NAMIBIA UNIVERSITY OF SCIENCE AND TECHNOLOGY

Faculty of Health, Natural Resources and Applied Sciences

Department of Mathematics, Statistics and Actuarial Science

1ST INTERNATIONAL CONFERENCE ON MATHEMATICAL AND STATISTICAL SCIENCES

Towards Multi-disciplinary Problem-Solving Research Advancements

... showcasing Mathematical, Statistical and Actuarial Sciences capabilities for multi-disciplinary research and global problem-solving challenges and priorities.

CONFERENCE PROGRAMME AND BOOK OF ABSTRACTS

ABOUT THE CONFERENCE

The 1st International Conference on Mathematical and Statistical Sciences (ICMSS-1), taking place on Monday 3rd and Tuesday 4th July 2023 is a two-day Hybrid (Blended) international conference organised by the Department of Mathematics, Statistics and Actuarial Science, Namibia University of Science and Technology. It brings together physically and virtually researchers, scientists, and educators in Mathematical sciences around the world to share their research contributions and ongoing projects from diverse applications of Mathematical and Statistical Sciences.

Precisely, the maiden conference provides an international forum to showcase Mathematical and Statistical Sciences capabilities for multi-disciplinary research and global problem-solving challenges and priorities. The conference package features Plenary sessions from highly recognised academic leaders and experts and Parallel presentations of Invited Talks and Research papers spread over the following core and related thematic areas: Applied Mathematics, Applied Statistics, Reliability theory and Applications, Inventory Management and Applications, Queueing Theory and Applications, and Multi-Disciplinary research presentations.

The Conference celebrates an amazing collaboration of academic institutions across the world and the support provided for the participation of their academic staff and research students. Moreover, the stakeholders collaborative support behind the provision of various conference complimentary items showcases collective interest towards advancing multi-dimensional benefits of applications of Mathematical and Statistical Sciences from their basic principles to highly advanced scientific research solutions. The maiden conference hopes to provide important foundation and feedback for more successful subsequent conference editions.

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1st International Conference on Mathematical and Statistical Sciences (ICMSS-1)

3 - 4 July 2023| HTTPS | NUST| https://www.icmss.nust.na	
Monday 3 July 2023	
07:30 - 09:00	**Registration**
09:00-10:00	**CONFERENCE OPENING CEREMONY Venue: HTTPS Plaza, NUST**
	Director of Ceremony: Prof. Rakesh Kumar
09:00-09:10	**Welcoming Remarks** by Dr Erold Naomab, Vice Chancellor, Namibia University of Science nand Technology (NUST)
09:10-09:20	**Guest Speaker:** Ms Natalie Russmann, Konrad Adenauer Stiftung (KAS) Resident Representative
09:20-09:40	**Keynote Speaker**: Dr Reinhold Kamati, Technical Expert at the Bank of Namibia
09:40-09:50	**Vote of Thanks** by Dr Onesmus Shuungula, Executive Dean (FHNRAS)
09:50-10:15	**Tea Break**
10:15-10:55	**Plenary Speaker: Professor Oluwole D. Makinde, Stellenbosch University, South Africa** **Topic – Mechanism of Fuel Flow in Automobile's Exhaust Catalytic Converter: A Mathematical Model** **Chair: Professor Tadeusz Czachorski (Polish Academy of Sciences, Poland**
10:55-11:35	**Plenary Speaker: Professor (Dr.) Dhara Singh HOODA, GJ University of Science & Technology, India** **Topic: Information Theoretic Techniques for Dependence Analysis and Missing Data Estimation** **Chair: Professor V. Thangaraj (Vel Tech Dr RR & Dr RS Technical University, India**
11:35-11:40	**Break**
11:45-13:20	**Parallel Session 1** (Online Participants to Join Appropriate Breakout Rooms)

