformly convex Banach spaces.

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## VALUATION OF EUROPEAN PUT OPTIONS WITHIN A FRAMEWORK OF GEOMETRIC BROWNIAN MOTION AND VOLATILITY MODELS

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Abstract. This paper focuses on the valuation of European put options in a Geometric Brownian Motion(GBM) with uncorrelated stock and volatility. The study considers the impact of changes in volatility, maturity time and market price of volatility risk on option values. GBM stochastic volatility model was used in pricing European put option numerically, since closed form solutions are not available for this model, CrankNicolson and Alternating Direction Implicit (ADI) finite difference schemes are employed for pricing. It was shown that option value in a GBM stochastic volatility model is an increasing function of volatility. The efficiency of the two numerical schemes is compared in relation to their computing time.
**Keywords:** Geometric Brownian Motion, Black-Scholes Model, Alternating Direction Implicit Scheme, Crank Nicolson Scheme, European Put Option

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## Multiple Optimal Control Strategies in a Trypanosomiasis-Malaria co-infection Reaction-Diffusion Model

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Abstract. We formulate a reaction diffusion model to consider spatial movement of humans and vectors in a trypanosomiasis-malaria transmission. Prevention and treatment are introduced as control variables to characterize an optimal con- trol strategy that reduces the number of exposed and infected individuals and vectors at the minimum possible cost. The optimal control characterization is obtained in terms of state and adjoint equations. Numerical simulation of established results are also presented.
**Keywords:** Optimal control, Sensitivity system, Adjoint system, Objective

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## Logistic Growth Model of Field Crops with Pest Control Measures

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Abstract. In this paper a logistic growth model of field crops is formulated and analysed to examine the best measure to reduce pest infestation to enhance food security. A control model is developed with three control measures, namely prevention (brush trimming and removal of weeds) ($u_1$), the use of pesticide ($u_2$) and removal of infected plants ($u_3$). The effective reproduction number that determines pest extinction and crop survival is obtained and use to establish the condition for the local asymptotic stability of the pest-free equilibrium using the method of linearization. The existence of the pestendemic equilibrium is verified using the Descartes rule of signs. Numerical simulations are performed to reveal the effects of the control measures on the field crops. The findings show that each integrated measure is able to mitigate pest infestation in the specified time.
**Keywords:** Logistic Growth Model, Field Crops, Control Measures, Effective Reproduction number, Pest

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## ON THE RANK OF QUASI-NILPOTENTS IN FINITE PARTIAL TRANSFORMATION SEMIGROUP.

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let be a finite set and be the Semigroup of partial transformations on , in this work, we obtained the Quasi-nilpotent rank of the partial transformation Semigroup, that is the cardinality of the minimal quasi-nilpotent generating set as the sterling number of the second kind which is the same as its idempotent rank.
**Keywords:** Rank, Quasi-nilpotent, Transformation Semigroup.

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## EFFECTS OF MAPLE SOFTWARE ON STEM STUDENTS? PROBLEM-SOLVING SKILLS IN MATHEMATICS AMONG KANO STATE SCIENCE AND TECHNICAL SCHOOLS

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Abstract. The study investigates the effects of Maple software on STEM students? problem-solving skills in mathematics in Kano State science and technical schools: the implication of the 21st century in Nigeria. The study was guided by three research questions and three research hypotheses. A quasi-experimental design was adopted for the study. The population of the study comprises all SS II students in Kano state science and technical schools. Two intact classes were selected for the study from two different schools randomly selected, that is, science and technical schools, respectively; thus, 115 students were the sample size of the study, making 58 science and 57 technical students. The Mathematics Problem-Solving Skills Test (MPSST) was the instrument used for data collection. The instrument was valid and reliable, with a reliability coefficient of 0.87 using Cronbach's alpha. Mean and standard deviation were used to answer the research questions, while ANOVA and Pearson Product Moment Correlation were used for testing the null hypotheses. The study concludes that Maple software affects STEM students? problem-solving skills in mathematics. The study suggests that computer programs like Maple should be used collaboratively in the mathematics

teaching and learning process. **Keywords:** Maple software, STEM, Problem-Solving Skills, Mathematics, 21st century learning Skills.

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## THE ROLE OF ARTIFICIAL INTELLIGENCE IN ENHANCING THE TEACHING AND LEARNING OF MATHEMATICS FOR NATIONAL DEVELOPMENT

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This study investigated the role of AI towards Enhancing the Teaching and Learning of Mathematics for National Development. The study was guided by two objectives, two research questions and two null hypothesis. The teaching and learning of Mathematics in Nigeria are faced with great problems that make most student to perform poorly in the subject. This observations became a challenge and this is why the current effort is been raised. An instrument titled Perceptions of students on the role of AI towards enhancing the teaching and learning of Mathematics with twenty items was used for data collection and was analyze using chi-square. The instrument was validated by three experts. The reliability of the instrument was tested using split-half and found to be reliable with 0.76 reliability coefficient. The result shows that; AI plays a pivotal role towards enhancing the teaching and learning of Mathematics. The researcher concluded that the use of AI should be encourage among Mathematics students and researchers so as to make the best use of it toward national development and recommended that Government should fund researches on Mathematics so as to investigate more in diverse areas on AI in order to put to an end the down ward Mathematics performance among students.
**Keyword:** Mathematics, Artificial Intelligence, Teaching and Learning, Students

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## Results On Application of Exponential Pareto Distribution (EPD) in Geometric Function Theory

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Abstract. Various authors have successfully applied Exponential Pareto Distribution and its generalized form to different real life situations and problems. However, the applications of Exponential Pareto Distribution in geometric function theory have not been considered. In this study therefore, the authors considered some new classes of functions associated with Exponential Pareto Distribution, The coefficient bounds and Hankel determinants for the classes of functions were also established and discussed in the work.

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## An Explicit Formula for the number of fuzzy Subgroups of ,

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One of the most important problems in fuzzy group theory is to count the number of fuzzy subgroups of a finite group G . Based on the natural equivalence relation defined on the subgroup lattice of G, the problem of counting all distinct fuzzy subgroups of G can be translated into a combinatorial problem on the subgroup lattice of G. In this paper, the distinct fuzzy subgroups were characterised by an enumerative technique derived from the set of representatives of isomorphism classes of subgroups with their sizes. A linear non-homogeneous recurrence relation of degree one with constant coefficients was formulated. The associated linear homogeneous solutions and particular solutions were applied to prove

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the explicit formula. Keywords : Fuzzy subgroups, Natural equivalence relation, recurrence relations, Enumerative techniques

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## Hyers-Ulam Stability Criteria for Third Order Nonlinear Differential Equations with Nonlinear Damping.

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Abstract. This paper is concerned with the Hyers-Ulam stability of third order nonlinear differential equations with non- linear damping.The third order nonlinear differential equations considered are transformed to integral inequalities before establishing our results. Several new criteria for the Hyers-Ulam sta- bility are established under quite general assumptions,which im- prove and extend the known results in the literature. **Keywords and phrases:** Nonlinear Damping, Integral inequality, New criteria, HyersUlam stability, Nonlinear differential equation.
2010 Mathematical Subject Classification: 26A46, 34C10, 11R33, 35Q31. Orcid Number:0000 0003 0205 637X.

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## Bregman Subgradient Extragradient Method for Solving Pseudo-monotone Variational Inequalities and Fixed Point Problems in Banach Spaces with Application

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In this paper, we study modified subgradient extragradient method in reflexive Banach space. We proved a strong convergence theorem for approx- imating a common fixed point of Bregman nonexpansive mapping and solutions of variational inequality problem with Lipschitz continuous and pseudomono- tone mapping, without knowledge of Lipschitz constant. Our result extends and improve important recent results announced by many authors.
**Keywords:** Bregman distance; Bregman non-expansive mapping; Sub-gradient Extragradient; Pseudomonotone; Variational Inequality; Fixed Point.

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## Analysis of Variable Properties on Ternary and Tetra Hybrid Nanofluids Using Blasius Rayleigh-Stokes Time Dependent Variable: A Model For Solar Aeronotic Engineering

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Abstract. This study analyses the properties of ternary and tetra hybrid nanofluids using the Blasius Rayleigh-Stokes time dependent variable model. The study focuses on the behavior of the hybrid nanofluids under various conditions and the effects of variable viscosity and variable thermal conductivity on their performance. Copper (Cu), Zirconium dioxide ($ZrO_2$), Aluminium Oxide ($Al_2O_3$) and Iron Oxide ($Fe_2O_3$) are the four nanoparticles examined in this study with the mixture of Ethylene glycol (EG) as the base fluid. The governing partial differential equations were reduced to a non-dimensional equation with the aid of the Blasius Rayleigh-Stokes variable resulting into a set of coupled nonlinear ordinary differential equations. The resulting non-linear ordinary differential equations together with their boundary conditions were solved numerically using Finite Difference Method (FDM) with the aid of symbolic mathematical computation program, Maple 18.0 software. The results showed that the tetra hybrid nanofluid flow has enhanced velocity when compared to the ternary nanofluid as a result of the presence of magnetite in the fluid. Overall, this study provides a comprehensive analysis of the potential of hybrid nanofluids in solar aeronautic engineering and highlights the importance of considering variable properties in their design and implementation.
**Keywords:** Solar radiation; Blasius Rayleigh-Stokes Variable; magnetic; variable properties; Finite Difference Method.

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## Algorithmic approaches for solving time-fractional coupled systems of partial differential equations

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Abstract. In this paper, we introduce and apply an efficient computational algorithm utilizing the capabilities of the MAPLE 18 software, incorporating coded fractional derivatives in the Caputo and Riemann-Liouville sense. Our focus is on solving coupled systems of partial differential equations commonly encountered in engineering and mathematical physics domains, including fluid dynamics, viscoelastic materials, viscous damping, polymer physics, and seismic analysis. Our algorithm leverages various mathematical commands within the MAPLE 18 software package. We present three illustrative examples of both linear and nonlinear time-fractional coupled systems of partial differential equations. The obtained results are systematically compared with analytical solutions to assess the accuracy. These findings are presented in both tabular format and as 2D and 3D graphical representations. The proposed algorithm is characterized by its ease of use, reliability, and efficiency. It holds the

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potential to serve as a valuable mathematical tool for addressing a wide range of system of partial differential equation in applied mathematics.

**Keywords:** Caputo fractional derivative, MAPLE 18 software, coupled system, partial differential equations, computational algorithm, 2D and 3D plots.

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## $p^{th}$ - ROOT CHARACTERISATION OF FULL TRANSFORMATION SEMIGROUP

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Abstract. Tn is the set of all mappings from $X$ to $X$, where $X = \{1,2,...,n\}$ and the semigroup operation employed is composition of maps. A method for constructing and characterising the $p^{th}$ - root of an arbitrary element was developed. Also, subsemigroups and subgroups were classified.
**Keywords:** Idempotents, Multiple Roots, Subgroups

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## Regression Models for Predicting the Effect of Depth on Temperature of Three Different Lakes

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Abstract. The temperature of lakes at different depths affect fish activities; this can be determined by the time taken to effectively harvest the fishes in the lake either on the surface water or deep down the lake. This work seeks to predict the temperature of different lakes at different depths using statistical analysis. Hypotheses were made and linear regression models showing the effect of water depth on the temperature of lakes 1, 2 and 3 were formulated and solved using the SPSS software package. The R-Square values for each lake were also determined. It was observed that the predicted values were not significantly different from the observed values. The results showed that R-Square values for each lake were, 0.947, 0.956, and 0.944 respectively. It can be concluded that linear regression models can be used to analyse the effect of water depths on lake?s temperature and the simulated data for each lake show that there is an inverse relationship between the depth and temperature of the lakes, which means that, the lake depth increases as the temperature decreases. The models obtained compete favourably with other existing models.
**Keywords:** Depth, Fish farming, Lakes, Linear Regression model, R-Square values, SPSS, Temperature.

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## Statistical Analysis for the Effect of Temperature on the Swelling Capacity of Acha Semolina

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Abstract. In this research work Statistical analysis for the Effect of Temperature on the Swelling Capacity of Acha Semolina is presented. Hypothesis and Regression equations showing the relationship between the temperature and swelling capacity of control, 100% Acha and 90% Acha with 10% cassava mixtures were obtained using Statistical tools embedded SPSS software. Swelling capacity of the different samples were also simulated and the R-Square values obtained. The results obtained shows that the predicted data is not significantly different from the observed data with a very strong positive relationship between the ? Swelling capacity? and ?Temperature, as seen in the Correlation coefficient, R, values of 0.980,

0.959 and 0.954 and p- values of 0.020, 0.041 and 0.046 for the three samples respectively. Based on the p-values stated which are less than the level of significance 0.05, there is a statistical reason to conclude that, there is a significant effect of temperature on the swelling capacity of Acha Semolina?.

**Keywords:** Acha Semolina, Correlation (R) values, p- values, Regression equation, SPSS, Swelling Capacity and Temperature.

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## Solving Singular Integral Equations of the Second Kind Using Chebyshev Polynomials

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Abstract. A numerical developed technique to solve Fredholm integral equation of the second kind with separable singular kernel is proposed. This technique relies on the truncated expansion functions of the kernels in the finite series of the weighted Chebyshev polynomials of first, second, third and fourth kinds. Three numerical examples are presented for verification and validation of the developed technique. The results showed that even with small n, the numerical results are accurate.
**Keywords:** Singular integral equations, Singular kernel, Cauchy singularity, Chebyshev polynomial, Weight function, Accuracy.

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## On a Numerical computation of Quantum Stochastic Differential Equation.

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Abstract. Abstract:In this work we review the Boukas Numerical computation associated with the Hudson - Parthasarathy QSDE. The operator valued processes employ the Hudson-Parthasarathy quantum noises of the Boson Fock Space to show some explicit computations.
**Key words :** Numerical computation, QSDE, Operator processes AMS Subject Classification (2020):81S25

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## Financial Growth Forecasting of Greek Rho using Malliavin Calculus

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Abstract. In the financial market, investors and traders depend on information about trades before investing in the market due to the risks involved. Forecasting therefore becomes an important tool in projecting the financial performance of the security or derivative prior to the trade. It gives critical information on the trade. In this work, we consider the financial performance of an Asian option on a stock by studying the option?s sensitivity to the interest rate. We use a Greek Rho model based on the principles of the Malliavin Calculus to study this sensitivity.

**Keywords:** Forecasting, Malliavin Calculus, Asian options, Greeks

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## Assessing the sanitary conditions and inmates' knowledge and attitudes towards hygiene practices and disease propagation in a maximum-security prison: A mathematical modelling study of the case of Nigeria.

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Abstract. The information on the Nigerian correctional service as at April 1, 2024 provides that the total inmates in the Nigerian correctional facility is 77, 934, male make up 98% of the population which stands at 76, 132, while female make up only 2% of the population which stands at 1,802. Convicted inmates are 24,577 with 24, 133 males and 444 females, while those awaiting trials are 53, 357 with 51, 999 males and 1, 358 females. Nigeria has about 240 correctional facilities with occupancy level of over 136% making hygiene practice in the facility a burden. The inmates are vulnerable, and their health is conditioned not only on their nutrition and health-care services but also on available water and sanitation services, personal and collective hygiene behaviour, within the prison environment. To ascertain the level of hygiene practice its impact on disease propagation on the inmates in a maximum-security prison, we developed an SEIR model to predict the effect of sanitary conditions, knowledge and attitudes of inmates about hygiene practices to their exposure to different diseases in the maximum-security prison. Our model showed existence of equilibria and their stability, also we had occurrence of Hopf bifurcation which we studied using qualitative theory. Data was collected, analysed and fitted into our model and further analysis showed that poor sanitary conditions and overcrowding drives disease propagation in the facility. We propose adequate public awareness in our correctional facilities and expansion of the correctional centers or provision of new correctional facilities.

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## On Products of $F_h$-convex interval-valued functions for Hermite-Hadamard type Inequalities on time scales

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Abstract. In this paper, some integral inequalities of Hermite-Hadamard type are established and extended for products of $F_h$-convex interval-valued functions on time scales. The results are as well applied to variational calculus on time scales. Keywords: Time scales; Hermite-Hadamard; Interval-valued functions; $F_h$-convex; $(F_h(\lambda))^s$-functional.

**2020 MSC:** 26*A*39;35*A*05;26*D*15;34*N*05
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# STABILITY ANALYSIS ON A MATHEMATICAL MODEL OF AN ELECTORAL PROCESS IN NIGERIA

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We developed and analyzed a mathematical model that studies the dynamics of Elections in Nigeria with three political parties as major actors. The ruling party; major opposition party and minority parties. The model includes classes of eligible voters, political party campaigners of the ruling party, political party campaigners of major opposition party and political party campaigners of minority parties. The model also incorporates classes of electoral body, electoral observers, judiciary, security personnel and thugs. The influx of voters into the system is determined by registration rate of voter cards. One of our major interests was to carry out existence of stabilities, which were found namely; i. Party free Equilibrium ii. Single Equilibrium iii. Dual Party System and Three Party Equilibrium. The equilibria were locally asymptotically stable when certain conditions were satisfied.

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## A Quantum Finance Model for Technical Analysis in the Stock Market

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Abstract. This paper, is a contribution to quantum finance theory. The time-dependent Schrodinger wave equation for the harmonic oscillator was used to model the movement of stocks in a daily price-limited stock market. Using the Nigeria Stock Exchange(NSE) as a case study, the "price wave" function was developed. From this, given any quoted stock, the rate of return and the investment risk measure (standard deviation) of the corresponding stock can be computed in a continuous manner. This is an improvement over earlier computational method such as arithmetic and logarithmic rate of return which are discrete and do not provide means for the computation of standard deviation indicator.

**Keywords:**Schrodinger equation, harmonic oscillator, quantum finance, velocity indicator, momentum indicator, technical analysis, price wave.

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## ANALYSIS OF HIV/AIDS MODEL WITH NON LINEAR INCIDENCE FUNCTION

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Human Immunodeficiency Virus - Acquired Immune Deficiency Syndrome HIV/AIDS stands as one of the most prevalent sexually transmitted disease globally and is regarded

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as one of the deadliest epidemic in human history. This study presents a mathematical model for understanding the dynamics of HIV/AIDS transmission, incorporating a saturated incidence rate. The model employs a system of ordinary differential equations, comprising various group of individuals including susceptible $S(t)$, asymptomatic infective $I_1(t)$, symptomatic infective $I_2(t)$, treated $T(t)$ and AIDS class $A(t)$. The validity of the solution states affirms that the model is well-defined and holds epidemiological significance. The disease-free and endemic equilibrium states are identified, and their stability is analyzed using Routh Hurwitz criteria. Sensitivity analysis was carried out using normalized forward sensitivity index and result showed that the contact rate $\beta_1$ is the most sensitive parameter. However, it is observed from the numerical simulation that screening and treatment of the infective play a significant role in reducing the transmission of the disease. The outcome of the stability analysis for both disease-free and endemic equilibrium states indicate the potential for HIV/AIDS control.

**Keywords:** HIV/AIDS, Saturated Incidence, Screening, Treatment, Basic Reproduction Number, local Stability, global stability, Sensitivity Analysis.

