MATHEMATICAL ASSOCIATION OF NIGERIA
(M.A.N)

abacus

THE JOURNAL OF THE
MATHEMATICAL ASSOCIATION OF NIGERIA

VOLUME 49, NUMBER 2
MATHEMATICS SCIENCE SERIES
JULY, 2022

NR-ISSN 0001 3099

Editor-in-Chief:
Professor Muhammad Lawan Kaurangini, FICA
Kano University of Science and Technology, Wudil, Nigeria

National Executive Officers (2021-2023)

1. Prof. K. O. Usman	President
2. Prof. M. A. Yusha'u	Vice President
3. Alhaji Jimoh Taylor	National Secretary
4. Prof. B. Y. Isah	Asst. Nat. Secretary
5. Mrs. Okodugha Brigitta Eno	Treasurer
6. T. A. Muhammad	Financial Secretary
7. Dr. Sadiq Abubakar	Publicity Secretary
8. Dr. Aliyu Taiwo	Business Manager
9. Prof. Muhammad L. Kaurangini	Editor-in-Chief
10. Dr. Olayemi O. Oshin	Deputy Editor-in-Chief
11. Prof. Mamman Musa	Immediate Past President
12. Dr. A. J. Alkali	Immediate Past National Secretary
13. Mr. Bankole J	Ex-Officio I
14. Dr. Chika C. Ugwuanyi	Ex-Officio II
15. Dr. Abimbola N. G. A	S. A. to President

Abacus:

Submission of the paper
Authors are requested to visit www.man-nigeria.org.ng to submit manuscripts in Microsoft word and make payment accordingly.

Preparation of the manuscript
General: The manuscripts should be in English and typed with single column and single line spacing on single side of A4 paper. The first page of an article should contain;
(1) a title of paper which well reflects the contents of the paper (Arial, 12pt),
(2) all the name(s) and affiliations(s) of authors(s) (Arial, 12pt),
(3) an abstract of 100-250 words (Times New Roman, 11 pt),
(4) 3-5 keywords following the abstract, and
(5) footnote (personal title and email address of the corresponding author). The paper should be concluded by proper conclusions which reflect the findings in the paper. The normal length of the paper should be between 10 to15 journal pages.

Tables and figures: Tables and figures should be consecutively numbered and have short titles. They should be referred to in the text as following examples (e.g., Fig. 1(a), Figs. 1 and 2, Figs. 1(a)-(d) / Table 1, Tables 1-2, etc). Tables should have borders (1/2pt plane line) with the captions right before the table. Figures should be properly located in the text as an editable image file (.jpg) with captions on the lower cell.

Units and Mathematical Expressions: It is desirable that units of measurements and abbreviations should follow the System International (SI) except where the other unit system is more suitable. The numbers identifying the displayed mathematical expression should be placed in the parentheses and referred in the text as following examples (e.g., Eq. (1), Eqs. (1)-(2)). Mathematical expressions must be inserted as an object (set as Microsoft Equations 3.0) for Microsoft Word 2007 and later versions. Image-copied text or equations are not acceptable unless they are editable. The raised and lowered fonts cannot be used for superscription and subscription.

References : A list of references which reflect the current edition of APA format, to locate after conclusion of the paper.

Review
All the submitted papers will undergo a peer-review process, and those papers positively recommended by at least two expert reviewers will be finally accepted for publication in the Abacus Journals or after any required modifications are made and a payment of **₦15,000.00** as publication fee. The normal length of the paper should be between 8 to 12 pages. Any extra page will attract additional charges at the rate of **₦500.00** per page.

Copyright
Submission of an article to Abacus Journal implies that it presents the original and unpublished work, and not under consideration for publication elsewhere. On acceptance of the submitted manuscript, it is implied that the copyright thereof is transferred to the Abacus. The Transfer of Copyright Agreement may also be submitted.