	1A: Applied Mathematics and Related Fields Venue: HTTPS Plaza, NUST & Online Chairperson: **Prof AS Eegunjobi (NUST)** Co-Chairs: **Prof H Garg (Thapar Univ, (India) and Dr. S M Nuugulu (UNAM)**	**1B: Applied Statistics** Venue: **HTTPS Plaza, NUST & Online** Chairperson: **Prof Indra Rani (KUK, India)** Co-Chairs: **Dr D Ntirampeba (NUST) and Dr O Oyedele (UNAM)**	**1C: Multidisciplinary Research** Venue: **HTTPS Plaza, NUST & Online** Chairperson: **Prof Kalyan Das (NIFTEM, India)** Co-Chairs: **Prof Justice Emuoyibofarhe (Nigeria) and Dr Jacob Ong'ala (NUST)**	**1D: Queuing Theory and Applications** Physical Venue: **HTTPS Plaza, NUST & Online** Chairperson: **K Vytovtov (ASTU, Russia)** **Co-Chairs: Dr V Kumar (NIFTEM, India) and Dr SN Neossi-Nguetchue (NUST)**
11:45-12:05	**Numerical simulation of a phenomenon of silting up of river banks** Cyr-Séraphin Ngamouyih Moussata and Benjamin Mampassi, Marien Ngouabi University, **Congo**	**Estimation Using Graph Sampling: a New Approach** Prof (Dr) Diwakar Shukla, Dr. H.S. Gour Vishwavidyalaya, Sagar, **India**	**Applications of Binary Petri nets and Binary Reachability Trees** Dr. Gajendra Pratap Singh, Jawaharlal Nehru University, New Delhi, **India**	**Stochastic Queues with Reverse Balking and Reverse Reneging** Bhupender Kumar Som, GNIOT Institute of Management Studies, Greater Noida, **India**
12:05-12:20	**Topological indices of zero-divisor graph of Zn** Pradeep Singh, Maharishi Markandeshwar (Deemed to be University), **India**	**The Determinants of Housing prices in Namibia** Elisia Dula, University of Namibia, **Namibia**	**Learners' Perceptions of the Challenges and Improvement Strategies in Distance and Online Undergraduate Mathematics Learning in Nigeria** Comfort Reju, University of Lagos, **Nigeria**, Loyiso Jita, University of Free State, **South Africa**	**Transient analysis of M/M/1/N queue with encouraged arrivals** Bhupender Kumar Som, GNIOT Institute of Management Studies, **India,** Sunny Seth and Himanshu Goel, Jagan Institute of Management Studies, **India**
12:20-12:35	**Variational Optimisation Method and Applications to Meteorological Modelling** Gabriel Mbokoma, Sunday A. Reju, Nnenesi A. Kgabi and Benson Obabueki, Namibia University of Science and Technology, **Namibia**	**A General Framework for Generating Three-component Heavy-tailed Distributions** Patrick Osatohanmwen, Pan-Atlantic University, **Nigeria**	**Grey wolf optimization and its improved version: Application for Reliability Optimization** Doorgeshwaree Devi Heeramun, Deepika Garg and Alina Banerjee, GD Goenka University, **India**	**Flexible group service, Bernoulli Feedback and Bernoulli Vacation** Ayyappan G and Kalaiarasi S, Puducherry Technological University, **India**
12:35-12:50	**Digital technologies, Fourth Industrial Revolution and mathematics education nexus in emerging economies: A systematic analysis** Ruth Eegunjobi, Shihaleni Ndjaba and Rosalia Mwalundilange, IUM, **Namibia**	**An M/M/2 Queueing System with Differentiated Vacations Subject to Servers Breakdown** V Karthick and V Suvitha, SRM Institute of Science and Technology, **India**	**Optimal Policies for Replenishment, Pricing, Promotional efforts, and Preservation Investments for Deteriorating Items with Price-dependent Stochastic Demand** Mamta Keswani, Dr Harisingh Gaur Central University, **India**	**Numerical investigation on MAP/PH/1 Inventory Retrial Queueing System With Constant Retrial Rate, Single Vacation, Breakdown and Repair** G Ayyappan and S Meena, Puducherry Technological University, **India**
12:50-13:05	**Comparison of the WENO and RBF Methods for the Numerical Solution of the 2D Burgers Equation** S.N Neossi-Nguetchue, Namibia University of Science and Technology, **Namibia**	**M/M/c Heterogeneous Arrivals Queue with Two Kinds of Working Vacations and Impatient Customers.** Yohapriyadharsini R S and Suvitha V, SRM Institute of Science and Technology, **India**	**Pseudo Code and C++ Implementation of the Power Dominator Star Coloring Algorithms for Path and Cycles** S Mathangi and Sharmila Mary Arul, Saveetha School of Engineering, **India**	**M/M/1/N Queueing Model with Reverse Balking, Catastrophe and Restoration** Letta Nm Thomas, Rakesh Kumar, Adetayo Eegunjobi and David Iiyambo, Namibia University of Science and Technology, **Namibia**

13:05-13:20	**Magnetohydrodynamic Nanofluid Flow over Convectively Heated Plate on Radially Stretching Sheet Embedded on Porous Media** Kulow Alai, Kenyatta University Nairobi, **Kenya**, Maurine Wafula, United State Internatinal University (USIU), Nairobi, **Kenya** and Lawrence Njau, Department of Mathematics and Actuarial Science, Kenyatta University Nairobi, **Kenya**	**Algorithmic construction of Bayesian optimal block designs using the linear mixed effects model** Dibaba Bayisa Gemechu, Namibia University of Science and Technology, **Namibia**, Legesse Kassa Debusho, University of **South Africa**, **South Africa**, Linda M. Haines, University of Cape Town, **South Africa**	**Factors Influencing Adoption of UPI Payments by Indian Tourists: Extended UTAUT Model with Relative Advantage, Compatibility, Promotional Benefits, and Trust** Sweta Yadav and Gurjeet Kaur, University of Delhi, **India**	**M/M/1 queue with soft failures and N-Policy** Janani B, Rajalakshmi Institute of Technology, **India**
13:20-14:10	**LUNCH**			
14:10-14:50	**Plenary Speaker: Professor Delfim FM Torres, Universite d' Aveiro, Portugal** **Topic – Mathematical Modeling of COVID-iuuhiicic19 and Optimal Control Industry** **Chair: Professor Samuel John (Namibia University of Science and Technology)**			
14:50-15:30	**Plenary Speaker: Professor Yuliya Gaidamaka, RUDN University, Russia** **Topic: Resource Loss Systems and Performance Analysis of Wireless Networks** **Chair: Professor Oluwatosin T. Mewomo (University of Kwazulu Natal, South Africa)**			
15:30 -15: 50	**Tea Break**			
15:55-17:30	**Parallel Session 2** **(Online Participants to Join Appropriate Breakout Rooms)**			
	2A: Applied Mathematics and Related Fields Venue: **HTTPS Plaza, NUST & Online** Chairperson: **Prof G C Rana (India)** **Co-Chairs: Prof A Singh Yadav (India) and Dr. Ram Singh (BGSBSU, India)**	**2B: Applied Statistics** Venue: **HTTPS Plaza, NUST & Online** Chairperson: **Prof SS Mishra (RMLAU** **Co- Chairs: Dr. UK Khedlekar (DHSGSU, India) and Dr. Blessings (IUM, Namibia)**	**2C: Multidisciplinary Research** Venue**: HTTPS Plaza, NUST & Online** Chairperson: **Prof Fungai Bhunu Shava (NUST, Namibia)** **Co-Chair: Prof Sandile Motsa (Eswatini)**	**2D: Queuing Theory, and Related Fields** **Venue: HTTPS Plaza, NUST & Online** **Chairperson: Prof G Ayyappan (PTUNIV, India)** **Co-Chairs: Dr. K Kumar (CUJ, India)**
15:55-16:15	**A Generalization of Truncated S-Fractional Derivative and Applications to Fractional Differential Equations** Sushil Dhaneliya, ITM Goi Gwalior M.P., **India**, Dr. Manoj Sharma, RJIT BSF Tekanpur Gwalior (M.P.), **India**	**Application of Dummy Variable Regression Model in Business and Economics** Prof. Manoj Kumar Mishra, Salale University, **Ethiopia**	**Need of Cryptography: Introduction & Research Aspects** Dr Varun Shukla, PSIT, Kanpur, Uttar Pradesh, **India**	**Type I Heavy-Tailed Family of Generalized Burr III Distribution with Applications** Wilbert Nkomo, Broderick Olusegun Oluyede and Fastel Chipepa, Botswana International University of Sc and Technology, **Botswana**