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## NEW SPECTRAL PARAMETER VIA SECANT CONDITION FOR SYMMETRIC NONLINEAR EQUATIONS

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Conjugate Gradient method was proposed in order to reduce or overcome the short-comings of Newton's and Quasi-Newton's methods for solving unconstrained optimization method which was extended to Systems of Nonlinear Equations and efficient for handling large-scale problems because of its convergence properties, simple implementation and low storage requirement. Spectral gradient method was introduced so as to solve potentially large-scale unconstrained optimization problems whereby only gradient directions are used at each line search which makes the method to outperform conjugate

gradient algorithms in many problems. In this research, a New Spectral Parameter (NSP) is derived via Secant Condition with two-term direction and the classical Newton's direction using similar approach used to derive Conjugate Parameter by Waziri, Kufena and Halilu (2020). The proposed method generates a descent direction using inexact line search and the global convergence of the proposed algorithm was established under appropriate conditions. The codes were written in *MATLABR*2014*a* and run on a Personal Computer. Iteration stopped if the total number of iterations exceeds 1000 or the norm of the residual at the stopping point . The two methods were tested using five (5) test problems with different initial points and dimensions (n values). Numerical results for the benchmark test problems using the profiles of Dolan and More (2002), which is a tool for evaluating and comparing the performance of iterative methods, shows that our proposed method is more efficient and effective than some existing ones in the literature. For future research, this work will be applied to the experiments on the L1-Norm regularization problems in compressive sensing.

**Keywords:** Descent condition, Global Convergence, Secant Condition, Spectral parameter, Symmetric Property.

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**On the conjugate of harmonic functions**

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Abstract. In this paper we seek to show that if H1(D) = 0 then any hamonic $u : D \to \mathbb{R}$ is part of a harmonic pair $(u;v)$,$v$ unique up to addition of constants, from its elementary unit using

exactness condition and Cauchy-Riemann equations, instead of using total differential as is obtainable in Dass [4]..

**Mathematics Subject Classifications:** 30C15, 32A10, 31A35.

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## SENSITIVITY ANALYSIS OF COVID-19 MODEL WITH 52 PARAMETERS USING PYTHON SNIPPET GENERATED BY THE AID OF AI

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The study developed a python code assisted by the AI tool ChatGPT 3.50 that used the basic reproduction number ($R_0$) of a mathematical model of COVID-19 transmission dynamics with controls (awareness for vaccination and isolation with treatment) to carryout sensitivity analyses. The study presented a Python snippet that accurately in few seconds, evaluated the obtained $R_0$ that so complicated, using parameter values computed the sensitivity indices of all the 52 parameters in model, with less than 25 lines of codes. The code used a list of all parameters in the model and the list of parameter values to create a dictionary, looped through the parameter list to obtain the sensitivity indices of all parameters on the model $R_0$, ranked the indices and plotted the ranked indices of significant parameters. The indices were visualised using bar chart that distinguished positive and negative indices using different colours. The results attributed high incidences of COVID-19 to rejection of vaccination, incomplete vaccination, high recruitment level into the susceptible population among others. **Keywords:** AI, COVID-19, model, Python, sensitivity

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## A class of third-order IMEX Runge-Kutta time-stepping methods for air-pollution tracking

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Abstract. Explicit Runge-Kutta methods are limited by implementation with smaller timestep for stiff problems. In this talk, we are concerned with the class of IMEX Runge-Kutta methods for air-pollution tracking systems. Such systems are described by Advection-Diffusion-Reaction (ADR) equations. The implementation idea of the IMEX schemes is based on a split system such that the explicit and implicit component of the IMEX Runge-Kutta method tackles the non-stiff and stiff component of the ADR, respectively. We give a rooted tree theory for deriving a class of third-order IMEX Rung-Kutta method. The algebraic order conditions including the coupling conditions are presented. Furthermore, we construct a class of third order schemes for the numerical simulation of air-pollution tracking. We consider several case for the stability and phase analysis of the methods. Numerical experiments are presented to show the effectiveness of IMEX Runge-Kutta methods over traditional Runge-Kutta methods. Finally we present some simulation results to visualize the dynamics of the pollutant material and the polluted zone.

**2000 Mathematics Subject Classifications:** 65L04, 65L05, 65L06, 65M20 **Key words:** IMEX RungeKutta methods; Stiff ODE solution; Advection-DiffusionReaction; Air pollution modelling.

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# FRACTIONAL DIFFERENTIAL TRANSFORM METHOD FOR ANALYZING ARTERIAL BLOOD FLOW OF FRACTIONAL ORDER

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Abstract. This paper focuses on the application of the Fractional Differential Transform Method (FDTM) to obtain approximate analytical solutions for arterial blood flow of fractional order. The fractional derivative is defined in the Caputo sense, which allows for the modeling of non-local and memory-dependent behaviors in the blood flow system. The FDTM is utilized to transform the fractional differential equations governing the blood flow into a system of algebraic equations, facilitating the derivation of approximate analytical solutions. Numerical example is carried out with the help of Maple21 software to demonstrate the feasibility and effectiveness of the FDTM as an approximate analytical solution technique for blood flow of fractional order. The results of the numerical experiments showcase the capability of the FDTM to accurately capture the complex dynamics of arterial blood flow with fractional order. The proposed method provides a valuable tool for investigating the behavior of blood flow in situations where fractional derivatives are involved. Furthermore, it contributes to the advancement of analytical approaches for modeling and analyzing blood flow phenomena.

**Keywords:** Blood flow, Fractional Order, Fractional Differential Transform Method, Maple21.

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## State-Space Approach to Eigen Solution of a Mechanical System with Three Degrees of Freedom

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Abstract. In this paper, a translational mechanical system with three degrees of freedom was modelled and analysed using state-space approach. The system was first presented in its time domain differential equation model followed by a state-space model. Laplace transform and the state-space technique was used for the analysis of the system. From the model, the natural frequencies and mode shapes (eigenvalues and eigenvectors) of the system were obtained by solving the system's eigenvalue problem. Two numerical examples were used in the analysis and the results were presented using line graphs and tables. The results presented certain sets of special initial conditions that will make the system to have normal vibrations in the form of vectors called eigenvectors and also the reference points at which these vibrations take place in the form of frequencies called eigenvalues. The results also show graphically, the contribution of each mode in the motion of the three masses relative to each other.

**Key Words:** eigenvalue, eigenvector, differential equation, mechanical system, statespace.

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## STABILITY ANALYSIS OF DENGUE FEVER TRANSMISSION DYNAMIC

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Abstract. This study presents a mathematical model for analyzing the dynamics of Dengue fever transmission, exploring both quantitative and numerical aspects. The model underwent comprehensive examination, including investigations into solution existence and positivity. The basic reproduction number R0 was investigated using next generation matrix technique. Stability analysis utilized Jacobian techniques to explore the system's behavior. Through numerical simulations, it was observed that heightened treatment and immune system fortification correlate with reduced Dengue fever transmission rates.

**Keywords:** dengue fever, stability, reproduction number.

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## HANKEL DETERMINANT OF A CLASS OF ANALYTIC FUNCTION DEFINED BY FRASIN DIFFERENTIAL OPERATOR

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Abstract. A class of functions involving Frasin differential operator in the unit disk was defined. Coefficient bounds for the function belonging to the new class was obtained. Furthermore, second Hankel determinant for the class were established.

**Keywords:** Toeplitz determinant,Frasin differential operator polynomial, Subordination, Coefficient bound, Analytic function

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## Implicit Multiderivative One - Step Method for Direct Solution of Second Order Ordinary Differential Equations

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Abstract. This paper describes the development, analysis, implementation and comparative study of an Implicit Multiderivative linear one - step method for direct solution of initial value problems of general second order ordinary differential equations. In developing the method, the step number (k) was made constant at one (1) while the order of derivative (l) was made constant at two (2) and Taylor's series expansion was adopted as the basis function. The basic properties of the method were analysed and the analysis revealed that the method was accurate, consistent , zero - stable, convergent and absolutely stable. The method was used to solve some sampled initial value problems of linear and non - linear second order ordinary differential equations. The numerical results when compared with the exact solutions showed that the method was accurate, effective and efficient.

**Keywords:** Implicit, Multiderivative, One - step, Second order, ordinary differential equation

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## MATHEMATICAL MODEL OF ANTI-MALARIAL DRUG RESISTANCE

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Abstract. This research focuses on developing a mathematical model to study the phenomenon of anti-malarial drug resistance. The model takes into account the three wellknown levels of resistance in humans, incorporating both sensitive and resistant strains of the malaria parasites. By analyzing this model, we gain insights into the dynamics of the disease when treatment is administered. The analytical results challenge the common assumption that disease elimination can be achieved solely by maintaining a basic reproduction number below unity. We demonstrate that additional factors must be considered to effectively combat malaria. Using quantitative analysis, we investigate the impact of varying treatment levels in high transmission areas characterized by different levels of resistance. The findings indicate that increasing treatment has limited benefits in populations with resistant strains, particularly in high transmission settings. Consequently, determining the optimal rate of treatment and the percentage of the population to be treated becomes a complex question to address in a cost-benefit analysis. By employing a mathematical modeling approach, this sheds light on the intricate dynamics of antimalarial drug resistance. The insights gained from this study can inform policymakers and healthcare professionals in devising more effective strategies for combating malaria in regions with varying levels of resistance.

**Keyword:** mathematical model, anti-malarial drug resistance, strains and basic reproduction number.

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## THE PROOF OF STRONG GOLDBACH'S CONJECTURE

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Abstract. Goldbach's Conjuncture is an unsolved Mathematical problem stated by Christian Goldbach in the year 1742. The conjecture states that an even number is the sum of two prime numbers. In this work, the symmetrical distribution of some primes P1 and P2 relative to any even number 2n, n¿1, enables the generation of a Ratio. The graph of 2n against the Ratio is also obtained. Using the boundedness of the smooth line graph obtained, the primes P1 and P2 are found for any given even number 2n. The even number with the highest Ratio is established.

**Keywords:** Strong Goldbach's Conjuncture, Prime numbers, Even numbers, Symmetric Distribution, Boundedness.

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## FILIPPOV APPROACH IN ONE SIDED LIPSCHITZ CONTINUOUS IMPULSIVE QUANTUM STOCHASTIC DIFFERENTIAL INCLUSION

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Abstract. In this work,the authors consider the impulsive quantum stochastic differential inclusion of the form

We relax the Lipschitz continuity of P and obtain the Fillipov type result.

AMS Subject Classification: 81S25 , 34A37
**Keywords and Phrases:** Impulsive quantum stochastic differential inclusion, one sided Lipschitz condition,continuous selections,Filippov theorem

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## Artificial Intelligence and Mathematics Instructional Delivery for Sustainable National Economy in Kano State, Nigeria

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Abstract. Educators across the globe are assiduously seeking ways to improve instructional delivery methods in order to meet up with needs of this century in general and in particular to promote sustainable development of their respective economy. Without any doubt, incorporation of Artificial Intelligence (AI) is one of the promising approaches in mathematics instruction. This phenomenon has shown great potential to enhance learning outcomes by providing personalized and adaptive learning experiences. Hence, this paper, attempts to examine the impact of AI on mathematics teachers' instructional delivery and techniques to be adopted as well as its potential role in promoting sustainable economic growth. Similarly, the paper will give insights on the possible challenges and opportunities that come with the integration of AI into instructional practices and provide recommendations for future researches in the field. The results of this study will expose how practically AI based mathematics instruction can significantly improve students' achievement and foaster a more sustainable economy in Kano State, Nigeria. **Keywords and Phrases:** Artificial Intelligence (AI), Sustainable National Economy, Mathematics Instructional Delivery, development, Mathematics Teachers Awareness and Mathematics Teachers Readiness.

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## A Model for Controlling Malaria Transmission from Vector to Human; A case study of a public university in Nigeria

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Abstract. Malaria is one of the leading cause of deaths in sub- saharan Africa, despite global efforts to eradicate malaria, its remains a major health threat to nearly half of the world's population. Recent statistics show that globally there are over 200 million malaria cases and estimated deaths close to half a million, several studies on malaria importation focuses on the effect of conventional malaria control strategies as approved by the World Health Organization (W.H.O) on how malaria is transmitted from vector to human but did not capture the effect of the use of traditional malaria control strategies by vigilant human. To include that in our study a system of ordinary differential equations was remodified comprising of the recruitment rate , natural death and those who are moving from susceptible compartments into traveler compartments. The numerical computations was done using maple and shows that the population will be free from malaria if the exposure rate to mosquitoes is minimized.

**KEYWORD:** Malaria, Endemic, Reproductive number, Sensitivity Analysis.

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## ANALYZING THE INFLUENCE OF CONTROL VARIABLES ON

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## COVID-19 VACCINATION DYNAMICS: INSIGHT FROM HOMOTOPY PERTURBATION METHOD

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Abstract. The global fight against the COVID-19 pandemic hinges significantly on effective vaccination strategies. In this study, we utilize the Homotopy Perturbation Method to rigorously quantify the impact of control factors on the dynamics of COVID-19 vaccination. By integrating variables including vaccine efficacy, distribution rates, and population compliance levels into sophisticated mathematical models, we dissect their collective influence on the dynamics of the vaccinated population. Through meticulous analysis and extensive numerical simulations, we unveil nuanced insights crucial for optimizing vaccination strategies and curtailing the spread of the virus. Our findings not only deepen the understanding of vaccination dynamics in the context of COVID-19 but also offer actionable recommendations to policymakers and public health authorities navigating the complexities of pandemic response efforts.

**Keywords:** COVID-19, Vaccine Efficacy, Control Factor, Perturbation, Vaccination

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## AN EQUIVALENCE IN A SELECTED FAMILY OF CYCLIC SUBSEMIGROUPS AND ALGORITHM FOR GENERATING SYSTEMS OF SEMIGROUP

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Abstract. This paper focuses on generators of cyclic subsets of semigroups which determines the whole semigroup through algebraic closure. We call a generating set minimal if it does not have a proper generating subset. A set is independent if no element of the set can be generated by the remaining members of the set. Independent subsystems of cyclic semigroups are intersected to obtain the generating set of cyclic semigroups. From intersecting subsystems of cyclic semigroups, a certain equivalence relation on the set of all cyclic Subsemigroups are obtained. The paper also shows how such equivalence relation is a tool for partitioning cyclic subsemigroups into generating subsystems. Algorithm to find the minimal generating set of a semigroups is given.

**Keywords:** Semigroup, Cyclic, Independent, Minimal, Generating sets **Mathematics Subject Classification (MSC):** 20-XX, 20Mxx, 20M05, 20M75.

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## ALGEBRAIC MODEL FOR PREDICTING ECONOMIC GROWTH IN NIGERIA: A DATA-DRIVEN APPROACH

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Abstract. This paper proposes an innovative algebraic model for forecasting economic growth in Nigeria. Leveraging historical economic data and employing advanced mathematical techniques, the model aims to provide accurate predictions and insights into the factors driving economic development in the country. The study contributes to the field of economic modeling by offering a novel framework tailored to the specific context of the Nigerian economy.

**Keywords:** Algebraic model, Economic growth, Nigeria, Data-driven approach, Forecasting, Mathematical modeling

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## Quantum computations and Quantum information Theory

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Abstract. This paper proposes an innovative algebraic model for forecasting economic growth in Nigeria. Leveraging historical economic data and employing advanced mathematical techniques, the model aims to provide accurate predictions and insights into the factors driving economic development in the country. The study contributes to the field of economic modeling by offering a novel framework tailored to the specific context of the Nigerian economy.

**Keywords:** Algebraic model, Economic growth, Nigeria, Data-driven approach, Forecasting, Mathematical modeling

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## A STUDY ON GENERALIZED REVERSE DERIVATIONS AND SKEW DERIVATIONS OF PRIME NEAR-RINGS

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In this paper, let $N$ be a prime near-rings and $G$ be a generalized reverse derivative associated with mapping $donN$. An additive mapping $d : N \to N$ is said to be a derivation on $N$ if $d(xy) = d(x)y + xd(y)$ for all $x,y \in N$. A mapping $G : N \to N$ associated with derivation $d$ is called a generalized derivation on $N$ if $G(xy) = G(x)y + xd(y)$ for all $x,y \in N$. Also, a mapping $d : N \to N$ is said to be a reverse derivation on $N$ if $d(xy) = d(y)x+yd(x)$ for all $x,y \in N$ and a mapping $G : N \to N$ associated with reverse derivation $d$ is said to be a generalized reverse derivation on $N$ if $G(xy) = G(y)x+yd(x)$ for all $x,y \in N$. We prove some results on commutativity of prime near-rings involving generalized reverse derivations. In addition, we prove that; for prime near-rings $N$, if $d(x)d(y)xy = 0$ for all $x,y \in N$ then $d = 0$ where $d$ is a skew- derivation associated with an automorphism $\beta : N \to N$ Furthermore, for a prime near-ring N with generalized derivative $G$ associated with mapping $d$ on $N$, if $G(x)G(y)xy = 0$ for all $x,y \in G$ then $d = 0$.

**KEYWORDS:** Prime near-ring, reverse derivation, generalized reverse derivation, skew derivation.

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## LATTICE-BASED CRYPTOGRAPHIC SCHEME FOR SECURE BLOCKCHAIN DEVELOPMENT AND FINANCIAL SYSTEMS IN NIGERIA

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Abstract. This research proposes the adoption of lattice-based cryptographic schemes for enhancing the security and resilience of blockchain development and financial systems in Nigeria. Lattice-based cryptography offers robust protection against quantum attacks and can address emerging security challenges faced by traditional cryptographic algorithms in the context of blockchain technology. This paper explores the potential benefits, challenges, and implications of integrating lattice-based cryptographic techniques into the Nigerian blockchain ecosystem, with a focus on improving security, scalability, and trust in financial transactions.

**Keywords:** Lattice-based cryptography, Blockchain technology, Financial systems, Security, Quantum resistance, Nigeria

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## Analyzing the Effectiveness of Jacobi, Gauss-Seidel and Successive OverRelaxation Techniques in Solving System of Linear Equations

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Abstract. This research introduces and assesses three iterative approaches for solving systems of linear equations. The findings indicate that the Successive Over- Relaxation method surpasses the other two in terms of efficacy, as evidenced by the fewer iterations needed to converge to a precise solution. The insights from this study will enhance analysts' understanding and appreciation of employing iterative methods in comprehending systems of linear equations.

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**Keywords:**The system of linear equations, Iterative methods, Initial approximation, Jacobi method, Gauss-Seidel method, Successive Over.

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## Some Remarks on Thermo-Physical properties of Magnetohydrodynamics Heat and Mass Transfer of Nano-Fluid Flow over a Nonlinear Permeable Stretching Sheet

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Abstract. The study aims to explore the potential benefits of investigating the MHD heat and mass transfer of nano-fluid over a nonlinear permeable stretching sheet. This is achieved by examining the influence of temperature-dependent viscosity and temperaturedependent thermal conductivity on nano-fluid. The governing partial differential equations that describe the nano-fluid flow are transformed and parameterized into a set of ordinary differential equations. These equations are subsequently solved numerically using shooting technique with the fourth order Runge-Kutta method. A graphical analysis is employed to assess the impact of specific fluid parameters on the momentum, thermal, and concentration equations. The outcomes depicted in the graphs reveal a noticeable effect of temperature-dependent viscosity and temperature-dependent thermal conductivity on the mathematical model.

**KEYWORDS:** Nano-fluid, MHD, temperature-dependent viscosity, temperature-dependent thermal conductivity

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## FREE CONVECTION FLOW OF VISCOUS DISSIPATIVE FLUID AFFECTED BY PERMEABILITY AND HEAT SOURCE/SINK IMPACTS IN A HEATED SUPERHYDROPHOBIC MICROCHANNEL

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The focus of this article is to scrutinize the performances of viscous dissipation, porous medium and super-hydrophobicity on free convection of an electrically conducting fluid across an upstanding microchannel affected by an imposed magnetic field. The plates were alternatively heated and incorporated with heat source/sink effect. The steady state expressions of the formulated differential equations have been solved using a semi analytical method (regular perturbation). It is interesting to report that the heat gradient and fluid motion are significantly propelled for mounting values of Brickman number, Darcy porous number and heat source parameters in the superhydrophobic microchannel. On the other hand, the velocity deteriorates for increasing levels of magnetic field and heat sink factors. Further, the comparison of this present analysis with previously published literature for limiting cases when $Z = 0$ and $K = 1000$, so that the term $1/K$ disappears, demonstrate an excellent relationship, thereby authenticating the accuracy and correctness of this present work. Nuclear power plants, gas turbines and the various propulsion devices for aircraft, missiles, satellites and space vehicles are examples of such engineering areas where this study can find relevance.