Editorial Board

Professor Muhammad Lawan Kaurangini, FICA

Editor-in-Chief,

Department of Mathematics,
Kano University of Science and Technology, Wudil, Nigeria

1. Professor K.O. Usman, Provost, Federal College of Education, (Special), Oyo, Nigeria
2. Professor M. A. Yusha'u, Department of Science and Vocational Education, Usmanu Dafodiyo University, Sokoto
3. Professor M. O. Ibrahim Department of Mathematics, University of Ilorin, Nigeria
4. Professor B. Sani, Department of Mathematics, Ahmadu Bello University, Zaria
5. Professor B. K. Jha, Department of Mathematics, Ahmadu Bello University, Zaria
6. Professor B. Ali, Department of Mathematics, Bayero University, Kano
7. Professor E. Oghre, Department of Mathematics, University of Benin, Nigeria.
8. Professor Mueide Promise, DG National Mathematical Centre, Abuja. Nigeria
9. Professor U.N.V. Agwagah, Department of Science Education, University of Nigeria, Nsukka
10. Professor B.I. Olajuwon, Department of Mathematics, Federal University of Agriculture, Abeokuta.
11. Professor S. I. Binds Department of Science and Technology Education, University of Jos, Nigeria

Associate Editors (2021-2023)

1. **Professor (Mrs.) M. F. Salman**
Department of Science Education,
University of llorin, llorin, Nigeria

2. **Professor E. T. Jolayemi**
Department of Statistics
University of llorin, llorin, Nigeria

3. **Professor Herbert Wills**
Department of Mathematics Education,
Florida State University, Tallahassee,
Florida, U.S.A.

4. **Professor O.S. Adegboye**
Department of Statistics,
LAUTECH, Ogbomoso, Nigeria.

5. **Professor A. Gumel**
Department of Mathematics,
Arizona State University Arizona, USA.

6. **Professor B. A. Oluwade**
Department of Mathematical Sciences,
Kogi State University, Anyigba, Nigeria

7. **Professor M. R. Odekunle,**
Department of Mathematics
Modibbo Adama University of
Technology, Yola.

8. **Professor Y. Korau**
Department of Science Education,
Ahmadu Bello University, Zaria.

9. **Professor J. A. Adepoju**
Department of Mathematics
University of Lagos, Lagos.

10. **Professor G. O. S. Ekhaguere**
Department of Mathematics
University of Ibadan, Ibadan

11. **Professor M. A. Ibiejugba**
Department of Mathematical Sciences
Kogi State University, Anyigba.

12. **Professor A. U. Afuwape**
Department of Mathematics
Obafemi Awolowo University lle-lfe,
Nigeria.

13. **Professor Mamman Musa**
Department of Science Education
Ahmadu Bello University Zaria.

14. **Dr. Olayemi O. Oshin,**
Department of Mathematics Education,
Federal College of Education (special),
Oyo.

15. **Professor Ibrahim Galadima**
Department of Science Education
Usman Dan-Fodio University Sokoto

16. **Professor S. A. Abbas**
Department of Science Education
Bayero University, Kano

TABLE OF CONTENTS

1. A- 4 Step Hermite Based Multiderivative Block Integrator For Solving Fourth Order Ordinary Differential Equations
*[1]*O.M Ogunlaran and [2]M.A Kehinde* 1

2. Stability Analysis Of Quadrupled Fixed Point Theorems For Mixed Monotone Mappings In Partially Ordered Metric Spaces
Aniki, S. A.[1] and Rauf, K.[2]* 20

3. Closed Form Solution Of A Dirichlet Harmonic Problems Using Complex Variable Techniques
Ndubueze George Emenogu & Anyanwu Jude Abara 32

4. Some Lacunary Sequence Spaces Of Generalized - Difference Operator And Invariant Means Defined By Musielak- Orlicz Functions On - Normed Space.
Balili, Ado 42

5. Diagonal Multivariate Generalised Autoregressive Conditional Heteroskedasticity Models And Their Applications To Real-Time Volatility Series.
Usoro, Anthony E. and Ekong, Nsisong P. 56