16:15-16:30	**Penalised Portfolio Optimisation Models with Augmented Lagrangian** Kornelia David, Sunday A. Reju and S N. Neossi, Namibia University of Science and Technology, **Namibia**	**Dynamics of a virally infected phytoplankton and zooplankton system with delay,** Rakesh Kumar, Amanpreet Kaur, Shaheed bhagat Singh State University, Ferozepur, **India**, and Ajender Kumar Malik, UP Rajarshi Tandon Open University, **India**	**Deep learning classification algorithm for small laboratory animals' trajectories in Morris Water Maze** Patatchona Keyela, RUDN University, **Russia**, Oksana Streltsova, Tatevik Bezhanyan and Yuri Severyukhin, Joint Institute for Nuclear Research (MLIT JINR), **Russia**	**Transient Analysis of a Machine Repair Model with Hot Standbys and Retention of Reneged Machines** C K Anjali and Sreekanth Kolledath, Amrita School of Physical Sciences, **India**
16:30-16:45	**Upper bounds for the complex growth rates in the Darcy-Brinkman convection in a binary viscoelastic fluid saturated porous layer** Renu Bala, Madhu Aneja and Tania Bose, Chitkara University Institute of Engineering and Technology**, India**	**Stochastic Inventory Model for Imperfect production with FRW Scheme Under Uncertainties** Lalji Kumar, Harisingh Gour Cenral University Sagar, **India**	**The Digital Transformation of the Dairy Industry with Artificial Intelligence: A Systematic and Bibliometric Analysis** Mohit Malik, Vijay Kumar Gahlawat, National Institute of Food Technology Entrepreneurship and Management, **India**, Rahul Mor, University of Northampton, **United Kingdom**, Vijay Dahiyar, Maharaja Surajmal Institute, **India**	**Analysis of a Single Server Queueing Model with Working Vacation, Customer Impatience and Bernoulli Interruption** K.V Vijayashree and K. Ambika, Madras Institute of Technology, **India**
16:45-17:00	**Neural Networks Applications to Ecological Modelling** Nikodemus Amon, Sunday A. Reju and Benson Obabueki, Namibia University of Science and Technology, **Namibia**	**A comparison of the discrimination and calibration performance of the Logit-power and Pareto Families of Links in discrete survival models** Susan Maposa, Midlands State University, **Zimbabwe**, Alphonce Bere, Caston Sigauke, University of Venda, **South Africa**, and Charles Chimedza, Wits University, **South Africa**	**Optimal Analysis of a Sustainable Inventory Model for a Controllable Carbon Emission with Two Warehouse System and Hybrid Cash-Advance Payment** Ankur Saurav, Vijender Yadav and Chandra Shekhar, BITS PILANI, **India**	**Cost & Profit Analysis of Two-Dimensional state M/M/2 Queueing Model with Correlated Servers, Multiple Vacations, Balking and Catastrophes** Sharvan Kumar and Dr. Indra, Kurukshetra University, **India**
17:00-17:15	**Fractional Calculus Approach in RLC Circuit Using Miller and Ross Function** Kiran Sharma, Shri Venkateshwara University, **India**, Manoj Sharma, Rustamji Institute of Technology, **India**	**Artificial Intelligence Integrated Queuing Model for the Dairy Industry: A Conceptual Approach** Vijay Kumar Gahlawat, Mohit Malik, NIFTEM, **India,** Rahul Mor, University of Northampton, **United Kingdom,** Vijay Dahiy, Maharaja Surajmal Institute, **India**	**Impact of Mathematical Modelling for Control Strategies of Listeriosis Diseases in RTE Food** Kapil Toor and Kalyan Das, National Institute of Food Technology Entrepreneurship and Management , **India**	**Approximating Fixed Points of Nonexpansive Type Mappings via General Picard–Mann Algorithm** Rahul Shukla and Rekha Panicker, Walter Sisulu University, **South Africa**
17:15-17:30	**Dynamical analysis of a phytoplankton-zooplankton model with time delay** Dr. Rakesh Kumar, Shaheed Bhagat Singh State University, **India**, and Navneet Rana, Guru Nanak College, **India**	**Markov Chain Analysis for Rainfall Pattern Distribution : A Case Study** Ritu Gupta, Gurpreet Kaur, Amity University, **India**, Shashi Kant Mishra, Ministry of Earth Sciences, **India**	**Modelling of Flood Hazards in Zambezi Kwando Linyanti Basin, Namibia; a 1D Flood Hazard Model** Dianah Irenge, Sunday Reju, Namibia University of Science and Technology, **Namibia**, Nnenesi Kgabi, North West University, **South Africa**	**Genetic Algorithm for Redundant Multi-server Machine Repair System under Generalized Triadic Policy** Parmeet Kaur Chahal and Kamlesh Kumar, Central University of Jammu, **India**
Tuesday, 4 July 2023				
07:30 - 09:00	**Registration**			