**Keywords:** Viscous dissipative fluid, Heat source/sink, Permeability effect, Magnetohydrodynamics (MHD), Superhydrophobic surface (SHS), Microchannel

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# Natural Convective Couette flow in a Darcy porous medium with Thermal Radiation, Variable Thermal Conductivity and Chemical Absorption Characteristics: A Finite Element Approach (FEM)

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Here the natural convection Couette flow in a Darcy porous medium taking into account the influence of thermal radiation, variable thermal conductivity and chemical absorption is examined. The flow is governed by modelled partial differential equations (PDEs) in non-dimensionless form with initial and boundary conditions and the Couette fluid model is also be used to characterize the fluid behavior. Then, using suitable dimensionless quantities, these PDEs are transformed. Since the flow governing equations of the problem under study are extremely complex and complicated, techniques that complement experimental and theoretical fluid dynamics by providing alternative potentially cheaper means of testing fluid flow systems is used. Therefore, the Finite Element Method (FEM) is employed after discretization of the PDEs. With the help of Graphs and tables, the significance of embedded thermo physical parameters associated with the flow quantities viz. velocity, temperature, concentration of the fluid was explained through series of numerical computations and analysed. This research also studied and compares the results obtained by Omokhuale and Jabaka (2022). It is interesting to report that an excellent agreement was established, thereby authenticating and validating the accuracy of FEM as a strong tool.

**Keywords:** Couette Flow; Thermal Radiation; Variable Thermal Conductivity; FEM; Natural Convection.

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## Submicron particle transportation and deposition in a Pressure-Driven Couette Slip flow

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Abstract. This paper presents a thermodynamically steady limiting forced convection flow and mass transfer between vertical walls heated and concentrated asymmetrically. The equations governing the flow, temperature and concentration fields are reduced to a system of joined non-linear ordinary differential equations expressed in a non-dimensional form. The roles the parameters of buoyancy ratio, concentration ratio and thermal ratio play at the vicinity of hot and cold plates are observed and their effect on skin friction displayed. Behavior and convergence of buoyancy ratio can be observed as the concentration ratio increases. Slip, thermophoresis and the degrees of heating and concentration greatly disturbs the deposition and transportation rates of particles across the channel in a flow of particles with a high Schmidt number.

**Keywords:** Forced Convection; Couette Slip flow; Thermophoretic transport; Asymmetric heating/Concentrating

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## NONLINEAR HEAT AND MASS TRANSFER WITH A FIRST ORDER CHEMICAL REACTION IN A VERTICAL CHANNEL

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In this research paper, a theoretical study is reported of a fluid having high temperatures and laden with chemically reactive particles trapped in an upright channel. The governing equations consider a nonlinear Boussinesq approximation of nonlinear Density, Temperature-Concentration variation. The main objective is to investigate the effects of magnetism, buoyancy, Prandtl number, Schmidt number and temperature gradient on the first order chemical reaction fluid flow and heat transfer characteristics. We consider two cases: With thermophoresis and without thermophoresis. Solutions are presented in graphical form

for friction at hot and cold walls against fluid and ratios of convective mass transfer to diffusive mass transfer at hot and cold surfaces for various parameters.

**Keywords:** Nonlinear heat and mass transfer; Chemical reaction; Thermophoresis; Vertical channel

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## Approximating Fixed Point of Weakly Enriched Contraction Map via an Implicit Kirk Iteration in Banach Spaces

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Abstract. This paper introduces a weakly enriched contraction mapping using an implicit Kirk iterative fixed point scheme in Banach spaces. We prove the well-posedness of the weakly enriched contraction map, namely; the existence, uniqueness, and stability, associated with the implicit double-averaged mapping. The results show that any fixed point of the double-averaged map is also a fixed point of the implicit double-averaged mapping but the inclusion is, however, strict. Some practical examples are presented to show the efficacy of the results.

**Keywords:** Weakly enriched, Implicit Kirk Iterative scheme, fixed points, Contraction mapping, Banach spaces, Stability.

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## Optimising Plasmodium falciparum Malaria Control Strategies in Nigeria

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Abstract. Plasmodium falciparum (P.f.) malaria is a public health problem in tropical countries with 247 million cases annually occurring globally and 86% in Africa. Malaria is endemic in Nigeria and remains one of the leading causes of morbidity and mortality in the country. Many studies have been done on the modelling of malaria but those that have been used to predict the effect of the use of various intervention strategies in low and high transmission regions in Nigeria are yet to be done. Therefore, in this study, we designed a population-based mathematical model for human-mosquito interactions with combined interventions to predict the optimal control intervention(s) of P. f. malaria in Nigeria. The interventions applied were focused on mosquito biting rate and the human recovery rate to reduce the spread of malaria in low and high transmission regions in Nigeria. This model suggested that the inclusion of various control strategies for the effective control of malaria in both low and high transmission regions of Nigeria will guide the Public health officers and policymakers in the choice of control strategies required for each region and it will also support the use of control strategies and/or elimination of Plasmodium falciparum malaria in Nigeria.

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# On Common Fixed Point Theorems in -Complex valued b-Metric Spaces

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**Abstract.** In this paper, we obtain sufficient conditions for the existence of common fixed points of a pair of mappings satisfying contractive type conditions as follows: Let $(Z, m)$ be a complete -complex valued b-metric space and let $F, G: Z \to Z$ be two mappings satisfying the rational condition

$$m(Fy, Gz) \leq m(y, z) + , \text{ for all } y, z \ Z,$$

where are nonnegative real numbers and $< 1$. Then $F, G$ have a unique common fixed point in $Z$.

**Keywords**: **-co**mplex-valued metric space; fixed point; Jaggi-contraction.

**2010 Mathematics Subject Classification:** 47H10, 54H25.

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# MATHEMATICAL MODELLING AND ANALYSIS OF THE EFFECT OF ISOLATED-TREATED CLASS ON THE DYNAMICAL SPREAD OF COVID-19

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**Abstract.** Severe Acute Respiratory Syndrome Corona Virus 2 (SARS-CoV-2) also called Covid-19, recently became a pandemic and its ravaging still lingers on. In this paper, a new seven compartmental model incorporating isolated-treated class was formulated, to study the dynamics of the disease. The model was observed to have two equilibrium points: the Disease Free Equilibrium Point (DFEP) and the Endemic Equilibrium Point (EEP). The stability analysis of the equilibrium points showed that the DFEP is locally asymptotically stable whenever , while the EEP is locally asymptotically stable whenever . Sensitivity analysis of the parameters in , revealed the most sensitivity parameters to be the contact rate, the recruitment rate and the transfer rate of exposed individuals into the symptomatic infected class. Furthermore, it was observed that an increase in the contact rate between susceptible and exposed individuals would

have a negative effect on the dynamics of the disease. Additionally, good treatments could lead to more recoveries from the disease. In conclusion, Covid-19 could be controlled by reducing the contact rate between the exposed and susceptible individuals, as well as increasing the efficacy of treatments.
**Keywords:** Covid-19, Mathematical modeling, Basic reproduction number.

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## IMPACT OF EDUCATIONAL STRATEGIES ON the CONTROL of MARITAL CONFLICT: A MATHEMATICAL MODELLING APPROACH

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**Abstract**
The study examines the impact of different education strategies on controlling marital conflict, focusing on the effective contagion rate as an indicator of conflict spread. The analysis compares the outcomes of educating 80% of married men and 20% of married women versus educating 20% of married men and 80% of married women about the dangers of divorce. The findings reveal that the former strategy fails to reduce the effective contagion rate to zero, indicating ongoing conflict propagation within the population. In contrast, the latter approach shows a significant reduction in the effective contagion rate initially, although it starts to rise again along the trend. To achieve optimal control of marital conflicts, a balanced approach is recommended, with a 50% coverage rate of education for both genders. This balanced strategy aims to strike a gender equilibrium, ensuring a substantial portion of the population receives education on the dangers of divorce. Implementing this comprehensive education approach holds promise for minimizing conflict spread, promoting healthier marital relationships, and fostering stable family units. However, further research is needed to consider additional factors and long-term effects in understanding and addressing marriage conflict dynamics.
**Keywords:** Marital conflict, Education strategies, Mathematical model

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## THE ROLE OF ARTIFICIAL INTELLIGENCE IN ENHANCING THE TEACHING AND LEARNING OF MATHEMATICS FOR NATIONAL DEVELOPMENT

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## Abstract

This study investigated the role of AI towards Enhancing the Teaching and Learning of Mathematics for National Development. The study was guided by two objectives, two research questions and two null hypothesis. The teaching and learning of Mathematics in Nigeria are faced with great problems that make most student to perform poorly in the subject. This observations became a challenge and this is why the current effort is been raised. An instrument titled Perceptions of students on the role of AI towards enhancing the teaching and learning of Mathematics with twenty items was used for data collection and was analyze using chi-square. The instrument was validated by three experts. The reliability of the instrument was tested using split-half and found to be reliable with 0.76 reliability coefficient. The result shows that; AI plays a pivotal role towards enhancing the teaching and learning of Mathematics. The researcher concluded that the use of AI should be encourage among Mathematics students and researchers so as to make the best use of it toward national development and recommended that Government should fund researches on Mathematics so as to investigate more in diverse areas on AI in order to put to an end the down ward Mathematics performance among students.

**Keyword: Mathematics, Artificial Intelligence, Teaching and Learning, Students**

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# COOLING ENHANCEMENT OF A COMBUSTIBLE MATERIAL IN A VERTICAL CHANNEL: BY SUSPENSION OF ALUMINIUM OXIDE NANOPARTICLES

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## Abstract

Combustible materials pose a risk of self-ignition and subsequent explosions, leading to significant property damage and loss of lives. The Beirut Lebanon explosion in August 2020 serves as a tragic example, causing numerous fatalities, injuries, displacements, and destruction of infrastructure due to the ignition of an abandoned cargo ship carrying Ammonium nitrate. To tackle this issue, this study focuses on improving cooling of a combustible material during combustion by suspending Aluminum oxide nanoparticles within the material. The approach involves developing a mathematical model describing the behavior as heat transfer of a reactive nanofluid in a vertical channel. The governing equations of the problem are solved using spectral collocation weighted residual method (SCWRM), a numerical technique. The method's efficiency is validated by comparing the obtained results with existing findings. The influence of thermophysical parameters, such as nanoparticle concentration, convective heat loss, as well as thermal stability of the system are comprehensively analyzed. The findings of this study can potentially have practical implications for improving safety measures and preventing property damages and loss of lives.

***Keyword:*** First Boubaker polynomials, Fish, Investment, Model, Optimal control problem
*AMS Subject Classification*: 49N05, 65L05, 65L06, 65Z05

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## THE STABILITY ANALYSIS OF MULTIPLE ORDER RATIONAL INTEGRATORS FOR THE SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS.

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**Abstract**
In this research, we implement the basic formulas of the multiple order rational integrators for the solution of ordinary differential equations. The Region of Absolute Stability (RAS) of the various order of the rational integrator is examined. The stability analysis of the method was carried with the use of MAPLE-18 and MATLAB softwares to obtain the Jordan Curves. It was discovered that the various methods are all A-Stable, and that the regions of absolute stability of the different integrators are in the entire left - half of the complex plane.

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## Prediction Variance-Based Efficiency Criteria for Exploration of Variations of Partially Replicated Response Surface Designs

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**Abstract**
Partial replications of the cube (factorial) or the star (axial) components in the exploration of regression-based response surface designs, especially the central composite designs (CCD) improve the quality of the designs for experimental purposes. To minimize the prediction variance (PV) of the design, the G- and V-efficiency criteria are the efficiency criteria of choice. By replicating the factorial component of the CCD times and the axial component, times, , this study presents new computational techniques for the G- and V-efficiency criteria for spherical and cuboidal regions of the CCD. Partial replications the factorial and axial portions of the CCD give a new configuration of the extended design matrix, , thereby modifying the dispersion matrix, and the corresponding inverse, for a *k*-factor CCD. The matrix algebra of gives the prediction variances, which are scaled by N and divided by to obtain the G-efficiency criterion, N = number of runs, *p* = number of model parameters. Normalizing the integrated scaled prediction variance using the volume of the design space, , gives the V-efficiency for partially replicated CCD. For *k* = 3-10 factors, numerical results are presented for different placements of the star points.

**Keywords:** design space, matrix algebra; prediction variance; replication; star point

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# INTEGRATING ARTIFICIAL INTELLIGENCE AND DIGITAL ECONOMY CONCEPTS INTO MATHEMATICS EDUCATION: A SYNERGISTIC APPROACH FOR FUTURE-READY SKILLS

**by**

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***Abstract***
*This paper explores the integration of artificial intelligence (AI) and digital economy concepts within mathematics education, aiming to equip students with future-ready skills. Traditional mathematics education is enhanced by incorporating AI algorithms, data analysis, and digital economic principles. The paper discusses the pedagogical strategies, challenges, and opportunities associated with this integration. It emphasizes the importance of fostering a seamless connection between mathematical reasoning, AI technologies, and digital economic frameworks to prepare students for the evolving demands of the workforce. Case studies and practical implementations in educational settings are presented to demonstrate the effectiveness of this synergistic approach. The paper concludes with implications for curriculum development and the broader impact on shaping a workforce adept at navigating the complexities of a digitally-driven economy.*

**Keywords:** Mathematics Education, Artificial Intelligence, Digital Economy, Future-Ready Skills, Pedagogical Strategies, Curriculum Development, Data Analysis, Workforce Preparedness.

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# Amortization Strategy and Effect on Annuity Contracts in a Defined Contribution (DC) Pension Scheme during the Wealth Generation Stage

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## Abstract
A policy on Pension Annuity contracts in a DC scheme, during the wealth generation process is developed. The fund investor invested in a stock (a risky asset), modeled with C.E.V process and Money in the account (a riskless asset), modeled with constant interest rate. Here, the Pension Fund Administrator (P.F.A)

considered and investigated the relevance/significance of extra stochastic contribution, as a form of amortization fund to his investment. The constrained optimization program was developed and transformed into a nonlinear partial differential equation, using the associated Hamilton Jacobi Bellman (H.J.B) equation. The explicit solution of the constant relative risk aversion (C.R.R.A) is obtained, using Legendre transform, dual theory, and change of variable methods. Theorems are constructed and proved on the pension wealth investment strategy and the optimal utility function. It is established herein, with the optimal utility function that the extra stochastic contribution is of no physical significance to the satisfaction of the investor, due to its absence in the optimal utility function at the terminal stage.

Key words: Amortization, Annuity, C.R.R.A; D.C; C.E.V, Wealth Generation

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## LATTICE-BASED CRYPTOGRAPHIC SCHEME FOR SECURE BLOCKCHAIN DEVELOPMENT AND FINANCIAL SYSTEMS IN NIGERIA

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### Abstract

This research proposes the adoption of lattice-based cryptographic schemes for enhancing the security and resilience of blockchain development and financial systems in Nigeria. Lattice-based cryptography offers robust protection against quantum attacks and can address emerging security challenges faced by traditional cryptographic algorithms in the context of blockchain technology. This paper explores the potential benefits, challenges, and implications of integrating lattice-based cryptographic techniques into the Nigerian blockchain ecosystem, with a focus on improving security, scalability, and trust in financial transactions.

**Keywords:** Lattice-based cryptography, Blockchain technology, Financial systems, Security, Quantum resistance, Nigeria

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## AN EFFECTIVE CONJUGATE GRADIENT-LIKE METHOD VIA CONJUGACY CONDITION FOR SYSTEM OF NONLINEAR EQUATIONS

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***Abstract***
Conjugate Gradient algorithm was initially introduced to remedy or overcome the short-comings of Newton's and Quasi-Newton's methods for solving unconstrained optimization problems which was later extended to System of Nonlinear Equations and is efficient for handling large-scale problems because of its rapid convergence properties, simple implementation and low storage requirement. In this research, a Hagher-Zhang-type conjugate gradient parameter is derived via conjugacy condition. Under mild assumptions, the global convergence of the proposed algorithm was established. The codes were written in MATLAB (R2014a) and run on a Personal Computer 2.13GHz CPU processor and 2GB RAM memory. The Iteration would be terminated if the total number of iterations exceeds 1000 or stopping conditionis attained. The two methods were tested using twenty (20) test problems with different initial points and dimensions (n values). Numerical results for the benchmark test problems using the profiles of Dolan and More (2002), which is a tool for evaluating and comparing the performance of iterative methods, demonstrate that our proposed algorithm is more effective and efficient than some existing ones.

**Keywords:** Nonlinear Equations, Conjugate Gradient Methods, Conjugacy Condition, Non-negative Parameter, Hagher-Zhang parameter, Global Convergence.

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## An Economic Order Quantity Model for Repaired Non-Instantaneous Deteriorating Items with Two-phase Demand Rates and Time-dependent Linear Holding Cost

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**Abstract**
In this research, an EOQ model for repaired non-instantaneous deteriorating item with two components demand rates and time-dependent linear time holding cost has been established. The demand rate is assumed to be time dependent quadratic before deterioration sets in after which it is considered as constant. Optimal cycle length and order quantity are determined so as to minimise total variable cost. The necessary and sufficient conditions for the existence and uniqueness of the optimal solutions are provided. Numerical examples are given to demonstrate the application of the model. Finally, sensitivity analysis of some model parameters on the decision variables have been carried out and the implications are discussed. In the discussions, suggestions toward minimizing the total variable cost of the inventory system are given.
**Keywords**: Economic Order Quantity, Repaired Non- instantaneous deteriorating item, Two-phase demand rates, Linear Holding.

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## EFFICIENT HYBRID BLOCK NUMERICAL METHOD FOR THE SOLUTION OF STIFF INITIAL VALUE PROBLEMS AND OSCILLATORY DIFFERENTIAL EQUATIONS

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**Abstract**
A highly effective hybrid block technique has been devised for numerically integrating first-order stiff ordinary differential equations in initial value problems, as well as for handling oscillatory differential equations. This method computes two solution approximations alongside two off-step points at each integration step, achieving remarkable sixth-order accuracy. By adjusting a parameter ρ within the range (-1, 1), various sets of formulas can be derived from this method. Upon selecting a specific value for ρ, the method's consistency, zero stability, and convergence are confirmed. The absolute stability region is depicted graphically, illustrating that the method is A-stable. Through comparative numerical experiments, the efficiency of this novel method is demonstrated when compared with certain existing implicit numerical block methods. Notably, the developed approach exhibits superior accuracy over certain existing algorithms while remaining competitive in terms of execution time.

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## POPULATION GROWTH USING PSEUDO-LOGISTIC MODEL

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**Abstract.**
Malthusian, Verhulst and Richards Growth Models are widely used population growth models. However, in this article, we simulate the future population growth of Federal Capital Territory (F.C.T) using three models: exponential, logistic and Richards; to ascertain the model that has the best fit in modelling population growth of FCT over time. This study is based on the assumption that population growth follows a sigmoid curve that shows the rate of population growth slowing down as the population approaches a certain limit or carrying capacity. Then, a comparative analysis of exponential, logistic and Richards methods is presented. Furthermore, the

result of the analysis shows that FCT has a growing population and that Richards growth model with MAPE and RMSE values of 1.39% and 19159.53826 respectively is the most accurate and closely followed by logistic growth model with values 3.18% and 63451.47975 respectively. The study concludes that Richards growth model with R−squared value of 0.786 has the best fit for population growth projection of FCT. with approximate growth rate at 9.3% per annum, the projected population of the FCT will hit 31,635,270 million by the year 2045 all things being equal. Therefore, the government should invest in massive agricultural revolution to accommodate the growing population. management system.
**Keywords:** carrying capacity, population size, population density, census, mathematical model.