6. A Production Inventory Model With Linear Level Production Rate, Linear Level Dependent Demand And Constant Holding Cost
A. Atama Madaki[1] and B. Sani[2] 72

7. An Eoq Model For Non-Instantaneous Deteriorating Items With Two Phase Demand Rates, Linear Holding Cost And Partial Backlogging Rate Under Trade Credit Policy
B. Babangida and Y. M. Baraya 91

8. An Optimal Control Analysis Of Malaria HBV Coinfection Model
[1]Ashafa S. U., [2]Oduwole H. K., and [3]Umar M. A. 126

9. Construction Of Vector Space Using Permutation Patterns
M. S. Magami∗, O. U. Amama∗∗, A. I. Garba∗ 147

10. A Robust Block Unification of Multi-Step Methods for the Solution of Boundary Layer Flow
H. Abdullaha, U. Mohammeda, M. D. Shehua, & A. A. Abdullahib 154

11. Parameter Estimation Of Log-Arimax Model Via Generalized Linear Method Of Exponential Form
K. I. Ekerikevwe and T.O. Olatayo* 167

12. Analysis Of Patients Flow In An Emergency Ward Using Fuzzy Critical Path Method And Fuzzy Program Evaluation And Review Technique (A Case Study Of Aminu Kano Teaching Hospital, Kano, Nigeria)
[1]Ali Maianguwa Shuaibu, [2]Maryam Nuraini Muhammad and [3]Nasir Rabiu 179

13. An Order 2k Hybrid Backward Differentiation Formula for Stiff System of Ordinary Differential Equations Using Legendre Polynomial as Basis Function
Umaru Mohammed1, Aliyu Ishaku Ma'ali2, Jamiu Garba1, Ben Gbenro Akintububo1 197

14. Oredr-4 Predictor-Corrector Time Series Smoothing Technique
C. I. Nwokike[1], G. O. Nwafor[2], B. B. Alhaji[3], K. M. Koko+, C. Nwutara[5], H. E Chukwuma[6], S. N. Nwanneako[7], O. G. Onukwube[8], J. O. Onyeukwu[9] 203

15. Modified 2-Step Implicit Linear Multistep Technique for Time Series Smoothing
C. I. Nwokike[1], G. O. Nwafor[2], B. B. Alhaji[3], K. M. Koko[4], C. Nwutara[5], H. E Chukwuma[6], S. N. Nwanneako[7], O. G. Onukwube[8], J. O. Onyeukwu9 217

16. Relating With The Phrase "A Chain Is As Strong As Its Weakest Link" Using Fuzzy Logic
Onyekonwu, A. C. 230

17. Assessing the Impact of Climate Change on Yam Production using Probability Density Function in a Humid Rainforest Agroecological Region of Nigeria
I. Nnabue [1] , N.R. Okereke [2] , J. E. Obidiegwu 3 236

18. A Continous Collocation Formulation Of Two-Step Implicit Block Method For Second Order Odes Using Legendre Basis Function
Folake Lois Joseph 255

19. Effects Of Mhd Free Convective Heat And Mass Transport Flow Past An Infinite Plate With Viscous Energy Dissipation
Ugwu U.C., Cole A. T., Faruk A. I., Adedayo O. A., Asonibare F. I., and Fadepo J. T 267

20. On The Study Of The Basic Properties Of Multivariate Autoregressive Models
Usoro, Anthony E. 289

21. Applications Of Fractional Differential Equations Via Scott Blair's Model To Generalize Hooke's And Newton's Laws
Aku D. H1, Abegye S. Y2 and Madaki A. A3 314

22. Improving Credit Scoring Performance using Two-Stage Technique
Ibrahim Anas and Sam Olu Olagunju 329

23. Numerical Solution of Optimal Control Problems Using Improved Euler Method
M. F. Akinmuyise1; S. O. Olagunju2; S. A. Olorunsola3 338

24. Modelling The Risk Index Of Infant Mortality In Nigeria
Iseh, Matthew Joshua1, & Udoh, Nse Sunday2, Ph.D. 350