09:00-09:40	**Plenary Speaker: Professor Dr Andreas Meister, University of Kassel, Germany** **Topic – Unconditionally Positive and Conservative Time Integration Schemes** **Chair: Professor Vijay Kumar Sehgal (Bundelkhand University, India)**			
09:40-10:20	**Plenary Speaker: Associate Professor (Dr) Manoj Sharma, Rustamji Institute of Technology (BSF), Tekanpur, India** **Topic –Fractional order Linear Kinetic Equation** **Chair: Professor Dharm Singh Jat (Namibia UNiversity of Science and Technology)**			
10:20-10:40	**Tea Break**			
10:45-12:35	**Parallel Session 3** **(Online Participants to Join Appropriate Breakout Rooms)**			
	3A: Applied Mathematics and Related Fields Venue: **HTTPS Plaza, NUST & Online** Chairperson: **Professor Sylvanus Onjefu (NUST)** **Co -Chair: Prof Mallikarjun Pillalamarry (NUST)**	**3B: Reliability Theory and its Applications** Venue: **HTTPS Plaza, NUST & Online** Chairperson: **Dr D Iiyambo (NUST)** **Co-Chair: Prof Kamlesh Shukla (India)**	**3C: Multidisciplinary Applications of Mathematics** Venue**: HTTPS Plaza, NUST & Online** Chairperson: **Dr Shihaleni Ndjaba (IUM)** **Co-Chair: Dr Azeta Ambrose (NUST)**	**3D: Mathematics and Related Fields (Group-2)** Venue: **HTTPS Plaza, NUST & Online** Chairperson: **Professor Joshua Abolarinwa (NUST)** **Co-Chair: Prof Guy-Alain Lusilan Zodi (NUST)**
10:45-11:05	**Applications of Multi Criteria Decision Making Techniques for the Medical Diagnosis of Vector-Borne Diseases** Vijay Kumar, MRIIRS, **India**	**Reliability Availability Maintainability analysis and optimization for Pharmaceutical Industries** Deepika Garg, GD Goenka University, **India**	**Electronic-Word-Of-Mouth in Online Markets** Anu Gupta Aggarwal, University of Delhi, **India**	**Customer Discouragement in Unreliable Single Server Double Orbit Retrial Queue** Khushbu Antala, Sudeep Singh Sanga, NIT-SURAT, **India**, and Khushbu Antala, SVNIT SURAT, **India**
11:05-11:20	**Intuitionistic Fuzzy k-Ideals of Intra Regular Gamma semirings** Tilak Sharma, HPU Regional Centre Dharamshala(HP), **India**, Rajesh Kumar, Government College Dharamshala(HP), **India**	**Integrating Testing Coverage, Effort and Change Point in a Software Reliability Growth Model: A Comprehensive Analysis** Sudeep Kumar, Amity University Uttar Pradesh, **India**, Anu G Aggarwal, University of Delhi, **India** and Ritu Gupta, Amity University Uttar Pradesh, **India**	**Exploration of autonomous vehicles in smart city environment** Shubham Prakash, Begishev Vyacheslav Olegovich and Shubham Prakash, Peoples' Friendship University of Russia (RUDN University), **Russia**	**Single server bulk service priority queue with Differentiate Breakdown, Repair, Close down, Set up and Multiple vacation** G Ayyappan and S Nithya, Puducherry Technological University, **India**
11:20-11:35	**Wavelet Application to Geomagnetic Monitoring and Modelling of Power Networks** Ilenikemanya Ndadi and Sunday A. Reju, Namibia University of Science and Technology, **Namibia**	**Inventory Control System for Seasonal Products for Small Retailers** Priyanka Arora, SRM Institute of Science and Technology, **India**	**Markov Models for Dimensionning and Provisioning of Battery Energy Storage Systems (BESS) for Off-Grid Green Mobile Network Base Station Sites** Godlove Suila Kuaban, Tadeusz Czachórski, Institute of Theoretical and Applied Informatics, **Poland**, and Piotr Czekalski, Silesian University of Technology, **Poland**	**Service control for an M/M/1 queueing system with a single unreliable server** Nidhi Nidhi, NIT SURAT, **India**