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## Managing Infectious Diseases Under Quiescence

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**Abstract**

In this work, quiescence is added to the Susceptible-Infectious-Recovered (SIR) model with demography. In order to investigate consequences of quiescence in the infection process in more depth, we use stochastic simulations on the stochastic version of model that we built. This method provides a more accurate picture of the dynamics of infectious diseases by taking into consideration the inherent randomness in the disease processes. We examine the effects of quiescence on the number of infected people using simulations. The results, presented in histograms depicting the distribution of infected individuals, reveal a notable trend: the mean number of infected individuals is higher when quiescence is incorporated into the dynamics. These finding emphasizes the dynamic influence of quiescence on infectious disease spread. The higher mean number of infections during periods of quiescence highlights the need for public health strategies that are flexible enough to focused interventions during these times to reduce the possibility of an increase in infections.

**Keywords:** Parasite quiescence; Managing; Model; Stochasticity; Public Health; Prevention.

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## CONSUMER BEHAVIOUR ANALYSIS VIA THE FUSION OF NONLINEAR MATHEMATICAL MODELLING AND BIG DATA ANALYTICS

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**ABSTRACT**
This study focuses on developing a mathematical model to predict consumer behaviour on social media platforms using big data analytics. It addresses limitations of previous linear model-based approaches by introducing a nonlinear mathematical model with an exponential transformation. The methodology involves collecting data from various social media platforms and cleaning it for quality. Machine learning models such as linear regression, decision tree regression, and random forest regression are employed and evaluated for predictive accuracy using metrics like root mean square error (RMSE) and model comparison. The results show significant differences in consumer behaviour metrics across social media platforms, highlighting the multifaceted nature of user engagement. The integration of nonlinear models, particularly with Decision Tree (RMSE: 1929.1020, Accuracy: 0.99377808) and Random Forest Regressors (RMSE: 2122.0389, Accuracy: 0.993234067), improves predictive accuracy compared to Linear Regression (RMSE: 6373.38372, Accuracy: 0.8682727). The study concludes that advanced predictive models, such as nonlinear models, better capture the complexities of consumer behaviour on social media. It emphasizes the need for evolving methodologies and sophisticated modelling techniques to accurately predict and understand consumer behaviour in digital contexts.

**Keywords**: Prediction, Consumers' Behaviour, Non-Linear Mathematical Modelling and Big Data Analytics

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## Numerical Evaluation of Adverse Effects of Economic Fluctuations on the Investment Returns of Insurance Industry in Nigeria

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**Abstract**
The investment landscape in Nigeria is inherently influenced by economic fluctuations that pose substantial challenges and opportunities for investors and policyholders. This paper aims to investigate and provide solutions to the adverse effects of economic fluctuations on the investment returns of Insurance Industry in Nigeria through a numerical evaluation. These adverse effects are capable of resulting into future delay and

volatility-noise in the financial market which influences the investment returns of Insurance Industry. These adverse effects are modeled as Advanced Stochastic Delay Differential Equation (ASDDE). The modeled equation is solved using a two-step Hybrid Block Adams Moulton Methods (2HBAMM) with the newly developed mathematical expressions for the evaluations of the delay term and noise term. Numerically, through mathematical demonstration, these adverse effects are expressed by solving some examples of the modeled equation which revealed its financial and economic implications.

**Keywords:** ASDDE; HBAMM; Absolute Random Error; Economic Fluctuations; Investment Returns; Insurance Industry

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## Order and Convergence Analysis of the New Fixed Coefficient 3-Point Diagonally Implicit Block Backward Differentiation Formula for the Numerical Treatment of Stiff Ordinary Differential Equations

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**Abstract**
This research explores the utilization of the new fixed coefficient diagonally implicit block backward differentiation formula for solving stiff initial value problems. The study encompasses the determination of the order of accuracy with error constant of the method. The necessary and sufficient conditions for the convergence of the method, namely zero stability and consistency are both met, ensuring the method's effectiveness. Through a comparative analysis of numerical and theoretical solutions for chosen stiff initial value problems, the impact of convergence criteria becomes evident. Notably, the method demonstrates improved accuracy as the step length approaches zero.

**Keywords:** Fixed coefficient, Stiff IVPs, Order of the method, Convergence analysis, Zero stability and Consistency.

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## ON THE RADIAL PART OF BRIOSCHI-HALPHEN EQUATION

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**Abstract**

In this research we apply the method of asymptotic separation of variables to find the radial part of Brioschi-Halphen equation in order to discuss exact and quasi-exact solvability of its algebraic equation in the framework of *sl*(2)-algebra. By passing through the Banach Gelfand triples we also, of independent interest, obtain the distributional solution of the radial equation as an infinite sum of scalar multiples of derivatives of the Dirac delta distribution.

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## INTEGRATION OF STOCHASTIC BLACK-SCHOLES MODEL WITH GAUSS-LEVYJUMP USING EULER-MARUYAMA METHOD

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Abstract
This work studies the independent disturbances in the stochastic chart of Black-Scholes asset model. Aside the Wiener process, there are other notable disturbances in the market chart of the Black-Scholes asset model. This disturbance known as the Levy process is a discrete process which arises as a result of Stochastic Independent Poisson Analysis (SIPA). To study this disturbance, a one-step Euler-Maruyama method was developed to handle the SIPA scenario. Mean Absolute Error(MAE) and Strong Order of Convergence was used to establish the stability of the method as well as the Region of Stability. Numerical examples was considered and the method was found to be accurate and recommended for use as a financial tool.

**Keywords:** Euler-Maruyama method, Stochastic differential equation, Ito integral, Levy process, Stochastic-independent, Poisson distributed jump, random variables, deterministic model

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## Second law analysis of a MHD Jeffrey Fluid with Variable Viscosity and Nonlinear Thermal Radiation Flowing over a Stretching Sheet

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**Abstract**
This study rigorously explores entropy generation in the flow of and heat transfer of an electrically conducting Jeffrey fluid with non-linear thermal radiation. The fluid flows over a linearly stretching sheet with non-uniform heat source/sink. This particular model takes into consideration variable fluid viscosity and convective boundary conditions. The governing equations were derived based on the first and second law of thermodynamics, while suitable similarity transforms were deployed to non-demensionalise the equations. The effects of various thermophysical parameters on Bejan (contribution of heat transfer irreversibility), total entropy generation,

temperature and velocity profiles are scrutinized. Results for Nusselt (heat transfer rate) and skin friction coefficient are presented in a tubular form, while the other were graphically visualized. This study unequivocally depicts that increasing values of viscosity variation parameter reduces both velocity and temperature profiles. The findings reported here have significant in potential applications in material and metallurgical engineering, as well as various industrial processes where controlling heat and flow is crucial.

**Keywords:** Entropy generation, nonlinear thermal radiation, Jeffrey fluid, non-uniform heat source/ sink, Runge-Kutta coupled with shooting technique.

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## GENERALIZED INERTIAL ALGORITHM INVOLVING FAMILY OF SUM OF TWOMONOTONE MAPPINGS AND STRICTLY PSEUDOCONTRACTIVE MAPPINGS

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Abstract
In this paper, we introduce a new inertial type algorithm for approximation of a common point
in the set of fixed point of strictly pseudocontractive mappings and the set of solutions of finite family of monotone variational inclusion problems involving generalized cocoercive mapping.

**Keywords**: Generalized cocoercive mapping; fixed point; strictly pseudocontractive mapping; monotone variational inclusion problem.

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## Galerkin Weighted Residual Method for the Solution of Cantilever Beam Equations

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**Abstract**
Cantilever beams, commonly employed in construction to support balconies, roofs, and other overhangs, constitute structures with one end fixed to a solid vertical body while the other end remains free. The equations governing cantilever beams are often higher-order differential equations with complex boundary conditions, typically addressed through numerical methods. This study explores the application of the Galerkin weighted residual method, acknowledged in literature for its efficacy, to approximate solutions for select cantilever beam equations. A comparative analysis is conducted among exact solutions, the iterative integration method, and results obtained through the Galerkin weighted residual method. The findings underscore the effectiveness of the proposed method, which consistently outperforms existing literature in yielding superior results.

**Keywords:** Cantilever beam equation, Numerical solution, Boundary value problem, Galerkin weighted residual method.

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## Thermal Mechanism in Magneto Radiated [(Fe3O4–Ag) / EG]hnf with Modified Magnetic Field: Applications in Technological Processes.

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## Abstract

The rapid development of modern nanotechnology in industries and medical area have brought about the idea of mixing more than one nanoparticle in a base fluid which is called hybrid nanofluid. Hybrid nanofluid enhances the thermophysical properties of flow better compare to ordinary nanofluid. The main object of the present paper is to examine the thermal mechanism in magneto radiated [(Fe3O4-Ag)/EG] casson fluid flow through a porous medium with modified magnetic field. This led to a mathematical flow model in terms of highly non-linear differential equations. The partial differential equations and their boundary conditions were reduced to ordinary differential equations using a suitable similarity variable. The resulting non-linear system of equations is then solved using Chebychev Collocation Method with the aid of Wolfran Mathematical software. It is found that the heat transfer rate of the hybrid nanofluid is higher as compared to the traditional nanofluid. The imposed magnetic field of high strength is a better tool to control the motion of (Fe3O4-Ag)/EG inside the boundary layer. Thermal radiations and slip parameter are observed to be beneficial for thermal enhancement for both (Fe3O4-Ag)/EG and Fe3O4/EG.

**Keywords:** Ethylene Glycol (EG), Fe3O4-Ag, Hybrid Nanofliud, Slip Boundaries, Casson Fluid

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## Analytical solutions of linear two-dimensional liquid chromatography model for single component heterogeneous reaction

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**Abstract**
In this work, we obtain analytical solutions for a two-dimensional general rate model of liquid chromatography considering a single component heterogeneous reaction. The model equations are made up of a set of coupled partial differential equations, consisting of axial and radial dispersion, together with various mass transfer kinetics that are considered. Hankel and Laplace transformations are used to obtain solutions for Danckwerts and Dirichlet boundary conditions. Various test cases are carried out considering different physical parameters that are used to analyze the chromatographic reactor. A high-resolution finite volume scheme is used to obtain approximate solutions for the governing equations of the model. Both the analytical and numerical results were compared and were in good agreement, validating the numerical results. The obtained results shows that the chromatographic reactor performs more efficiently for increased value of the heterogeneous-type first-order reaction constant.

**Keywords:** liquid chromatography, finite volume scheme, heterogeneous reaction, two-dimensional general rate model.

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## Heat and Mass transfer in Casson MHD nanofluid flow over a horizontal plate with nonlinear thermal radiation.

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**Abstract**
This article explored the importance of highly nonlinear thermal radiation on Casson MHD nanofluid flow and heat and mass transfer over a horizontal plate. The thermal, momentum and diffusion partial slip conditions are considered are the plate surface. The partial differential equations were simplified into ordinary differential equations through a similarity procedure. The final ordinary differential equations were solved numerically through Runge-Kutta Fehlberg algorithm in Maple software. The importance of the various parameters such as Casson Parameter, nonlinear thermal radiation parameter (R), Prandtl number (Pr), thermophoresis parameter (*Nt*), Brownian motion parameter (*Nb*), magnetic parameter (*M*), local Grashof number, temperature relaxation parameter , momentum slip parameter , concentration relaxation parameter , thermal slip parameter , Lewis number (*Le*), diffusion slip parameter , density variation with temperature and density variation with concentration are fully discussed in details through tables and graphs.

**Keywords:** Casson Fluid; Nanofluid; Nonlinear thermal radiation; Partial slip; MHD

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## Extragradient-type algorithm for zeros and fixed-point problems in Banach

**Spaces**

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**Abstract**
In this paper, we introduce a new hybrid extragradient-type algorithm for approximating an element in the set of common solutions of equilibrium problems and common fixed points of family of Bregman demigeneralized mappings which is also a common zero of the sum of maximal monotone and Bregman inverse strongly monotone operators in the setting of reflexie Banach space. Strong convergence of the proposed algorithm to a solution of the said problems is established which improves and generalizes many recently announced results in the literature.

**Keywords**: Equilibrium problem, Maximal monotone operator, Bregman inverse strongly monotone operator, Bregman demigeneralized mapping.

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**On the characterization of some variants of inverse properties in conjugate loop***.

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**Abstract**
A conjugate loop is a two-sided loop that obeys the identity $x(yx^{-1}) = (xy)x^{-1}$. In this work, necessary and sufficient(s) conditions for conjugate loop to possess variants of inverse property (left, right, weak, cross, automorphic, anti-automorphic) were established.

**Keywords and Phrases**: left, right, weak, cross, automorphic, anti-automorphic inverse properties, conjugate loop.

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**Games Theory and its Application to Real Life Situation (A Case Study of Delta State Police Divisional Head Quarters, Abraka**.

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**Abstract**

This paper discussed Games Theory and its application to real life situation. Emphasis was on the application of Games Theory to check some unlawful practice and even suspects under investigation such as multiple (or false) confession from suspects, use of physical violence during investigation and wrong conviction of suspects. This paper uses the prisoner's dilemma method, a situation where two suspects apprehended for a crime are held in separate rooms and cannot communicate with each other. Also, quantitative method was employed to examine the research problem effectively. Data collection that aided this research were sourced through systematic sampling from previously existing works from authors. This research was developed to check some sharp unlawful Police practice and even from suspect under investigation as well as employing the technique of Game Theory as a way of obtaining truth from suspects, administering justice speedily and a strong avenue for prison decongestion due to the alarming conditions in most Nigerian Prisons.

**Keywords**: Game theory, Quantitative technique method, prisoner dilemma method, systematic sampling.

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## A Nonlinear Mathematical Model for the Effect of Diabetes Population on a Community

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**Abstract**
This work presents a susceptible, diabetes without complications, diabetes with minor and major complications mathematical model to study the effect of the diabetes population on the population dynamics of a community. The model is a system of four linear differential equations of first order. The solutions of the model were found to exist and are positive by positivity analysis. The diabetes-free and diabetes-endemic equilibrium points are found to be locally stable using the Routh-Hurwitz Stability Criterion for a degree n-polynomial. The numerical simulation of the model was carried out using various scenarios, and the results were presented. The results show that the diabetes population in a community has a great effect on the population dynamics of the community.

**Keywords:** Diabetes, Mathematical Model, Stability, Simulation

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## On semi-symmetric (α, β, γ)-inverse quasigroup*.

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**Abstract**
A quasigroup (Q, ⋅ ) will be called an (α, β, γ)-inverse quasigroup, if there exist fixed permutations α, β and γ of Q, such that (x ⋅ y)α ⋅ xβ = yγ ∀ (x, y) ∈ Q×Q. Examples were given to illustrate that a quasigroup can have more than one (α, β, γ)-inverse property. Consequently, for a set ΔQ of such triples, it was shown that if the semi-symmetry law holds in (Q, ⋅ ), it induces a binary operation on ΔQ for which ΔQ is a group. Interestingly, this leads to an isomorphism between ΔQ and the autotopism group of (Q, ⋅ ).

**Keywords and Phrases**: Weak, cross, m-, (r, s, t)-, (α, β, γ)-, inverse properties, semi-symmetric

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## Is there any correlation between Teachers' method of teaching and the impact on Student`s Academic Achievements in school? A viewpoint from Senior Secondary Mathematics in Taraba state.

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**Abstract**
*This study examined the correlation between teacher's method of teaching and the impact on Student`s Academic Achievements in Senior Secondary School Mathematics in Taraba state. Nigeria. The study adopted simple survey design. A review of related literature to the study was carried out. Data collected and collated were based on a set of Scales in the Questionnaire Mathematics-Teachers-Method of Teaching- Related Scales* ***(MTMTRS)*** *consisting of twenty-four (24) items and was administered to eighteen (18) public schools across the State; three LGA from each senatorial zone of the State, consisting of nine (9) LGAs with sample size of 900 students. These instruments were validated and found to be reliable at 0.89 and 0.91 respectively. One hypothesis were generated and tested at 0.05 significant level and Data were analyst using Chi-square and Pearson product moment correlational Statistical Method through SPSS statistical Software computer package. The Null hypothesis was rejected and the alternative upheld. Findings revealed that there is significant strong positive correlation between teachers' methods of teaching and the impact on Students Achievement in senior secondary school Mathematics. Hence from the findings made, the researcher recommend among others that; the school Authorities, industrialists, parent's Government and private individuals should encourage the teachers with good teaching methods that would promote learning in schools; Curriculum planners should make the employment of teachers with good method of teaching in schools compulsory at all levels of education to enhances students performances.*

**Keywords:** Questionnaire, Student`s Achievements, Method of teaching, Pearson product moment correlation, Chi-square, SPSS.

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## Optimized Hybrid One-Step Method for Direct Integration of Second-Order Initial Value Problems

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**Abstract**
This paper presents a novel optimized hybrid one-step method for efficiently solving second-order initial value problems (IVPs). The proposed method combines the advantages of both classical one-step methods and implicit multistep methods, resulting in high accuracy and efficiency. The key feature lies in the optimized selection of hybrid point within the integration step, where a combination of interpolation and collocation techniques is employed to approximate the solution and its derivatives. The core contribution of this work is the optimization process, which minimizes the local truncation error of the method. This optimization is achieved through a carefully designed algorithm that iteratively adjusts the hybrid point based on specific error criteria. This optimization process ensures that the method achieves a desired level of accuracy while maintaining computational efficiency. The proposed method is rigorously analyzed for its convergence, stability, and order of accuracy. Numerical experiments demonstrate the effectiveness of the method by comparing it with existing one-step and multistep methods on various benchmark problems. The results showcase the superior performance of the optimized hybrid method, achieving higher accuracy with fewer integration steps compared to conventional approaches. This work provides a valuable contribution to the field of numerical integration by offering a new, efficient, and accurate method for solving second-order IVPs. The optimized hybrid approach has the potential to be applied to a wide range of applications in science, engineering, and other disciplines.

**Keywords:** Collocation, Initial Value problem, Interpolation, Optimize, Power series, Zero stability.

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## Analysis of weak associativity in some hyper-algebraic structures that represent redox reactions*†

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**Abstract**
In this paper, some chemical systems of Americium (Am), Titanium (Ti) and Gold (Au) which are represented by hyper-algebraic structures (SAm;), (STi;) and (SAu;) were studied. The analyses of their algebraic properties and the probabilities of elements in redox reactions were carried out. It was shown that in the redox reactions, the left nuclear (N_)-probability, middle nuclear -probability and right nuclear -probability for each of the hyper-algebraic structures (SAm;), (STi;) and (SAu;) is less than 1.000. This implies that, (SAm;), (STi;) and (SAu;) are non-associative hyper-algebraic structures. Also, from the results obtained for FLEX-probability, it was shown that, (SAm;), (STi;) and (SAu;) have flexible elements because the values of their FLEX-probabilities are 1.000 each. Hence, (SAm;), (STi;) and (SAu;) are flexible.