11:35-11:50	**Opposition-Based Learning and Biogeography Based Optimization: Application for Reliability Optimization** Nakul Vashishth, Doorgeshwaree Devi Heeramun and Deepika Garg, GD Goenka University, **India**	**Cost-Benefit Analysis of a Three Non-Identical Unit Standby System with Weibull Failure and Repair Laws** Laxmi Raghuvanshi, Rakesh Gupta and Pradeep Chaudhary, C.C.S. University Meerut, **India**	**Mathematical Analysis of Foot and Mouth Disease with Optimal Control: A Case study of FMD in Namibia** Palivamwe Merolly Ndeevelo, Adetayo Samuel Eegunjobi and Nega Chere, Namibia University of Science and Technology, **Namibia**	**Holistic Approaches in Queueing Analysis: Incorporating a Multi-Feature Queue with Failover Server, Multiple Vacations, Timely Feedback, Flexible Offering, Disruptions, and Restoration** Ayyappan G, Puducherry Technological University, **India**, Sankeetha S, Saradha Gangadharan College, **India**
11:50-12:05	**Optimizing Costs for the Multi-unit Machine Repair Problem with Primary and Secondary Repairer in the M/M/R+1 Configuration** Mahendra Devanda, Suman Kaswan and Chandra Shekhar, Birla Institute of Technology and Science, **India**	**A Byesian Study of a Two Non-Identical Unit Cold Standby System with Preparation for Repair and Corrrelated Failure and Repair Times** Vashali Saxena, Rakesh Gupta and Bhupendra Singh, C.C.S. University Meerut, **India**	**The Holiday Effect on Stock Return: an Empirical Evidence from the Tourism and Hospitality Industry of India** Gaurav Kumar, Prof. Bhartendu Singh and Jagadish Behera, Mizoram University, **India**	**V-modules, SSI-modules and Idempotent of hereditary pretorsion classes in σ[M]** Nega Chere, Namibia University of Science and Technology, **Namibia**
12:05-12:20	**Transient Solution of a Multi-Heterogeneous Servers' Queuing System with Impatience and Catastrophes** Sapana Sharma, Maharishi Markandeshwar Deemed to be University, **India,** Prof Rakesh Kumar, Namibia University of Science and Technology, **Namibia**	**Latent Growth Mixed Model Of The Progression Of Hiv Using Cd4 Counts: A Case Study Of Namibia** Samuel Ndungula And Victor Katoma, Namibia University of Science and Technology, **Namibia**	**Gesturing as a problem solving strategy in mathematics: The case of nonverbal reasoning** Beata Dongwi, St Paul's College, **Namibia**	**Gaussian and Weak Gaussian Gamma Semirings** Tilak Sharma, HPU Regional Centre Dharamshala (HP), **India**, Anuj Sharma, Government College Shillai, **India**
12:20-12:35	**Turning Nδ−sets into Discrete Dynamical Systems** Alfred H Kamupingene, Triumphant College, Windhoek, Namibia Zechariah Mushaandja, Botswana International University of Science and Technology, Botswana	**A Partially Backlogged Two-Warehouse Inventory Model for Deteriorating Items With Selling Price and Time Sensitive Demand and Carbon Emission Under Green Technology Investment** Krishan Kumar Yadav, Ajay Singh Yadav and Shikha Bansal, SRM Institute of Science and Technology, **India**		**Dominator Sum Coloring Algorithm for Linear Graphs: Pseudo Code and C++ Implementation** V Indhumathi and Sharmila Mary Arul, Saveetha School of Engineering, **India**
12::35-14:00	**LUNCH**			
14:00-15:35	**Parallel Session 4** **(Online Participants to Join Appropriate Breakout Rooms)**			
	4A: Queueing Theory & Related Fields Venue: **HTTPS Plaza, NUST & Online** Chairperson: **Prof Dmitry Kozyrev (Russia)** **Co-Chair: Dr Dibaba Gemechu (NUST)**	**4B: Inventory Management and Applications** Venue: **HTTPS Plaza, NUST & Online** Chairperson: **Prof C K Jaggi (India)** **Co-Chair: Prof Michael Mutingi (NUST)**	**4C: Multidisciplinary applications of Mathematics** Venue**: HTTPS Plaza, NUST & Online** Chairperson: **Prof Justice Emuoyibofarhe (Nigeria)** **Co-Chair: Dr Joseph Akande (NUST)**	**4D: Mathematics and Related Fields (Group-2)** **Venue: HTTPS Plaza, NUST & Online** **Chairperson: Professor Dipti Ranjan Sahu (NUST)** **Co-Chair: Prof David Uchezuba (NUST)**