**Keywords and Phrases**: Hypergroup, Polygroup, Polyloop.

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## Assessing the efficiency of cooling systems utilizing tetra-hybrid nanofluid in solar powered automobiles through numerical analysis

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**Abstract**
In the situation of escalating concerns over energy reduction, the study presents a comprehensive numerical investigation on the utilization of tetra-hybrid nanofluids, (a novel class of nanofluid comprising four distinct metallic nanoparticles) to enhance cooling performance in solar-powered automobiles. A system of governing partial differential equations incorporating magnetic field and radiation effects within a porous medium is formulated. To facilitate computational analysis, the PDEs are transformed into a system of ordinary differential equations using a similarity transformation approach. The resulted system ODEs were solved numerically using Galerkin method. The result analyses the effect of thermophysical parameters on velocity and temperature profiles. Furthermore, the significant of magnetic field and radiation on skin friction and Nusselt number were analysis. The numerical results demonstrate that tetra-hybrid nanofluids exhibit a substantial enhancement in cooling efficiency compared to conventional coolants. By strategically optimizing these parameters, this innovative technology offers a promising, sustainable solution to the

prevailing energy crisis, potentially reducing operational costs and promoting the widespread adoption of solar-powered automobiles.

**Keywords**: Solar-powered automobiles, Tetra-hybrid nanofluid, Galerkin method, magnetic field, radiation.

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## Application of Conjugate Gradient Parameter for Real Unconstrained Optimization Problems

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**Abstract**
Conjugate gradient (CG) method have been utilised to solve nonlinear unconstrained optimization problems due to less storage locations and fewer computational cost in dealing with large-scale problems. In this paper, we present a real-life application of spectral PRP CG method in regression analysis, the proposed method is suitably derived from the CG search direction without secant condition. Some benchmark functions with several variables have been use to prove the global convergence properties and satisfies sufficient descent condition. The numerical results are certified by exact line search techniques; the method outperform the prominent least square method.

**Keywords:** Spectral CG Global convergence property; Exact line search; Regression analysis.

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## Effect of Nonlinear Buoyancy on Variability in Viscosity and Thermal Conductivity on Steady Mixed Convection Couette Flow and Heat Transfer

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**Abstract**

In this paper, we investigated effect of nonlinear buoyancy on variability in viscosity and thermal conductivity. The dimensionless governing equations describing the different flow situations have been formulated and solved analytically using Homotopy perturbation method. The influences of the dimensionless flow parameter have been plotted graphically and discussed. During the course of computation, it was

found that an increasing viscosity corresponds to the increasing resistance to flow which suppresses the velocity of the working fluid, but decreasing the viscosity triggers a decrease in the temperature of the working fluid. It was also discovered that the momentum boundary layer thickness increased due to the corresponding strengthening of the convection currents caused by increase in the thermal conductivity and flow velocity increases as well. An increased in mixed convection increases the reverse flow region and the critical value of the mixed convection leading to the flow reversal.

**Keywords**: Couette flow; thermal conductivity; variable viscosity; Homotopy perturbation method; pressure gradient.

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## Commutativity Theorem for Semi-prime Rings Involving Multiplicative (Generalized)-Derivations

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***Abstract:***

In this paper, we first establish some results for associative rings involving multiplicative (generalized)-derivation. Secondly, it is shown that the commutativity theorems of semiprime rings admitting multiplicative (generalized)-derivation associated with the mapping if, for all and are integers, center of and satisfies one of the conditions:

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) ). Thirdly, some related results are considered for commutativity of prime rings and an example is given to justify the obtained results.

**Keywords**: Associative ring, commutativity, multiplicative (generalized)-derivation, prime ring, semi prime ring.

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## EFFECTS OF MAPLE SOFTWARE ON STEM STUDENTS' PROBLEM-SOLVING SKILLS IN MATHEMATICS AMONG KANO STATE SCIENCE AND TECHNICAL SCHOOLS

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**Abstract**
The study investigates the effects of Maple software on STEM students' problem-solving skills in mathematics in Kano State science and technical schools: the implication of the 21st century in Nigeria. The study was guided by three research questions and three research hypotheses. A quasi-experimental design was adopted for the study. The population of the study comprises all SS II students in Kano state science and technical schools. Two intact classes were selected for the study from two different schools randomly selected, that is, science and technical schools, respectively; thus, 115 students were the sample size of the study, making 58 science and 57 technical students. The Mathematics Problem-Solving Skills Test (MPSST) was the instrument used for data collection. The instrument was valid and reliable, with a reliability coefficient of 0.87 using Cronbach's alpha. Mean and standard deviation were used to answer the research questions, while ANOVA and Pearson Product Moment Correlation were used for testing the null hypotheses. The study concludes that Maple software affects STEM students' problem-solving skills in mathematics. The study suggests that computer programs like Maple should be used collaboratively in the mathematics teaching and learning process.

**Keywords:** Maple software, STEM, Problem-Solving Skills, Mathematics, 21st century learning Skills.

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## An Explicit Formula for the number of fuzzy Subgroups of ,

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**Abstract**
One of the most important problems in fuzzy group theory is to count the number of fuzzy subgroups of a finite group $G$ . Based on the natural equivalence relation defined on the subgroup lattice of $G$, the problem of counting all distinct fuzzy subgroups of $G$ can be translated into a combinatorial problem on the subgroup lattice of $G$. In this paper, the distinct fuzzy subgroups were characterised by an enumerative technique derived from the set of representatives of isomorphism classes of subgroups with their sizes. A linear non-homogeneous recurrence relation of degree one with constant coefficients was formulated. The associated linear homogeneous solutions and particular solutions were applied to prove the explicit formula.

**Keywords:** Fuzzy subgroups, Natural equivalence relation, recurrence relations, Enumerative techniques

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# Bregman Subgradient Extragradient Method for Solving Pseudo-monotone Variational Inequalities and Fixed Point Problems in Banach Spaces with Application

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**Abstract**
In this paper, we study modified sub gradient extragradient method in reflexive Banach space. We proved a strong convergence theorem for approximating a common fixed point of Bregman nonexpansive mapping and solutions of variational inequality problem with Lipschitz continuous and pseudomonotone mapping, without knowledge of Lipschitz constant. Our result extends and improve important recent results announced by many authors.

**Keywords**: Bregman distance; Bregman non-expansive mapping; Sub-gradient Extragradient; Pseudomonotone; Variational Inequality; Fixed Point.

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# Comparative Analysis of the Effects of Temperature on Swelling Capacity of Acha Semolina of different mix ratio.

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**Abstract:**
This work is primarily concerned with the optimal analysis of the effects of temperature on swelling capacity of Acha Semolina. Finite difference method was used to obtain models for the determination of the effect of temperature on the swelling capacity of the three different samples, (control, 100% Acha and 90% Acha with 10% cassava mixtures) using mathematical tools embedded in Maple 18' software. The model equations obtained were
, , for the control, Acha, and 90% Acha with 10% Cassava respectively. The Swelling capacity of the three different samples within the temperature range of $60^0$C to $120^0$C was also simulated. The optimum swelling capacity for control, 100% Acha and 90% Acha with 10% cassava mixtures at $100^0$C were 11.2856, 11.2144 and 14.165 respectively. The results conclude that 90% Acha with 10% cassava mixtures at $100^0$C has the best swelling capacity and finite difference method can be used to predict the effect of temperature on the swelling capacity of Acha Semolina".

**Key words**: Acha, Finite Difference Method, Maple 17' software Optimal Analysis, Swelling Capacity. Temperature

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# Pth – ROOT CHARACTERISATION OF FULL TRANSFORMATION SEMIGROUP

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**Abstract**

$T_n$ is the set of all mappings from X to X, where X = {1, 2, . . ., n} and the semigroup operation employed is composition of maps. A method for constructing and characterising the Pth – root of an arbitrary element was developed. Also, subsemigroups and subgroups were classified.

**Keywords:** Idempotents, Multiple Roots, Subgroups

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# Option Pricing of Dividend Paying Underlying with Discrete Investment Strategy

Akeju A. O and Dekede P. O

**Abstract**

The Black-Scholes model showed us that dividend payment is paid continuously, but in reality, we know that this is not so because they are paid discretely. In this paper, we developed a Close form formula for the European Call and Put Options of dividend paying assets using the Dynamic Discrete Trading strategy. Data from the Nigerian Stock Exchange was generated to test the model. The results obtained showed efficiency in the strategy and also helps in forecasting assets with high dividend rates which are appealing to investors.

**Keywords**: Option Pricing, European Call, European Put, Discrete Trading, Dividend Payment, Discrete Dynamics Investment Strategy.

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# A Panel Vector Autoregressive Model (Pvar) Analysis Of Impact Of Renewable Energy And Financial Development On Co2 Emission And Economic Growth In West African Region.

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**Abstract**
In contrast to prior research in the energy-environment domain, this study utilizes the panel vector autoregressive (PVAR) model developed by Love and Zicchino (2006) to explore the influences of renewable energy and financial development on carbon dioxide (CO2) emissions and economic growth across selected West African countries (Senegal, Ghana, Nigeria, Guinea, Burkina Faso, Mali, and Togo). Employing both vector autoregressive and panel vector autoregressive models, we delve into the reactions of CO2 emissions and economic growth (measured by GDP) to renewable energy and financial development variables, considering their interdependencies. Additionally, variance decomposition of the dependent variables concludes the analysis for the period spanning 1990 to 2020 across the seven West African countries. The results uncover intricate dynamics among CO2, GDP, and lagged variables, with the first lag of CO2 and GDP consistently driving significant changes in their current levels. The second lag of CO2 demonstrates a significant negative impact in both models. Noteworthy is the marginal influence of the credit to the private sector variable on both CO2 and GDP in the Panel VAR model. These findings contribute nuanced findings to the temporal relationships among these variables, enriching our understanding of their interactions over time.

**Keywords:** $CO_2$ emission, economic growth, renewable energy, financial development, Vector autoregressive model, Panel vector autoregressive model.

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# BUOYANCY DRIVEN CONVECTIVE FLOW OF STRATIFIED FLUID IN A VERTICAL CHANNEL WITH ACCELERATION AND IMPULSIVELY STARTED PLATES FILLED WITH ANISOTROPIC POROUS MATERIAL

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**Abstract**

In this research, the mathematical model that describes the theoretical analysis of the combined effects of thermal stratification, anisotropic porous material and buoyancy force distribution on natural convection in a vertically oriented channel; where the bounding plates and of the transport medium are subjected to acceleration and impulsive motions respectively is investigated. The governing mathematical model consist of a set of coupled second order partial differential equations which are solved using: Laplace Transform Technique, D'Alembert (decoupling) method and Riemann-sum Approximation algorithm. The choice of the D'Alembert method is to systematically uncouple the coupled governing equations while still retaining their

initial orders. The research established that if, the transient fluid flow becomes steady only at and close to the impulsively started plate.

**Keywords**: Buoyancy force distribution; Anisotropic porous material; Stratified fluid; D'Alembert method; Riemann Sum Approximation; Acceleration motion; impulsive motion

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## Mathematical Analysis of a three State Gonotrophic Cycle Model for the Population Dynamics of the Mosquito

Mary Y. Fomboh-Nforba, Gideon A. Ngwa

**Abstract**

The mosquito is at the center of transmission for many infectious diseases of humans. We develop an Ordinary Differential Equation model with three state variables. Our model's results show that there exists a threshold parameter, $R_m$ , the vectorial reproduction number and two equilibrium solutions: the trivial equilibrium solution (0,0,0), which is stable to small perturbations when $R_m \leq 1$ and unstable otherwise, and the non-trivial equilibrium solution, $(R_m -1)^{1/n}(1,1,1)$, which is locally and asymptotically stable with oscillatory returns to the equilibrium point. An approximation to the amplitude and period of these oscillations is derived. Variables which can be used to control the oscillatory dynamics and hence vector abundance are determined.

**Keywords**: gonotrophic cycle, vectorial reproduction number, mosquito dynamics, mathematical model, oscillatory dynamics.

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## VIBRATION ANALYSIS OF TIMOSHENKO BEAM UNDERNEATH TWO KINDS TRAVELLING LOADS

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**Abstract**

In this study, a process involving Galerkin and integral transformation technique has been extended and used to solve the problem of the dynamic behavior of structural elements placed on flexible foundation and subjected to two kinds moving loads. The first case treated involves the vibration analysis of Structural elements traverse by regular loads and exact form solution in series form describing the motion of the structural members is obtained. Lastly, in the second case, the dynamic behavior of the structural elements subjected to harmonic variable magnitude travelling loads with steady velocity is treated and the impacts of loads, foundation stiffness, axial force and distance apart of the travelling loads are examined. Plotted curves obtained show the effects of these parameters on the structural members under the action moving loads. Resonance condition for the beam load system is also established. These findings are useful in Engineering and related fields.

**Keywords:** Vibration, Harmonic loads, Resonance, Galerkin method, Flexible foundation, Moving loads

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## EFFECT OF THERMAL RADIATION AND CHEMICAL REACTION ON UNSTEADY MAGNETOHYDRODYNAMICS (MHD) PLANE POISEUILLE FLOW OF FOURTH-GRADE FLUID IN HORIZONTAL PARALLEL PLATES

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**Abstract**
This study investigates the thermal radiation and chemical reaction effects on unsteady magnetohydrodynamics plane poiseuille flow of fourth-grade fluid in horizontal parallel plates channel between stationary plates. The equations that govern the flow are the momentum equation, the energy equation and concentration equation. The partial differential equations were solved using He – Laplace method which is a combination of Homotopy perturbation method and Laplace transformation method. Results revealed that: (i) velocity and temperature fields rise due to the increment of thermal radiation parameter. (ii) for upsurging data of chemical reaction, velocity and concentration fields diminish. (iii) velocity profile goes up when third and fourth-grade parameters get to raise; velocity and skin friction fields decline due to the increment of magnetic parameter. (iv) increasing Prandtl number tend to diminish the velocity and temperature profiles. (v) strong values of Schmidt number decrease the boundary layer of the Sherwood number field. The results of this work are applicable to chemical and thermal reactions in the field of auto mobile, MHD power generators and industrial processes such as polymer extrusion of dye, draining of plastic films etc.

**Keywords**: Thermal radiation, Chemical reaction, Plane Poiseuille flow, Fourth grade fluid.

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## SIMULATING AND PREDICTING ANNULAR PRESSURE LOSSES IN ECCENTRIC HORIZONTAL WELLS

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**Abstract**
In this paper, we simulate and predict annular pressure losses in eccentric horizontal wells. The simulation was conducted using the work bench platform of ANSYS CFX 15.0. The Eulerian model of multiphase flow and Reynolds stress model of turbulence closure available in CFX was used. Experimental data from previous literature were compared with simulation data to confirm the validity of our model. The focus is on evaluating the effect of crucial parameters of fluid flow during horizontal well drilling.

**Keywords:** Annular pressure loss, eccentric horizontal well, horizontal well drilling

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## DIHEDRAL GROUPS AS EPIMORPHIC IMAGES OF SOME FIBONACCI GROUPS

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**Abstract**
The Fibonacci groups and one of its generalization are defined by the presentations; where and where all subscripts are assumed to be reduced modulo . In this note we give an alternative proof that for: and are all infinite by establishing a morphism onto the dihedral group , for all .

**Keywords**: Group, Fibonacci group, dihedral group, (homo)morphism.

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## Convergence and Stability Analysis of some Iterative Algorithms for a class of modified Zamfirescu Operators in Gb-Metric Spaces

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**Abstract**
In this paper, the Picard, Mann, Ishikawa and Noor iterative algorithms are considered in one of the metric space variant called complete $G_b$-metric space. Strong convergence and stability results are proved for a class of modified Zamfirescu operators in this space. In turns out that strong convergence and stability of the Picard iterative scheme is obtained as a corollary. Our results are generalizations and improvement on most results in the literature.

**Keywords:** Convergence; T-stability; modified Zamfirescu condition; iterative algorithms; $G_b$-metric space.

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## A New embedded Multi-step Collocation Approach for the Numerical Solution of Stiff Ordinary Differential Equations.

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**Abstract**
The K-step multi-step collocation approach (k > 2 ) is embedded in one step with the aim to improve both the accuracy and the stability properties of the numerical integration procedure for stiff ordinary differential equations (Odes). The associated initial boundary or mixed conditions can all be treated uniformly by the resulting one-step block methods. The process is demonstrated by three numerical initial value problems of stiff ordinary differential equations occurring in real life which work favorably with existent schemes

**Keywords**: K-step, Multi-step, Collocation, Embedded one-step, Stiff Ordinary Differential Equations.

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## INERTIAL HALPERN-TYPE METHOD FOR SOLVING MONOTONE VARIATIONAL INEQUALITY AND FIXED PROBLEMS IN BANACH SPACES

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**Abstract**
In this paper, we introduce inertial Tseng's method and Halpern-type algorithm for solving monotone variational inequality and fixed point problems in 2-uniformly convex and 2-uniformly smooth real Banach spaces. We establish strong convergence of our proposed method under some assumptions on parameters without knowledge of the operator norm. Finally, we give numerical experiments to illustrate the efficiency of our main result.

**Keywords and phrases:** Inertial method, Halpern Tseng's extradient subgradient method, monotone variational inequality problem, demigeneralized mapping, strong convergence, Banach space.

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**Abstract**
The dynamics of cancer cells and their interactions with the immune system has been a subject of scrutiny over the years due to the complexity in the interactions between the tumour cells and the immune system. In this paper, a new model on the roles of white blood cells on Cancerous tumour growth is presented. The mathematical model which is a system of partial differential equations is analysed using the Variational Iteration method (VIM). A stability analysis of these models is also presented to determine conditions for tumour free equilibrium and to verify the effect of white blood cells. The simulation result is presented in tables and graph.s the result reveals

that the model developed gives a robust representation of the dynamics of tumour cells and provide the interactions between the tumour cells, immune system and drug response and give an insight to some factors to be considered in the treatment of cancers. A superlative investigation of the effect of white blood cells was carried out and the result showed that a person with low white blood cells count is at a high risk when effected by tumour growth.

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## Formulation of A(α)-stability of A Stiffly Stable Extended Parameter Dependent Nested Linear Multistep Methods with an off-step points for Stiff ODEs

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**Abstract**
This paper considers the formulation of $A(\alpha)$-stability of a stiffly stable extended parameter dependent nested linear multistep with an off-step points of order for step number $k \leq 5$ for the numerical solution of stiff initial value problems (IVPs) in ordinary differential equations (ODEs). The method incorporates one or more off-step points for better stability properties. The stability properties of the methods were investigated and the intervals of absolute stability of the methods with step number $k \leq 5$ are presented using the boundary locus techniques. The method is *A- stable* for $k = 1$ and *A(α) –stable* for $2 \leq k \leq 5$. The instability of the new methods set in when >6.which makes the methods more suitable for stiff initial value problems.

**Keywords:** nested multi-step methods, stiffly stable**,** boundary locus, A-stability, A()-stability.

## 213
## HOMOTOPY PERTURBATION METHOD OF MAGNETOHYDRODYNAMICS (MHD) COUETTE FLOW WITH VISCOUS DISSIPATION AND NEWTONIAN HEATING IN A VERTICAL CHANNEL

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**Abstract**
The consequences of magnetohydrodynamics (MHD) and viscous dissipation on an electrically-conducting and incompressible fluid in a vertical channel affected by

Newtonian heating condition is analytically investigated. The governing equations have been derived using homotopy perturbation method. The impacts of the pertinent flow parameters on velocity and temperature were graphically displayed. The rate of heat transfers and shear stress on the heated and cold plates have also been calculated. It is noteworthy to mention that the hydrodynamic and thermodynamic distributions of the fluid increase with an increase in the viscous dissipation parameter while the function of increasing the magnetic field is to decelerate the fluid flow. The graphical comparison between the work of Zulkifree *et al*. (2019) and the present study demonstrates an excellent agreement when Br and M approaches zero respectively, thereby authenticating accuracy of the current investigation using HPM. Additionally, this research can have possible applications in the lubrication industry and biomedical sciences and have proved very useful to designers in increasing the performance of mechanical systems when viscous dissipation is involved.