14:00-14:20	**Sustainable EOQ Model for Weibull Deteriorating Items with Back-Ordering and Constant Demand** Chandra Shekhar, BITS Pilani, **India**	**Inventory Model with Non-instantaneous Deteriorating Items** A. K. Malik, UP Rajarshi Tandon Open University, Prayagraj (UP), **India**	**Profiling jobseekers in Senegal** Jean Pierre Adiouma Ndiaye, National Agency of Statistics, **Senegal**	**Analysis of phase type queueing system with startup times and single vacation** Ayyappan Govindan, Puducherry Technological University,**India,** Thilagavathy Karthikeyan, Hindustan Institute of Technology and Science (Deemed to be University), **India**
14:20-14:35	**Stochastic Modelling of a Multi-Layer HAP-LEO System for Energy Saving and Energy Harvesting through Semi-Markov Process** Raina Raj, Indian Institute of Technology Delhi, **India**	**Model of Partial Backlog Inventory for Deteriorating Goods in Two Warehouses with Quadratic Demand Under Inflationary Conditions** Krishan Pal, Ajay Singh Yadav and Seema Agarwal, SRMIST NCR Campus Modinagar Ghaziabad, **India**	**Bridging the Gap: Mathematical Modelling and Climate Change in Marine Ecosystems - A Systematic Examination** Ashish Mor and Kalyan Das, NIFTEM, **India**	**Analysis of MAP1, MAP2/P H1, P H2/2 with Working vacation, Re-service, Interrupted closedown, Unreliable server, Feedback and Impatient customers** Ayyappan Govindan, Puducherry Technological University, **India,** G. Archana Alias Gurulakshmi, Puducherry Technological University, **India**
14:35-14:50	**Steady-State Analysis of an M/M/1 Queue with Differentiated Vacations, Reverse Balking and Retention of Renege Customers** Miyanawathura Ihala Gamage Suranga Sampath, Wayamba University of Sri Lanka, **Sri Lanka**	**Stock Chain Management for Inventory Models** Deep Kamal Sharma and Om Pal Singh, SRMIST Delhi NCR Campus, **India**	**Small area estimation of consumption expenditure in Khomas region, Namibia using the Fay-Herriot EBLUP estimator** Selma Shifotoka, Dibaba Gemechu, Dismas Ntirampeba and Rakesh Kumar, Namibia University of Science and Technology, **Namibia**	**An investigation on M/PH/1 queueing model with single working vacation, breakdown, repair and standby Server** K Baby Saroja and V Suvitha, SRM Institute of Science and Technology, **India**
14:50-15:05	**Maximum Likelihood and Bayesian Estimation on M/M/1 Queueing Model with Balking** Himanshi Sharma and Gulab Singh Bura, Banasthali Vidyapith, **India**	**Two-Warehouse Inventory Models for Decaying Items with Inflation and Partial Backlogging** Vishakha Chaudhary, SRM Institute of Science and Technology, **India**	**Spares Parts Optimization of a Phased Mission Systems** Preeti Wanti Srivastava and Satya Rani, University of Delhi, **India**	**Optimizing inventory in business environments: Combining matrix analytical techniques with a cancellation policy, working vacation and working breakdown** G Ayyappan and N Arulmozhi, Puducherry Technological University, **India**
15:05-15:20	**Analysis of M[X1] , M[X2]/G1, G2/1 Retrial Queueing System with Priority Services, Breakdown Delayed Repair and Bernoulli Vacation** Dr.G Ayyappan and Thamizhselvi P, **India**	**Economic Analysis of a Retrial Queueing System with Balking, Orbit Search, Multiple Vacation, and Unreliable Server** Suman Kaswan, Mahendra Devanda and Chandra Shekhar, Birla Institute of Technology and Science Pilani, **India**	**The correlation between depression and attitudes towards suicide amongst students of the University of Namibia Main Campus Windhoek** Hilma Dhiginina Vulikeni Kasheeta and Poonam Dhaka, University of Namibia, **Namibia**	**Incorporating Dynamic Market Potential in Product Diffusion Model under Uncertain Marketing Environment** Shiva, Neetu Gupta, J. C. Bose University of Science and Technology, **India**, Anu G. Aggarwal, University of Delhi, **India**
15:20-15:35	**Economical Order Inventory Policies for Perishable Items with Permissible Delay in Payment under Credit Policy and Effect of Advertisement, Time, and Price-Discount** Vijender Yadav, Ankur Saurav and Chandra Shekhar, Birla Institute of Technology and Science Pilani, **India**		**Understanding the impact of review and reviewer characteristics on reviewer popularity** Sanchita Aggarwal and Abhishek Tandon, University of Delhi , **India**	**On the Power Dominator Equitable Coloring of Wheel Graphs** Sharmila Mary Arul, Saveetha School of Engineering, **India**
15:40-16:10	**CLOSING SESSION**			

ABSTRACTS OF PLENARY TALKS

Professor O. D. Makinde

Stellenbosch University, South Africa.

Mechanism of Fuel Flow in Automobile's Exhaust Catalytic Converter: A Mathematical Model

A catalytic converter is an exhaust emission control device in automobiles that reduces toxic gases and pollutants from an internal combustion engine into less-toxic pollutants by catalyzing a redox reaction (an oxidation and a reduction reaction). Catalytic converters are typically used with internal combustion engines fueled by either gasoline or diesel. It consists of an insulated chamber enclosing a porous bed, or substrate, coated with catalytic material through which hot exhaust gas must pass before being discharged into the air. In this paper, a nonlinear model is proposed and numerically tackled in order to gain an insight into the complex fuel flow, exothermic kinetics and combustion mechanism in an automobile exhaust catalytic converter. The impact of various emerging thermophysical parameters on the overall flow structure and thermal putrefaction in the system are presented graphically and discussed quantitatively.

Professor D.S. Hooda

G.J. University of Science and Technology, India

Information Theoretic Techniques for Dependence Analysis and Missing Data Estimation

In the proposed talk information theoretic dependence measure is defined using maximum entropy principle and that measures amount of dependence among the attributes in a contingency table. A relation between information theoretic measure of dependence and Chi-square statistic is discussed. A generalization of this information theoretic dependence measure is studied in detail. Yate's method and maximum entropy estimation of missing data in design of experiment are described briefly and illustrated by considering practical problems with empirical data. An algorithm to estimate the missing values in a fuzzy matrix is defined and applied to estimate of missing data in contingency table.

Professor Delfim F. M. Torres

University of Aveiro, Portugal

Mathematical Modelling of COVID-19 and Optimal Control

We present some of the work we have done during the COVID-19 pandemic within the Center for Research and Development in Mathematics and Applications (CIDMA) of the Department of Mathematics of University of Aveiro, with contributions to a systemic strategy for community health intervention in response to the COVID-19 pandemic.

Professor Yuliya Gaidamaka and Professor Konstantin Samouylov

RUDN University (Peoples' Friendships University of Russia) Russia

Resource Loss Systems and Performance Analysis of Wireless Networks

Mathematical analysis plays an indisputable role in almost all spheres of human activity. The world public telecommunications network is the largest technical object that a human has ever built. This network has been created since about the end of the 19th century and has survived all the stages of the development of industrial society. By 2020, 5 generations of the telecommunication network have already been created, and the scientific community is already discussing the networks of the future 6th generation of the network. At all stages, starting from the tasks set by the outstanding mathematicians Agner Erlang and Aleksandr Khinchin, engineers turned to various mathematical theories and methods both to evaluate the performance of existing networks as well as to build models of future systems, even those that have not yet passed the laboratory research stage. Almost no scientific article devoted to the R&D of telecommunication systems and networks is complete without the construction of mathematical models and their mathematical analysis. The created methods in some cases served the development of purely mathematical disciplines such, as queuing theory, coding theory, and some others. We devote this keynote to the problems of the application of mathematical analysis in telecommunications and base it on the book «Matrix and analytical methods for performance analysis of telecommunication systems» dedicated to our teacher Gely Basharin and written by Valeriy Naumov, Yuliya Gaidamaka, Natalia Yarkina, Konstantin Samouylov. Of course, it is impossible in one speech to even briefly outline a book that describes the research of RUDN University mathematicians for about 60 years. The presentation will be focused on the part where the evolution of models is sequentially presented, starting from the famous Erlang formula, and up to the Resource Loss Systems we have built, aimed at analyzing new generations of wireless networks.

Professor Dr. Andreas Meister

University of Kassel, Germany

Unconditionally Positive and Conservative Time Integration Schemes

In the talk we will present so-called modified Patankar-Runge-Kutta (MPRK) schemes. They adapt explicit Runge-Kutta schemes in a way to ensure positivity and conservativity irrespective of the time step size. Thereby, we introduce a general definition of MPRK schemes and present a thorough investigation of necessary as well as sufficient conditions to derive first, second and third order accurate MPRK schemes. The theoretical results will be confirmed by numerical experiments in which MPRK schemes are applied to solve non-stiff and stiff systems of ordinary differential equations. Furthermore, we investigate the efficiency of MPRK schemes in the context of convection-diffusion-reaction equations with source terms of production-destruction type. Finally, we present a stability analysis of some specific MPRK schemes.

Associate Professor Manoj Sharma

Rustamji Institute of Technology (BSF), Tekanpur, India

FRACTIONAL ORDER LINEAR KINETIC EQUATION

The aim of present talk is to explore the behavior of physical and biological systems from the point of view of fractional calculus. Fractional calculus, integration and differentiation of an arbitrary or fractional order provides new tools that expand the descriptive power of calculus beyond the familiar integer-order concepts of rates of change and area under a curve. Fractional calculus adds new functional relationships and new functions to the familiar family of exponentials and sinusoids that arise in the area of ordinary linear differential equations. Among such functions that play an important role, we have the Euler Gamma function, the Euler Beta function, the Mittag-Leffler functions, the Wright function, Fox functions, M-Function, K-Function etc. In recent year's fractional order linear kinetic equations are studied due to their usefulness and importance in mathematical physics, especially in astrophysical problems. In Astrophysics linear kinetic equations designate a system of differential equations, describing the rate of change of chemical composition of a star for each species in terms of the reaction rates for destruction and production of that species. Methods for modeling processes of destruction and production of stars have been developed for bio-chemical reactions and their unstable equilibrium states and for chemical reaction networks with unstable states, oscillations and hysteresis. The aim of present talk is to find the solution of generalized fractional order linear kinetic equation, using a new special function i.e. M- function. The results obtained here is moderately universal in nature. Special cases, relating to the Mittag-Leffler function is also considered.

Dr Reinhold Kamati

Bank of Namibia

Optimal Policy Design: The Daunting task of Applying Optimal Control Theory in Designing Dynamic Optimal Economic Policies.

Designing optimal economic policies using optimal control theory can be challenging and requires a high level of expertise. However, with the right approach and knowledge, it is possible to create policies that promote the equitable distribution of income and resources across all sectors of the economy. In Namibia, evaluating whether SACU, CMA, and monetary policies meet optimal standards is crucial. Additionally, fiscal rules should be designed to generate optimal results in employment, current and future consumption, and the preservation of future income, particularly with expected resources from the oil and gas sector. However, the functional domains in economics can be ambiguous, and practical constraints can make adjusting economic policies and fiscal rules challenging. Optimal control theory can help devise self-adjusting economic policies that ensure we remain on the highest indifference curves.

ABSTRACTS OF CONFERENCE PAPERS

Manoj Kumar Mishra
Salale University, Ethiopia

Application of Dummy Variable Regression Model in Business and Economics

Dummy variable regression model is one the important tools applied in research concerning to business and economics. It is applied in the case of quantitative dependent variable but independent variables may be qualitative or mixed of qualitative and quantitative. Generally in business and economics, explanatory variables are mixed of quantitative and qualitative like gender, education, nationality, region, income, demand, price, consumption, income, inflation, output, profit etc. The dependent variables may be quantitative or qualitative but dummy variable regression model contains quantitative dependent variable like consumption, demand, saving, investment, profit, sales etc. We quantify such variables by artificially assigning values to them (for example, assigning 0 and 1 to sex, where 0 indicates male and 1 indicates female), and use them in the regression equation together with the other independent variables. Such variables are called dummy variables. These models involve only dummy variables as explanatory variables is called ANOVA and it is represented as $Y_i = \alpha_1 + \alpha_2 D_i + u_i$. Regression models in most economic research involve quantitative explanatory variables in addition to dummy variables. Such models are known as analysis of covariance (ANCOVA) models and it is represented as $Y_i = \alpha_1 + \alpha_2 D_i + \alpha_3 X_i + u_i$. The category that is assigned a value 0 is referred to as the base category or the benchmark category, and all the comparisons are made with reference to this category. The coefficient attached to the dummy variable (e.g. α_2 in model) is referred to as the differential intercept coefficient. It tells us by how much the value of the intercept term of the category that is assigned the value 1 differs from that of the base category. We identify the problem of multicollinearity, heteroscedascity and autocorrelation in this model and generalized the model for BLUE estimation and hypothesis testing. This econometric model captures most of the socio-economic problems prevailing in society.