**Keywords:** Magnetohydrodynamics (MHD), Viscous dissipative fluid, Newtonian heating, Vertical channel, Homotopy perturbation method.

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## UNRAVELING THE COMPLEXITY OF HYPERACUSIS: A GRAPH THEORETICAL APPROACH

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**Abstract**

The prevalence of hyperacusis, an auditory condition characterized by heightened sen- sitivity to sounds, continues to rise, posing challenges for effective diagnosis and in- tervention. This work deepens our understanding of hyperacusis etiology by employing graph theory as a novel analytical framework. Our study constructs a comprehensive graph wherein nodes represent various factors associated with hyperacusis, including aging, head or neck trauma, infection/virus, depression, migraines, ear infection, anxiety, and other potential contributors. Relationships between factors are modeled as edges, allowing us to visualize and quantify the interactions within the etiological landscape of hyperacusis. Utilizing graph theoretical metrics, specifically the calculation of metric dimension of a connected graph, we identify key nodes (landmarks) that serve as critical influencers in the interconnected web of hyperacusis causes. This approach offers a unique perspective on the relative importance and centrality of different factors, shedding light on the complex interplay between physiological, psychological, and environmental determinants. Visualization techniques will be employed to enhance interpretability and facilitate the identification of central nodes.This research contributes to the growing body of knowledge surrounding hyperacusis byoffering a network-centric perspective on its multifaceted causes. The outcomes hold thepotential to inform clinical practices, guiding healthcare professionals in prioritizing interventions and personalized treatment plans based on the identified landmarks within the etiological network. Through the integration of graph theory into hyperacusis research, we unravel the complexity of this auditory condition and pave the way for more effective approaches to its management.

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## A Hybrid Inertial Iterative Method For Fixed Point problems and Finite Families of Generalized Equilibrium Problems

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**Abstract**
We propose a hybrid inertial iterative method for finding a common element of fixed points of a family of a general class of nonlinear nonexpansive mappings and a common solution of a family of generalized equilibrium problems. The sequence of the propose hybrid inertial iterative method is proved to converge strongly to a common element of the families. Our results extends, improves and generalizes several results in the literature.

**Keywords:** Inertial Iterative Method; Fixed Points problems; Nonexpansive Mappings; Generalized Equilibrium Problems

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## Viscous Dissipation Effect on a Steady Generalised Couette Flow of Heat-Generating/Absorbing Fluid Through a Vertical Channel with Convective Boundary Condition

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**Abstract**
In this article, the steady natural convection Couette flow of viscous incompressible fluid through a vertical channel with convective boundary condition has been studied. The dimensionless governing equations describing the different flow situations have been formulated and solved analytically using Homotopy perturbation method. The influences of the dimensionless flow parameter have been plotted graphically and discussed for varying values of the controlling parameters. During the course of computation, it is found that fluid velocity and temperature increase with an increase in viscous dissipation and also seen that growing mixed convection parameter leads to corresponding rise in velocity and temperature. It is further discovered that heat absorption leads to increase in the heat transfer on the heated plated. Finally, it is concluded that heat generation contributes to increase the mixed convection, hence it requires decrease in mixed convection parameters to bring about a reverse flow near the stationary plate.

**Keywords**: Couette flow; convective boundary condition; heat generation/ absorption; Homotopy perturbation method; viscous dissipation.

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## Thermal energy optimization of quartic autocatalysis characteristics in a stratified water-based ternary hybrid nanofluid flow conveying over a surface with non-uniform thickness: Contribution to SDG7

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**Abstract**
The relationship between solar radiation and ternary hybrid nanofluid is significant in optimizing solar energy systems and improving heat transfer efficiency in various industrial processes with potential relevance to Sustainable Development Goal 7. The research examines the analysis of bioconvective flow of ternary nanofluid conveying three distinct nanoparticles namely in a water based system influenced by heterogeneous-homogenous kind of chemical reaction within a stratified with variable thickness. In addition to the heat transfer efficacy of the system, the thermal properties of a parabolic trough solar collector (PTSC) installed on a solar plate to generate a continuous energy source is examined. The governing nonlinear equations are transformed and parameterized into dimensionless systems by invoking appropriate similarity variables. The simulation of the dimensionless system is carried out via shooting procedure coupled with 4th order Runge-Kutta integration scheme. The effect of pertinent parameters are tested on various distributions and discussed properly. It is envisioned that along upper horizontal surface of paraboloid of revolution at lowest layer of stratification there is diminution of temperature distribution for larger thermophoresis and at the highest layer of stratification incremental values of Brownian motion correspond to augmentation of the temperature distribution for ( and ( owing to the improved thermal efficiency of the conventional base fluid.

**KEYWORDS:** Homogeneous-Heterogeneous reaction, stratification, Brownian motion, non-uniform thickness, solar radiation, bioconvection

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## COMPARATIVE STUDY OF POLARITY IN SIGNED TRANSFORMATION SEMIGROUP.

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**Abstract**
Let where is the set of integers. Let and be the signed full transformation, signed partial transformation, polarity in signed order-preserving and order- decreasing full contraction transformation and polarity in signed order- preserving and order decreasing partial transformation. Thus, for we generated the elements of the subsemigroups and compared the polarity in signed order- preserving and order-decreasing full and partial transformation semigroup by the order and of order respectively.

**Keywords**: polarity, signed, full, partial, transformation semigroup.

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# CENTRALIZERS IN TRANSFORMATION SEMIGROUP OF ALTERNATING NONNEGATIVE INTEGERS

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**Abstract**

The semigroup $AZ_n$ is the transformation semigroup of alternating nonnegative integers using composition of mapping, which is constructible with odd – even parts approach and the centralizer of is defined as . The aim is to obtain equivalence and partial order relations that are definable with the centralizers, hence having symmetric bands.

**Keywords:** Centralizers, Relations, Bands, Semigroup

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# MHD elastico-viscous hybrid nanofluid flow between two stretchable rotating disks with thermal radiation and non-uniform heat source/sink: A spectral Approach

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**Abstract:**

The problem of fluid flow between two rotating disks is quite fascinating due to its applications across a wide range of scientific, engineering and product design. This study investigates the impact of MHD elastico-viscous hybrid nanofluid between two stretchable rotating disks in the presence of thermal radiation, non-uniform heat source, and chemical reaction. The governing nonlinear coupled partial differential equations were formulated. To access the significance of the various transport mechanisms in the fluid flow, appropriate similarity variables were employed to transform the partial differential equations to nonlinear ordinary differential equations. The resulting non-dimensional models were admissible to numerical solution using spectral method. The numerical solution was validated with the work in the literature and it was shown to be in the good agreement. The effects of some pertinent parameters in the system were shown on graphs and in tabular forms.

**Keywords:** Elastico-viscous Fluid, Thermal Radiation, Chemical Reaction, Heat Source/Sink, MHD

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## Non-similarity Approach to Heat Transfer Enhancement of MHD Casson Fluid Flow Past a Moving Plate with Cross Diffusion and Variable Properties

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**Abstract**
The objective of this work is to examine combined effects of thermal radiation, chemical reaction, cross diffusion, and variable thermophysical properties on an MHD Casson fluid flow over a moving plate. The flow model follow the usual conservation law was transformed using non-similarity technique. The resulting non-dimensional models were solved by an appropriate numerical solution. The accuracy of the numerical technique was validated with the works in the literature. The analysis of the effects of some embedded parameters in the system were shown through graphs and tables.

**Keywords:** Casson Fluid, Thermal Radiation, Cross Diffusion, variable properties, MHD

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## INTEGRAL INEQULITIES OF OPIAL-TYPE WITH TWO PARAMETERS ON TIMES SCALES

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**Absrtact**
The aim of this paper is to establish some proofs of Opial-type inequalities with two parameters of summation $\alpha < 0$, $\beta > 0$ and $\beta \leq \alpha < 0$ on time scales. The methodology employed is the Holder's inequality. Some exsisting results on other estimates were obtained.

**Keywords:** Opial-type Inequality, Monotonic Functions, Holder's Inequality, Time Scales.

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## APPROXIMATION OF FIXED POINTS OF S−GENERALIZED ASYMPTOTICALLY NONEXPANSIVE MAPPINGS

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**Abstract**
In this paper, a new class of mappings that unifies various classes of mappings associated with the class of asymptotically nonexpansive mappings is introduced. In addition, an iterative algorithm for approximation of solutions of nonlinear equations involving the new class of mapping introduced is proposed in the setting of uniformly convex real Banach spaces. Moreover, using Generalized Gossez-Lami Dozo Property (GGLD), Demiclosedness Principle for the new class of mappings under study is established. Using the Demiclosedness Principle, weak convergence of sequence of iterates generated by the proposed iterative algorithm is obtained. Furthermore, under the auspices of condition B; classical results due to Jung (2007), Schu (1991); and well-known properties of infimum, supremum, limit inferior and limit superior, strong convergence of sequence of iterates generated by the iterative algorithm is established. The results presented in the thesis not only generalize and improve the corresponding results of Alber, Chidume and Zegeye (2006), Ofoedu and Madu (2014), but also unify, extend, and generalize the corresponding result of Mukhamedov and Saburov (2010) and Temir (2009). The theorems obtained augment, generalize, improve, and unify several results that are recently announced.

**KEYWORDS**: S-generalized asymptotically nonexpansive mappings, Iterative algorithm, Fixed point theory, Weak and strong convergence theorems, uniformly convex real Banach spaces.

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## On Geometric Properties of a Class of Univalent Functions Involving Legendre Polynomials

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**Abstract**
Legendre polynomials, which are orthogonal polynomials that arise in the solution of many physical and mathematical problems with some other special functions, have recently gained increased importance in the study of geometric function theory. The aim of this paper is to derive the coefficient estimates and investigate the Fekete - Szego problem for a new subclass of univalent functions associated with Legendre polynomials.

**Keywords**: Univalent Function, Coefficient Estimates, Fekete - Szego Inequalities, Legendre Polynomials.

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## CONVERGENCE OF A FINITE DIFFERENCE SCHEME FOR SOLVING PARABOLIC PARTIAL DIFFERENTIAL EQUATIONS: A MODIFED CRANK-NICOLSON APPROACH

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Abstract

This paper presents the convergence of a finite difference scheme for solving one dimensional parabolic partial differential equation particularly the diffusion equation. Finite difference methods are types of numerical methods which gives approximate results to the solution of differential equations. Due to instability and low accuracy of some finite difference scheme, the implicit types are most employed. In this paper, an implicit finite difference scheme derived by modifying the classical Crank-Nicolson scheme is proposed. Worthy of note is that; for a finite difference approximation to converge, consistency and stability are necessary. Therefore, the local truncation error using Taylor's expansion, consistency and stability were constructed. The stability analysis of the method when examined, using matrix approach shows that the method is unconditionally stable. The scheme was implemented by solving some diffusion equations. When compared with the exact solutions and some existing results in the literature, the new scheme was found to be efficient and converges faster.

**Keyword:** Finite difference method, Local truncation error, Taylor's expansion, stability, diffusion equation, consistency

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## Block Method Coupled with the Compact Difference Schemes for the Numerical Solution of Nonlinear Burgers' Partial Differential Equations

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**Abstract**

In this paper, a novel block method is proposed to solve the nonlinear time dependent Burgers' equation. The Burgers' PDE describes the behaviour of one dimensional viscous fluid undergoing both advection and diffusion. The Burgers' PDE is semi discretized in spatial direction by using the standard fourth-order compact difference schemes to yield system of nonlinear ordinary differential equations (ODE) in time.The resulting system of first-order ODE from the Burgers' equation is approximated by a new derived Block method. The new two-step hybrid methods are developed through the Interpolation and Collocation techniques. The derived methods are applied as a block method for the numerical solution of the nonlinear Burgers' Partial Differential Equations (PDE) which is of physical relevance. The proposed block scheme has been proven to be zero-stable, consistent and convergent, also saving computational time while maintaining good accuracy. The efficiency of the derived method is demonstrated using three test problems.

**Keywords and phrases**: Block Method, Burgers' Equation, Collocation Technique, Compact Difference Scheme, Nonlinear PDEs.

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## STABILITY ANALYSIS OF DENGUE FEVER TRANSMISSION DYNAMIC

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**Abstract**
This study presents a mathematical model for analyzing the dynamics of Dengue fever transmission, exploring both quantitative and numerical aspects. The model underwent comprehensive examination, including investigations into solution existence and positivity. The basic reproduction number $R_0$ was investigated using next generation matrix technique. Stability analysis utilized Jacobian techniques to explore the system's behavior. Through numerical simulations, it was observed that heightened treatment and immune system fortification correlate with reduced Dengue fever transmission rates.

**Keywords**: dengue fever, stability, reproduction number.

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## Natural Convective Couette flow in a Darcy porous medium with Thermal Radiation, Variable Thermal Conductivity and Chemical Absorption Characteristics: A Finite Element Approach (FEM)

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**Abstract**
Here the natural convection Couette flow in a Darcy porous medium taking into account the influence of thermal radiation, variable thermal conductivity and chemical absorption is examined. The flow is governed by modelled partial differential equations (PDEs) in non-dimensionless form with initial and boundary conditions and the Couette fluid model is also be used to characterize the fluid behavior. Then, using suitable dimensionless quantities, these PDEs are transformed. Since the flow governing equations of the problem under study are extremely complex and complicated, techniques that complement experimental and theoretical fluid dynamics by providing alternative potentially cheaper means of testing fluid flow systems is used. Therefore, the Finite Element Method (FEM) is employed after discretization of the PDEs. With the help of Graphs and tables, the significance of embedded thermo physical parameters associated with the flow quantities viz. velocity, temperature, concentration of the fluid was explained through series of numerical computations and analysed. This research also studied and compares the results obtained by Omokhuale and Jabaka (2022). It is interesting to report that an excellent agreement was established, thereby authenticating and validating the accuracy of FEM as a strong tool.

**Keywords:** Couette Flow; Thermal Radiation; Variable Thermal Conductivity; FEM; Natural Convection.

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## Implicit Multiderivative One – Step Method for Direct Solution of Second Order Ordinary Differential Equations

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**Abstract**
This paper describes the development, analysis, implementation and comparative study of an Implicit Multiderivative linear one – step method for direct solution of initial value problems of general second order ordinary differential equations. In developing the method, the step number (k) was made constant at one (1) while the order of derivative (l) was made constant at two (2) and Taylor's series expansion was adopted as the basis function. The basic properties of the method were analysed and the analysis revealed that the method was accurate, consistent , zero – stable, convergent and absolutely stable. The method was used to solve some sampled initial value problems of linear and non – linear second order ordinary differential equations. The numerical results when compared with the exact solutions showed that the method was accurate, effective and efficient.

**Keywords**: Implicit, Multiderivative, One – step, Second order, ordinary differential equation

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## Two-point Taylor polynomial iterative linearization via Legendre nodes for exothermic diffusion model.

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**Abstract**
A novel approach was devised to solve an exothermic diffusion model by employing an iterative linearization method that utilizes a two-point Taylor polynomial and Legendre roots. The procedure commences with the process of linearization and thereafter addresses the nonlinear problem by employing the Legendre root collocation technique. Iterative solutions are derived by the repeated application of Legendre root collocation method until the intended solutions are attained. The accuracy of the procedure was assessed through the utilization of measures such as comparison with referenced results and the calculation of relative absolute error.

**Keywords**: Exothermic diffusion model; iterative linearization; Legengre nodes; two-point Taylor polynomial.

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## Comparative Analysis of Euler and Runge-Kutta Methods in Adam's Bashfor-Moulton Predictor-Corrector Method for Solving Second-Order Ordinary Differential Equations.

Akeju A. O and Olatunji O.I

**Abstract**

This paper presents a comparative study between the Euler and Runge-Kutta methods the framework of the Adams Predictor-Corrector method for solving initial value problems of second-order ordinary differential equations (ODEs). The Euler method, a simple first-order explicit scheme, and the Runge-Kutta method, a higher-order explicit scheme, are two widely used numerical methods for solving ODEs. However, their performance can vary significantly depending on the characteristics of the problem being solved. In this study, we focus on comparing these methods within the context of the Adams Predictor-Corrector method, which is known for its stability and efficiency in solving initial value problems. Through numerical experiments and theoretical analysis, we demonstrated that the Runge-Kutta method outperforms the Euler method when integrated into the Adams Predictor-Corrector framework. Runge-Kutta method exhibits more superior accuracy and stability than Euler method.

**Keywords:** Euler's Method (EM), Runge-Kutta Method of Order Four (RK-4), Adams-Bashforth-Moulton (ABM) Method, initial value problem.

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## Peak Value in Combined Effect Time Depended Matrix Using Geometric Mean

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**Abstract**

Combined Effect Time Depended Matrix (CETD) is used in determining the peak value of some attributes or entities. Often time, arithmetic mean is used to determine the peak value. Meanwhile, the problem of the skewness, outliers and fluctuation are still being encountered despite the use of Average Time Dependent (ATD) Matrix which was originally designed to eliminate biasedness. In this paper, Geometric mean is used instead of arithmetic mean because it usually takes care of the problem of skewness, outliers and fluctuation which exists in the ATD. The results of the computation shows that the class of peak value is invariant using Geometric mean.

**Keywords**: CETD, ATD, outliers, skewness, fluctuation.

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**Abstract**

The q-difference calculus or quantum calculus which was initiated at the beginning of 19th century by Jackson has attracted the serious attention of researchers. This great is due to its

application in various branches of mathematics and physics. Consequently, the aim of this paper is to establish the coefficient bounds and Fekete-Szego inequalities for certain classes of analytic functions associated with q-difference operator and the normalized Rabotnov function in an open unit disk. In addition, we explored certain applications of these results for the functions defined through convolution.

**Keywords and Phrases:** Univalent function, Schwarz function, q-starlike function, q-convex function, q-derivative operator, subordination, Fekete-Szego inequality, Rabotnov function.

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## BUCKLING LOAD OF AN ELASTIC CUBIC NON – LINEAR STRUCTURE STRESSED BY AN IMPULSE LOAD

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**Abstract.**
In this paper, perturbation procedures are used in asymptotic expansions of the variables in the analytical determination of the dynamic buckling impulse load of an imperfection - sensitive cubic model structure stressed by an axial impulse. The results show that light damping enhances the dynamic stability of the structure. This is evident as the structure buckles at relatively higher values of dynamic loads.

**Keywords**: Nonlinear structure, cubic model structure, impulse load, dynamic buckling. damping.

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## A Review of some Methods for Handling Singularity Problems in Linear Discriminant Analysis

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**Abstract**
Linear Discriminant Analysis is an aspect of Discriminant Analysis that is applicable when the interest is to describe group separation or predict group membership. But for LDA to perform well, some underlying assumptions are expected to be met by the data being treated. When any of these assumptions are not met, LDA will fail to perform. In an attempt to ensure the performance of LDA irrespective of the failure of these assumptions, researchers have been able to propose methods that are robust to the violation of such assumptions. One of such assumption is that the within class scatter matrix should be nonsingular. In this paper, we categorize some methods that have been proposed to handle the singularity problem with a view to elucidate some of their advantages and disadvantages
.

**Keywords:** Linear Discriminant Analysis, Violation of Assumptions, Singularity Problems, Robustness, Classification.

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**Abstract**
We consider a new integral operator defined by

We obtain sufficient conditions for the univalency, starlikeness and convexity of this operator defined on the space of normalized analytic function in the open unit disk. Some corollaries were
obtained as special cases of our theorems.

**Keywords**: analytic function, univalent function,integral operator, special function, starlikeness convexity.

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## Analysis of Variable Properties on Ternary and Tetra Hybrid Nanofluids Using Blasius Rayleigh-Stokes Time Dependent Variable: A Model For Solar Aeronotic Engineering

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**Abstract**
This study analyses the properties of ternary and tetra hybrid nanofluids using the Blasius Rayleigh-Stokes time dependent variable model. The study focuses on the behavior of the hybrid nanofluids under various conditions and the effects of variable viscosity and variable thermal conductivity on their performance. Copper (Cu), Zirconium dioxide (ZrO2), Aluminium Oxide (Al2O3) and Iron Oxide (Fe2O3) are the four nanoparticles examined in this study with the mixture of Ethylene glycol (EG) as the base fluid. The governing partial differential equations were reduced to a non-dimensional equation with the aid of the Blasius Rayleigh-Stokes variable resulting into a set of coupled nonlinear ordinary differential equations. The resulting non-linear ordinary differential equations together with their boundary conditions were solved numerically using Finite Difference Method (FDM) with the aid of symbolic mathematical computation program, Maple 18.0 software. The results showed that the tetra hybrid nanofluid flow has enhanced velocity when compared to the ternary nanofluid as a result of the presence of magnetite in the fluid. Overall, this study provides a comprehensive analysis of the potential of hybrid nanofluids in solar aeronautic engineering and highlights the importance of considering variable properties in their design and implementation.

**Keywords:** Solar radiation; Blasius Rayleigh-Stokes Variable; magnetic; variable properties; Finite Difference Method.

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## Regression Models for Predicting the Effect of Depth on Temperature of Three Different Lakes

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**Abstract:**
The temperature of lakes at different depths affect fish activities; this can be determined by the time taken to effectively harvest the fishes in the lake either on the surface water or deep down the lake. This work seeks to predict the temperature of different lakes at different depths using statistical analysis. Hypotheses were made and linear regression models showing the effect of water depth on the temperature of lakes 1, 2 and 3 were formulated and solved using the SPSS software package. The R-Square values for each lake were also determined. It was observed that the predicted values were not significantly different from the observed values. The results showed that R-Square values for each lake were, 0.947, 0.956, and 0.944 respectively. It can be concluded that linear regression models can be used to analyse the effect of water depths on lake's temperature and the simulated data for each lake show that there is an inverse relationship between the depth and temperature of the lakes, which means that, the lake depth increases as the temperature decreases. The models obtained compete favourably with other existing models.

**Keywords:** Depth, Fish farming, Lakes, Linear Regression model, R-Square values, SPSS, Temperature.

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## ON THE HOMOLOGY OF A COMPLETE FLAG

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**Abstract**
The geometry of ag manifolds is explored and the homology group H1 computed for the complete ag F(n+1) by viewing it as a simplicial complex. The homomorphisms between the vertices are extended to the free abelian groups generated by the vertices of the chain complex
and it is proved that .

**Keywords**: Flag manifold, Simplicial complex, Homology.

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## NEW CLOSED FORMS FOR A DILOGARITHMIC INTEGRAL, RELATED INTEGRALS, AND SERIES

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**Abstract**
In this study, we present a new closed form for the generalized integral

where a and is the dilogarithm function. This extension is achieved by leveraging our established findings in conjunction with V˘alean's results. Furthermore, we provide explicit closed forms for associated integrals, prove a transformation formula for double infinite series, expressing them as the sum of the square of an infinite series and another infinite series. We utilize this relationship to derive a novel closed form for the generalized series

;

for , where r , for any positive integer k, and denotes the Hurwitz zeta function.

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## Analyzing Cholera Transmission Dynamics: Insights for Public Health Interventions

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**Abstract**
The global challenge of cholera demands a comprehensive approach, blending treatment, immunization, and sanitation efforts for effective control. This study employs mathematical modeling, employing fixed-point reduction techniques, to delve into the dynamics of cholera transmission and assess the efficacy of integrated control strategies. We establish the existence of solutions, verify model positivity and boundedness, and analyze equilibrium points. Stability analysis, including global stability considerations, is utilized to assess the effectiveness of proposed control interventions. Furthermore, we integrate the Mittag-Leffler kernel to accommodate non-Markovian behavior in cholera dynamics. Employing the Adam-Bashforth algorithm implemented in Python, we conduct numerical simulations and present graphical results to elucidate the impact of integrated control measures on cholera transmission and population
dynamics. This research contributes to advancing our comprehension of longterm cholera control strategies, furnishing valuable insights for public health policymakers and practitioners.

**Keywords**: Stability analysis; Global stability; Mittag-Leffler kernel; Numerical simulations; Cholera; Treatment; Mathematical modeling

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## Mittag-Le_er stability for a problem arising in porous media

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**Abstract**
A fractional order problem arising in porous media is considered. Well-posedness as well as stability are discussed. Mittag-Le_er stability is proved in case of a strong fractional damping in the displacement component and a fractional frictional one in the volume fraction component. This extends an existing result from the integer-order (second- order) case to the non-integer case.

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## SENSITIVITY AND STABILITY ANALYSES OF COVID-19 AND TUBERCULOSIS CO-INFECTION DYNAMICS WITH VACCINATION AND RELAPSE

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**Abstract**
Latent and active Tuberculosis (TB) remain the main risk factors to increase the spread of Covid-19 in any community. Until date, the co-infection of Covid-19 and TB continue to result in untimely yet preventable deaths of its victims. This study presents a novel and robust deterministic co-infection model for Covid-19 and Tuberculosis. The model incorporates significant parameters such as vaccination and disease(s) relapse after recovery. Mono-infection models for Covid-19 and TB are also obtained. The positivity of the models' solution and possibility of an invariant region of solution to the models are established. Stability analyses of the models' equilibria are carried out by analyzing the basic reproduction numbers, $R_{0C}$, $R_{0T}$, and $R_0$. It is obtained that the mono-infection models have stable disease-free equilibria at $R_{0C}<1$ and $R_{0T}<1$ and unique locally stable endemic equilibria at $R_{0C}>1$ and $R_{0T}>1$. Sensitivity analyses of the basic reproduction numbers are performed using the forward index sensitivity approach. The result indicates that the recruitment rate into the susceptible population and contact rates for Covid-19 and Tuberculosis have a unitary sensitivity index. The loss of immunity for the vaccinated classes and rate of progression from latent TB to active TB exhibit a direct variation with $R_0$ while vaccination and recovery rates exhibit an indirect variation. Numerical simulation is performed by implementing the MATLAB ODE45 algorithm on all the models. Every parameter sensitive to $R_0$ is varied and the effects of these parameters on the spread and eradication of the co-infections discussed.

**Keywords:** Covid-19, Tuberculosis, Mathematical Modeling, Co-infection, Sensitivity Analysis

## 244
## STATISTICAL ANALYSIS ON MONETARY POLICY OF CURBING UNEMPLOYMENT RATE IN NIGERIA.

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**Abstract**
The study investigated the impact of monetary policy on unemployment rate in Nigeria. The data covered the period from 2002 to 2022, was sourced from the Central Bank of Nigeria (CBN) Statistical Bulletin. Multiple regression & Karl Pearson correlation were utilized to address the main objectives of the study. The test of significance for each variable shows that the constant variables, inflation rate, Gross Domestic Product (GDP), growth rate are significance to the model since the P value is < α value (0.05). Also Karl Pearson correlation coefficient revealed that there is positive degree of relationship on the impact of monetary policy variables in curbing unemployment rate in Nigeria.

**Keywords:** Unemployment rate, Inflation rate & monetary policy

## 245
## Bayesian Estimation of Convoluted Randomized Response Techniques

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**Abstract**
Randomized Response Technique (RRT) is a technique of estimating the proportion of people in a population U that has a stigmatizing attribute S for the purpose of protecting surveyee's privacy and avoiding evasive answer. Classical convoluted-dichotomous Warner and Mangat RR estimators were introduced by Hussain and Shabbir with more privacy protection but less precision. This study aimed at developing Bayesian convoluted-dichotomous RR estimators, πbcdw and ˆπbcdm that is effective and efficient in survey of sensitive variable. Beta distribution,
simple random sampling with replacement, binomial probability function, maximum likelihood
principle were employed as conjugate prior, randomization procedure, sampling distribution and
estimation technique, respectively. The developed estimators were illustrated both on real (druguse
among students of higher institution in Nigeria) and simulated datasets. For the simulation, π was varied from 0.1 to 0.9 with α = 2.00 and β = 90 while the hyper-parameters a and b were chosen arbitrarily. Percentage relative efficiency was used to

demonstrate the efficiency of Bayesian convoluted-dichotomous estimators over the classical counterparts.

**Keywords**: Randomized Response Technique, Sensitive Attributes, Population Proportion, Prior Information, Conjugacy.

**246**

## Algorithm for Computing Linear Volterra and Fredholm Integro-differential Equations by the Use of Boubakar and Third Kind Chebyshev polynomials

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**Abstract**
In this study, we investigated a computational algorithm designed for solving linear integro-differential equations of the second kind. The algorithm utilized Boubakar and third-Kind Chebyshev polynomials as basis functions and utilized Chebyshev-Gauss-Lobatto collocation points to approximate the solution. A comparative analysis was undertaken to evaluate the effectiveness of these collocation points based on the errors obtained. Numerical examples were provided to showcase the method's performance across various orders. Surprisingly, the results revealed that Boubakar polynomials exhibited superior accuracy when compared to third-kind Chebyshev polynomials, as demonstrated by the error tables presented.

**Keywords**: Boubakar polynomials, Chebyshev-Gauss-Lobatto, Third Kind Chebyshev Polynomials, Voltera-Fredhom Intergral Eqautions

**247**

## MATHEMATICAL MODELING OF THE PARASITIC TRANSMISSION DYNAMICS OF IROKO GALL BUG (Phytolyma lata) Walker Scott ON IROKO TREES (Miliciaexcelsa) Welw C.C. Berg.

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**Abstract**
Iroko gall bug (Phytolyma lata) is a major insect pest that threatens the sustainable production of Iroko tree (Milicia excelsa) in the humid tropics of Africa. It is common wherever natural stands, nursery, or plantation of the host species can be found. Establishment of plantations of (Milicia excelsa) has not been yielding the desired result due to the incessant attacks by this insect at the early stages of growth. This work was designed to build a mathematical model of the parasitic transmission dynamic of Iroko gall bug's attack on Iroko trees (Milicia excelsa) and to predict the future attack. The model built resulted into a system of six differential equations, the solution to each equation was found to be positive and bounded. The disease-free and

endemic equilibrium of the system was obtained. Numerical simulations were carried out using octave 6.4.0 version software to perform the sensitive analysis of the system and to show the behaviour of each state variables in the face of insects' attack.

**Keywords**: (Phytolyma lata), (Milicia excelsa), Reproduction number, Equilibrium, Differential Equations.

## 248
## A NOVEL DOUBLE INERTIAL STEPS METHOD FOR SOLVING SPLIT VARIATIONALINEQUALITY AND FIXED POINT PROBLEMS

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**Abstract**.
In this article, we consider the problem of approximating the common minimum-norm solution of
split variational inequality problem (when the underlying operators are Lipschiptz continuous and quasimonotone) and fixed point problem (when the underlying operator is demimetric). In solving this problem, we propose a modified subgradient extragradient method which incorporates the original Mann technique and double inertial steps. We prove the strong converge results of the suggested method with mild conditions on the control parameters. The strong convergence results of our method do not rely on Mann-type and viscosity techniques, unlike several existing methods in the literature. Dependence on the knowledge of the bounded linear operator norm is not required during implementation of our method. We present two numerical examples to test the applicability
of our method, which includes double inertial steps and compare the convergence efficiency of our method with some well known methods in the literature with single inertial term and methods without inertial term. The results in this article improve, extend and generalize several existing results from the setting of finding solutions of optimization problems in a single solution set to the setting of finding common solutions in two solution sets.

**Keywords**: Split variational inequality problem, fixed point problem, subgradient extragradient method, double inertial, quasimonotone operators and demimetric operator.

## 249
## A CERTAIN CLASS OF FUNCTION ANALYTIC AND SUBORDINATE TO THE MODIFIED SIGMOID FUNCTION

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**Abstract**
A certain class of function analytic and subordinate to the modified sigmoid function is defined. Coefficient inequalities, growth and distortion theorems of this class were investigated. It was observed that the results obtained provide extensions to many known results in Geometric function theory. Special cases of the results were equally highlighted.

**Keywords**: analytic function, univalent function, coefficient inequalities, sigmoid function, growth theorem, distortion.

## 250
## Coefficient estimates for certain class of univalent functions involving the modified sigmoid function.

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**Abstract**
In this study, we defined a class $\pounds\,\lambda(\beta, \Phi)$ of analytic and univalent function related to a differential operator by Ma Minda class. By subordination with modified sigmoid function, the bounds on initial coefficients for the function belonging to the class was investigated. Furthermore, the fekete szego functional was established and well known corollaries were highlighted .

**Keywords**: Analytic functions, univalent function, subordination, modified sigmoid function, fekete Szego functional.

## 251
## On the Solutions of Quantum Stochastic Differential inclusions.

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Abstract
This paper is devoted to establishing solutions to a class of quantum stochastic differential inclusion defined in the framework of the Hudson-Parthasarathy calculus. The quantum stochastic differential inclusions are driven by operator valued stochastic processes associated with the creation, annihilation and guage operators of quantum yield theory in a locally convex space of operator observables. These results are valid within the Hudson-Parthasarathy formulation of Quantum Stochastic Calculus.

**Keywords**: Quantum stochastic processes, Topological solutions, - Approximate solutions, Boson Fock Space, Operator Observables

## 252
## Fully Developed flow of Burger's fluid in annuli: Semi-analytical approach

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**Abstract**
Semi-analytical solution of the fully developed flow of Burger's fluid in annuli was investigated. The Laplace transformation (LT) and the Riemann-sum approximation method are performed to derive the analytical expression of the governing partial differential equations. The flow behavior under different physical parameters such as time (t), magnetic parameter (M), relaxation time (λ), retardation (θ) time and Burger's (β) parameter on the velocity and skin friction are presented graphically and discussed. The findings revealed that, the velocity increases with the decreasing of the magnetic parameter (M), relaxation time (λ), retardation time (θ) and increasing of the time (t), and Burger's parameter (β).

**Keyword**: Annuli, Burger's fluid, Riemann-sum approximation and Laplace transform.

## 253
## Approximating zeros of monotone maps and fixed point of generalized nonexpanive operators in CAT(0) spaces

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**Abstract**
We introduce, in this paper, a new iterative algorithm for approximating a common element belonging to the intersection of the set of common solutions of monotone inclusion problems and common fixed points of family of generalized nonexpansive mappings in a Hadamard space. We then prove strong convergence theorem which improved and generalized many recently announced results in the literature.

**Keywords:** Hadamard space, Monotone operators, Generalized Nonexpansive Mapping.

## 254
## Commutative Harmonic Analysis On Some Non-Commutative Nilpotent Lie Groups

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**Abstract**
In this presentation, we characterize the Gelfand pairs on a non-commutative H-type 2-step stratified Nilpotent Lie group. We give and examine the necessary and sufficient condition under which the non-commutative group obeys the Gelfand pairs.

**Keywords**: Nilpotent Lie Groups; Quaternionic Heisenberg Group; Gelfand Pairs; Semi direct Product; K-bi-invariant Functions; Haar Measures.

## 255
## A NUMERICAL SOLUTION OF THE FRACTIONAL NAVIER-STOKES EQUATION USING THE CAPUTO-FABRIZIO ABOODH TRANSFORM METHOD WITH THE REDUCED DIFFERENTIAL POLYNOMIALS

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**Abstract**
A combination of the Aboodh transform method and the reduced differential polynomial technique was employed in this work to solve the Navier-Stokes equations with the Caputo-Fabrizio derivative. Two illustrations are presented to show the efficacy of the used method. The results gotten are showcased with the aid of tables and graphs. It is discovered that the results derived are close to the actual solution of the problems illustrated. This work will thus make it simple to study nonlinear process that arise in various aspect of innovations and researches.

**Keywords**: Aboodh transform, Reduced differential polynomial, Navier-Stokes equation and Caputo-Fabrizio fractional derivative.

## 256
## Products of Quasi-Nipotents in the Symmetric inverse Semigroups

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**Abstract**
Let $Xn=\{1,2,\ldots,n\}$, and let $Sn$ and $In$ be respectively the symmetric group and symmetric inverse semigroup on $Xn$. In this work, we characterise qusi-nilpotents in $In$ and show that if $n$ is odd the semigroup $SIn=In\backslash Sn$, of all partial one-to-one mapping on $Xn$, is generated by its quasi-nilpotents whereas, if $n$ is even the quasi-nilpotents only generate the subsemigroup $SIn\backslash Wn-1$ of $SIn$, where $Wn-1$ is the set of all elements in $SIn$ of defect 1 whose completions are even permutations.

**Keywords**: Semigroup, Symmetric Inverse Semigroup, Quasi-nilpotents

## 257
## ALGORITHM FOR SEMIGROUP BASES AND ITS IMPLICATION ON THE BASES OF CLASSES OF SEMIGROUP

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**Abstract**
The study of generating sets and bases in semigroup started with the experience in the topic in vector spaces, and so with comparison, basic theorems on independent generating sets of semigroups that vary from those about independent generating sets in vector spaces, are formulated. It is shown that there may exist maximal independent set of elements in a semigroup which does not form a generating set. It reveals that there may exists independent set in a semigroup which cannot be expanded to a generating set; rather, adding an element independent from an independent set may make the independent set dependent in a semigroup. Relevant properties of independent elements and sets are investigated, and they serve as tools for developing some proposed algorithms for determining the basis of any given semigroup. Interesting graphical illustrations are given to explain the basis selecting algorithm.

## 258
## Laplace Transform and its Application in the Solution of State-Equation of a Linear Vibrating System

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**Abstract**
In this paper, a single degree-of-freedom mechanical system is modelled using state-space approach to obtain the state equation. The solution to this equation was determined using Laplace transformation. Based on the result of this work, it is found that total system state response X(t) is considered in two parts: a homogeneous solution that describes the response to an arbitrary set of initial conditions X(0) and a particular solution that satisfies the state equation for the given input function F(t). The MATLAB software was also used to determine the response of the system with initial conditions of position and velocity using a step input force as the system excitation. The result is presented graphically.

**Keywords**: differential equation, Laplace transformation, matrix exponential, mechanical system, state-space equation.

## 259
## Asymmetric Lebesgue () Space

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**Abstract**
In this paper, we introduce a special example of asymmetric Hilbert spaces called asymmetric
space. Some preliminary concepts of this new space are well presented. These include, Lebesgue type outer and inner measures; Lebesgue type outer and inner measurable subsets; Lebesgue type outer and inner Borel sets; Lebesgue type outer and inner measurable functions; simple type ona and type two function; and right and left integration of non-negative Lebesgue type outer and, respectively, inner measurable functions. The notion of asymmetric
space generalizes the classical space.

**Keywords**: Real asymmetric Hilbert space; Lebesgue type outer and inner measures; Lebesgue type outer and inner measurable subsets; Lebesgue type outer and inner Borel sets; Lebesgue type outer and inner measurable functions; and right and left integration of non-negative Lebesgue type outer and, respectively, inner measurable functions.

## 260
## Mathematical Modeling of Economic Dynamics in Nigeria: Integrating Artificial Intelligence for Policy Analysis and Forecasting"

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**Abstract**
The paper presents a mathematical model design to unravel the intricate dynamics of the Nigerian economy, focusing on key economic indicators such as Gross Domestic Product (GDP) Product (GDP) growth, inflation rate, and government spending. leveraging artificial intelligence (AI) techniques, the model is intended to enhance policy analysis and forecasting endeavours. Consisting of interconnected components encompassing a GDP growth model, an inflation rate model, and a government spending model, each components is directed by a mathematical structure that captures the intricate relationships between variables and parameters. Simulation and analysis were carried out to examine the impact of various policy interventions on economic performance and stability. Historical datasets encompassing GDP, inflation, and government spending in Nigeria serve as the pivot for model calibration and validation .

**Keywords:** Mathematical modeling, Economic dynamics, Artificial intelligence, Economic performance.

## 261
## FEKETE-SZEGO FUNCTIONAL FOR A CLASS OF NON-BAZILEVIC

# FUNCTION RELATED TO QUASI-SUBORDINATION DEFINED BY A MODIFIED A q- DIFFERENTIAL OPERATOR

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## Abstract
In this work, we investigated the upper estimate and the classical Fekete-Szego functional H2(1) for a new subclass of analytic function related to the class of bounded turning using the principle of quasi-subordination and defined by modified q-Opoola differential operator.

**Keywords**: Analytic functions, bounded turning, principle of quasi-subordination, Fekete-Szego functional, q-Opoola differential operator.

**262**

# Improved Hybrid Model for Direct Integration of Systems of Higher-Order Initial Value Problems

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## Abstract
This research introduces a novel numerical method to estimate solutions for higher-order differential equations with initial value problems (IVPs). It involves the direct integration of a system of third and fourth-order differential equations using a 2-point implicit algorithm constructed with collocation and interpolation techniques, resulting in significant efficiency improvements. The proposed hybrid method, which integrates the first and second derivatives
of the discrete algorithm, enhances both accuracy and convergence rates. Convergence analysis confirms the zero stability and consistency of the method, while numerical experiments showcase its superiority over existing methods for solving systems of third and fourth-order equations. This work presents a valuable numerical approach for efficiently and accurately estimating higher-order differential equations with IVPs.

**Keywords:** Collocation and Interpolation, Convergence, Higher-order ODEs, Hybrid-Block Method, Initial Value Problems (IVPs).

**263**

# The Advancement and Improvement of LASER Technology in a health system in Nigeria

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**Abstract**
This article discusses the mathematics of advancements and improvement of Light Application by stimulated Emission Radiation (LASER) in the health system. The development of LASERs have a wide range of applications in health system, such as removal of wrinkles, birthmarks, tattoos and unwanted hairs. It is worthy to note that LASER can be used to create highly detailed images of internal organs allowing doctors to diagnose and monitor conditions effectively. LASER technologies have become an integral part of healthcare offering a good opportunities for diagnosis treatment and research.

**Keyword:** LASER, Healthcare system, internal organs and diagnosis

## 264
## Weighted Special Atoms Space in Higher Dimensions

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*A joint work with Eddy Kwessi from Trinity University, San Antonio, Texas-USA; Geraldo de Souza, Professor Emeritus at Auburn University-USA and Abulmalik Usman Bello from AUST, Abuja-Nigeria.*

**Abstract.**
In the paper \The special atom space and Haar wavelets in higher dimensions", Demonstratio Mathematica 53 (2020), 1-21, by Kwessi et al., the special atoms space and Haar wavelets were introduced in higher dimensions. In this talk, we introduce \the weighted special atoms space in higher dimensions". A class of weighted functions is defined for which the space and , where , are defined as linear combinations of weighted
special atoms of Type I and II, defined by

respectively, (to be properly defined). We will show that and endowed with infimum norms over all representations in Type I and Type II special atoms, respectively, are Banach spaces. Furthermore, we relate these spaces with the Lebesgue spaces and compute their dual spaces.

## 265
## Hybrid D-iteration process for equilibrium problem and fixed points of asymptotically nonexpansive mappings

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**Abstract**
In this paper, we introduce a hybrid D-iteration process with inertial extrapolation method for two asymptotically nonexpansive mappings and equilibrium problems in

a real Hilbert space. Strong convergence of the proposed scheme is establised. Our results extend and improve some recently announced results in the literature. With numerical example, it is shown that the proposed iterative scheme has faster rate of convergence than inertial hybrid algorithm studied by many authors.

**Keywords**: Asymptotically Nonexpansive, Inertial D-iteration process, Equilibrium problem, fixed point.

## 266
## Application of Variational Iteration Method in Modeling Onchocerciasis Transmission Dynamics

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### Abstract
In this paper, we employ variational iteration method (VIM) to solve a mathematical model that captures the dynamics of onchocerciasis transmission. The proposed model incorporates factors influencing the transmission of Onchocerca volvulus by the dynamics of blackfly populations in human host demographics. Through the VIM, we obtain analytical approximation solutions of the model equations. We utilize Lagrange multipliers to incorporate constraints for acceptable disease prevalence. The variational iteration method and fixing appropriate value for Lagrange multipliers offer a powerful framework for computing state variables of neglected tropical diseases.

**Keywords**: Onchocerciasis, Lagrange Multiplier, Variational Iteration Method, Model Equations.

## 267
## On matrix-free iterative methods for large-scale nonlinear systems of equations_

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### Abstract
This paper examines various types of matrix-free algorithms used to solve non-linear systems of equations. These algorithms possess appealing characteristics such as global convergence without the need for level set assumptions and the norm descent property. Additionally, these algorithms are derivative-free, simple to implement, and require minimal storage. Preliminary numerical experiments showcased the algorithms effectiveness in solving general nonlinear systems of equations.

**Keywords**: Spectral conjugate residual methods; Quasi-Newton type methods; Nonlinear systems of equations; Global convergence.

## 268
## Artificial Intelligence algorithm for Predicting Stock prices and estimating parameter for Black Scholes model in the Nigeria Market

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**Abstract**
Stock price prediction and parameter estimation are critical tasks in financial markets, aiding investors in making informed decisions. This paper introduces a machine learning algorithm for predicting stock prices and estimating parameters for the Black-Scholes model in the Nigeria market. The performance of the models and parameter estimation techniques is evaluated using appropriate metrics such as mean squared error, mean absolute error, and parameter estimation error. Our results demonstrate the effectiveness of Artificial Intelligence techniques in predicting stock prices, providing valuable insights beneficial for investors and financial analysts, both domestically and globally.

**Keywords**: Artificial Intelligence, Stock Price Prediction, Black-Scholes Model, Parameter Estimation, Machine Learning

## 269
## Neural Stochastic Differential Equations and Optimal Stopping Problems

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**Abstract**
Stochastic optimal stopping problems have a wide range of applications, from finance and economics to neuroscience, robotics, and energy management. Many real-world applications involve complex models that have driven the development of sophisticated numerical methods. Recently, computational methods based on machine learning methods have been developed for solving such complex problems, even in high dimensions, beyond what traditional numerical methods can achieve. The neural stochastic differential equation (NSDE)

$$dXt = (Xt; t)dt + (Xt; t)dWt$$

where: and the drift and diffusion functions respectively , represent neural networks. has gained attention for modeling stochastic representations with great results in various types of applications. In this talk, we present an overview of some of these methods and the interaction of machine learning and stochastic control. We also investigate the extension of NSDEs that include jumps with some specifics.

**Keywords**: Machine learning, Neural Stochastic Differential Equations, Stochastic Optimal Control, Financial Modeling, Neural Networks.

## 270

# Generalization of Newton Dynamical Gravitational Potential Using Gravitational time dilation and Gravitational length contraction in Schwarzschild Spacetime

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## Abstract
In this article, we applied gravitational time dilation and gravitational length contraction in Schwarzschild spacetime to construct a generalized dynamical gravitational field equation. The generalized dynamical gravitational field equation was applied to static homogeneous spherical massive bodies to obtain generalized exterior gravitational scalar potential. The results obtained shows that the generalized dynamical gravitational scalar potential is augmented with additional correction terms of all which were not found in either Newton's dynamical equations of motion.

**Keyword:** Gravitational time dilation, gravitational length construction, Schwarzschild spacetime, static homogeneous, Spherical massive bodies and generalized dynamical gravitational field equation

**271**

# A General Composite Iterative Algorithm for Split Equality Fixed Point and Null Point Problem of Lipschitzian J□quasi-Pseudocontractive Mappings in Banach spaces

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## Abstract
We consider an iterative algorithm for split equality fixed point and null point problem for Lipschitzian J□quasi-pseudocontractive mappings and maximal monotone operators which includes split equality feasibility problem, split equality fixed problem, Split equality null point problem and other problem related to fixed point problems. Moreover, we establish a strong convergence results in real Banach spaces under some suitable conditions and reduce our main result to above-mentioned problems. Finally, we apply the study to split equality feasibility problem (SEFP), split equality equilibrium problem (SEEP), split equality variational inequality problem (SEVIP) and split equality optimization problem (SEOP). The results presented in
the paper extend and improve many recent results.

**Keywords and Phrases:** Split equality fixed point problem, J□quasi-pseudocontractive mapping, maximal monotone operators, Halpern-type algorithm.

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# AN AUTONOMOUS DIFFERENTIAL EQUATION MODEL FOR DEVELOPING THE DATABASE OF A FACE RECOGNITION SYSTEM

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*(being Abstract of paper intended for presentation at the 2024 Annual Conference of the Nigerian Mathematical Society (NMS), hosted by the Department of Mathematics, University of Ibadan, Nigeria. Date: Monday, 6th - Friday, 10th May, 2024. Theme: Mathematics, Artificial Intelligence and National Economy).*
*(This research is supported by a generous research grant provided by a group of foreign-based Nigerians. The author is grateful for the grant).*

Abstract
In face recognition system - an application area of artificial intelligence useful in the authentication of transactions - a database is created which stores a training set and a test set, both of which are compared. In the modeling of faces for the database, every face has to be unique. This can be facilitated via the qualitative classification of autonomous ordinary differential equations of the form:
(1)

where based on the real-valued critical points of the equation. In the model, faces are represented as phase portraits (pp), such that the degree n of the polynomial in (1) equals the natural number (f) of face features being considered. The relevant qualitative properties are existence and uniqueness of solutions. In general, the blocklengths of the elements of the set of pp of (1) for a typical $n > 2$ are not necessarily uniform. In order to create uniformity, a virtual pp on the line is defined. Ultimately, a novel algebra for pairwise feature comparison is introduced such that a typical feature is defined to be in a unique position in a pp. An illustration using values of $f < 10$ is presented.

**Keywords and Phrases:** Face recognition system, Autonomous ordinary differential equation, Phase portraits, Database, Qualitative classification

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## A Uniform Order Four-Step Hybrid Block Method for Numerical Solution of SIR And Growth Model

**Abstract**
In this research work, we derived a uniform order four step hybrid block method for the numerical solution of Susceptible-Infected-Recovered (SIR) and Growth model problems of ordinary differential equations (ODEs). A continuous linear multistep method (CLMM) with variable coefficients was developed using interpolation and collocation techniques via power series approximate solution as the basis function. This CLMM was evaluated at some selected grids points which give a class of discrete linear multistep methods (DLMMs) and was implemented as a block method. One case was considered for step numbers $k$=4. The basic properties of the block method were investigated and found out to be of order nine, consistent, zero stable and hence convergent. MATLAB 2015 codes were written to test the numerical performance of the block method on some real-life problems of ordinary differential equation and the results showed that the four-step hybrid block method compared favorably with the existing methods in terms of accuracy and efficiency, was found to be very effective.

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**Abstract**
In the paper, a forward-backward iterative algorithm induced by a certain dynamical system for solutions of variational inequality problem involving quasi-monotone operator is introduced and studied. Weak convergence of the sequence generated by the said algorithm is proved in the setting of real Hilbert space. Numerical examples are given to demonstrate the efficiency and workability of the algorithm. The theorem obtained augments, generalizes, improves and unifies several results announced recently.

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Paul ABAIVOH

**Abstract**
Partial algebraic theory and its representations are essential aspects of the unbounded operator theory. In this thesis we have worked on some properties of representations of partial algebras. If is a representation of an algebra A into B(H)- the space of bounded linear operators, where H is a Hilbert space. What are the properties of both the algebra A and the representation that can be made more general and fitted in the setting of partial algebras? Many researchers like Ekhaguere, Antoine, Inoue, Trapani, Bagarello and others have worked on different aspects of A as well as and have developed different properties of both the partial algebras and their representations. These contributions notwithstanding, there are still some properties of both A and that are either not adequately explored or not explored at all. Consequently, we have developed more about representations of partial algebras, with particular focus on the decomposition of the representations of A into irreducible ones. We have employed the concepts of stable (invariant) subspaces, derived operator sets, in application of multiplier spaces: left multiplier $M_L($, right multiplier $M_R($ of : $M_L($, $M_R($ and $M_U($, left multiplier, right multiplier and universal multipliers of , a subset of A. Also used in the methodology are commutants ($R'_\sigma$ and $R'_\sigma$) and bicommutants ($R''_{\sigma\sigma}$, $R''_{\sigma\lambda}$, $R''_{\lambda\lambda}$ and 16. $R''_{\lambda\sigma}$) as well as intertwining spaces in formulating representations of a partial algebra A.

We have extended results on algebras and their representations generally to partial algebras and their representations. Among others, we established that for a representation of a partial algebra A and a collection of all the -stable -irreducible subspaces $D_\sigma$, σ I, of D[, then is completely irreducible if and only if $_{\sigma\varepsilon I}D_\sigma$= D[. Also established is this result: Let be a completely reducible representation of a partial algebra A and D[ =$_{\sigma\varepsilon I}D_\sigma$, be a given direct sum decomposition of D[ into the -stable -irreducible subspaces. Then the σ-subspaces $D_\sigma$[] are linearly independent for all equivalence classes σ such that (i) D[ =$_{\sigma\varepsilon[\sigma]}D_\sigma$[] and (ii) 24.for each σ [σ] ρ, $D_\sigma$[]={$D_\sigma$: $D_\sigma$~σ}.

In conclusion, we successfully achieved the focus of this research and made applications of some of the research outcomes physical systems like quantum field theory and quantum statistical mechanics. Some areas of further research are also suggested as part of the conclusion.

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## ANALYSIS OF HIV/AIDS MODELWITH NON LINEAR INCIDENCE FUNCTION

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**Abstract**
Human Immunodeficiency Virus – Acquired Immune Deficiency Syndrome HIV/AIDS stands as one of the most prevalent sexually transmitted disease globally and is regarded as one of the deadliest epidemic in human history. This study presents a mathematical model for understanding the dynamics of HIV/AIDS transmission, incorporating a saturated incidence rate. The model employs a system of ordinary differential equations, comprising various group of individuals including susceptible, asymptomatic infective, symptomatic infective, treated and AIDS class. The validity of the solution states affirms that the model is well-defined and holds epidemiological significance. The disease-free and endemic equilibrium states are identified, and their stability is analyzed using Routh Hurwitz criteria. Sensitivity analysis was carried out using normalized forward sensitivity index and result showed that the contact rate is the most sensitive parameter. However, it is observed from the numerical simulation that screening and treatment of the infective play a significant role in reducing the transmission of the disease. The outcome of the stability analysis for both disease-free and endemics equilibrium states indicates the potential for HIV/AIDS control.
**Keywords:** *HIV/AIDS, Saturated Incidence, Screening, Treatment, Basic Reproduction Number, local Stability, global stability, Sensitivity Analysis.*

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## SENSITIVITY ANALYSIS OF COVID-19 MODEL WITH 52 PARAMETERS USING PYTHON SNIPPET GENERATED BY THE AID OF AI

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**Abstract**
The study developed a python code assisted by the AI tool ChatGPT 3.50 that used the basic reproduction number of a mathematical model of COVID-19 transmission dynamics with controls (awareness for vaccination and isolation with treatment) to carryout sensitivity analyses. The study presented a Python snippet that accurately in few seconds, evaluated the obtained that so complicated, using parameter values computed the sensitivity indices of all the

52 parameters in model, with less than 25 lines of codes. The code used a list of all parameters in the model and the list of parameter values to create a dictionary, looped through the parameter list to obtain the sensitivity indices of all parameters on the model , ranked the indices and plotted the ranked indices of significant parameters. The indices were visualised using bar chart that distinguished positive and negative indices using different colours. The results attributed high incidences of COVID-19 to rejection of vaccination, incomplete vaccination, high recruitment level into the susceptible population among others.

**Keywords**: AI, COVID-19, model, Python, sensitivity

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## On the conjugate of harmonic functions*

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**Abstract**
In this paper we seek to show that if then any harmonic is part of a harmonic pair (u; v), v unique up to addition of constants, from its elementary unit using exactness condition and Cauchy-Riemann equations, instead of using total differential as is obtainable in Dass [4].

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# Asymptotic stability of neutral integro-differential systems with variable delay

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**Abstract**

This paper focuses on the asymptotic stability of neutral integrodifferential systems with delay. The study employed Lyapunov-Krasovskiĭ functional to establish criteria for the asymptotic stability of the solutions for delay-(independent and dependent) neutral integro-differential systems. These conditions are obtained in terms of linear matrix inequality (LMI). Finally, examples are provided and run on Maple 17 software, to demonstrate the practical applications of the discussed models and to showcase the aptness and effectiveness of the employed method.

**Keywords:** Asymptotic stability, neutral integro-differential, LyapunovKrasovskiĭ functional, linear matrix inequality.

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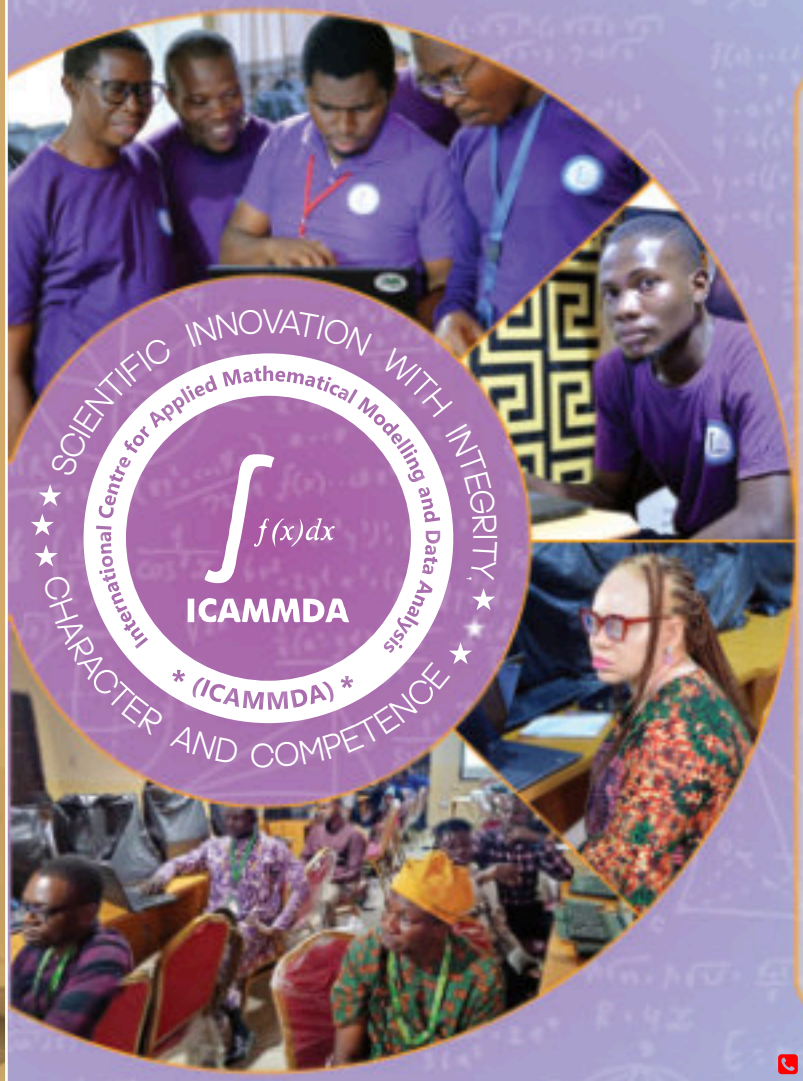


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