Bhupender Kumar Som
GNIOT Institute of Management Studies, India

Stochastic Queues with Reverse Balking and Reverse Reneging

Balking and reneging are well discussed phenomenon in queueing systems. An arriving customer may choose not to join the queue by looking at the length of the queue or otherwise, this behaviour is termed as balking. On other hand a customer may decide to abandon the system without completing the service due to impatience, this behaviour is termed as reneging in the queueing literature. However, there are businesses where large number of customers in the system becomes a motivating factor for the customers to join the system. That is a customer is more willing to join the system that has a larger number of customer in it already such as insurance, restaurant etc. The customers are also willing to wait for longer duration in the queue if they find a higher value for their money. These behaviours are termed as reverse balking and reverse reneging. The stochastic queuing systems are developed on these two newly introduced concepts and studied.

Mohit Malik[1], Vijay Kumar Gahlawat[1], Rahul S Mor[2], Vijay Dahiya[3]
[1] *National Institute of Food Technology Entrepreneurship and Management, India.*
[2] *University of Northampton, Northampton, UK.*
[3]*Maharaja Surajmal Institute,India*

The Digital Transformation of the Dairy Industry with Artificial Intelligence: A Systematic and Bibliometric Analysis

Milk and milk products provide essential nutrition to every age group and contribute to economic growth. The dairy industry is an essential part of the global food supply chain. Still, it faces many challenges from farm-to-fork activities, whether unstable product prices, demands, cost, environmental impacts, sustainable production, animal welfare practices, etc. Technological innovations have already impacted the dairy industry, such as the evolution of artificial intelligence (AI). It can revolutionize the industry through effective management and implementation of more efficient practices. The main objective of this paper is to examine the role of the potential application of AI in the dairy industry. A systematic approach was adopted to conduct the review following PRISMA guidelines, and bibliometric analysis was performed to investigate the possible application of different AI techniques. 225 articles were finalized to perform the analysis using the Web of Science database. The findings show that AI is being used in production to consumer end, including demand forecasting, quality analysis, animal welfare, real-time monitoring, data analysis, optimization, logistics, inventory management, consumer preferences, etc. This paper also highlights barriers to adopting AI techniques in the dairy context. Cost, awareness, technical knowledge, special skills, training, and privacy concerns were the main factors responsible for the slow adoption of AI. To fully utilize the power of AI, the dairy industry must integrate its operational activities with AI techniques. A collaboration between researchers and industries is much needed to enhance the dairy industry's operational capabilities in the future. Overall this review investigates potential applications of AI, highlights the challenges associated with adopting AI techniques, and discusses the future research directions in the dairy industry. The analysis and findings of the review will serve as a guiding document for researchers, practitioners, and policymakers to understand the power of AI and its benefits to society through proper implementation and utilization.

Jean Pierre Adiouma NDIAYE

National Agency of Statistics and Demography Claudel, Senegal

Profiling jobseekers in Senegal

Long-term unemployment is a serious social problem with sustainable repercussions on society. This issue can be tackled by profiling jobseekers. Thus, the objective of this study is to create a profiling tool for jobseekers in Senegal. In other words, our study is to profile or identify job seekers who have a higher risk of being unemployed for at least 12 months. Data from the National Employment Survey in Senegal (ENES-2019) was used to analyze jobseekers who were affected or not by this long unemployment. Firstly, we did a descriptive analysis of our study population to better understand their characteristics. Secondly, we looked for the existing relationships between the dependent variable of the study "long-term unemployed" and the independent variables which are: marital status, gender, being currently in school, the fact of having followed a vocational or technical training, the employment situation and the main obstacle encountered in the search for employment. Finally, a logistic modeling was done to see the factors that influence jobseekers to remain in unemployment.

Doorgeshwaree Devi Heeramun Alina Banerjee and Deepika Garg

GD Goenka University, Gurugram – 122103, Haryana, India

Grey wolf optimization and its improved version: Application for Reliability Optimization

In an effort to enhance the performance of the Grey Wolf Optimization (GWO), two improved versions Modified Grey Wolf Optimization (MGWO) and Differential Evolutionary and Grey Wolf Optimization (DE-GWO) along with GWO are considered in this paper. GWO, MGWO and DE-GWO are applied for solving cost constrained redundancy allocation problems of manufacturing plants for reliability optimization. Further from comparative analysis of the results of DE-GWO, and MGWO, with the results of GWO, genetic algorithm and hybrid genetic and particle swarm optimization techniques taken from existing studies it is found that proposed DE- GWO are better over other considered techniques.

Deepika Garg

GD Goenka University, India

Reliability Availability Maintainability analysis and optimization for Pharmaceutical Industriess

Reliability, availability, and maintainability (RAM) analysis and optimization is a crucial aspect of pharmaceutical plant operations (Li et al., 2023). The production of high-quality pharmaceutical products requires reliable and efficient equipment, and any failure or breakdown can have serious consequences, including product defects, production delays, and even safety hazards (Sharma,2023). RAM analysis and optimization involves identifying potential failures, minimizing downtime, and improving equipment performance. It includes a combination of preventive, predictive, and corrective maintenance activities, as well as the implementation of new technologies and processes. By analyzing and optimizing the RAM of the manufacturing process, pharmaceutical plants can improve productivity, reduce costs, and ensure compliance with regulations. Geng et al .(2023) designed proactive and visual approach for product maintainability design as in highly regulated industry like pharmaceutical plant , the importance of reliable and efficient operations cannot be overstated. . Recent researchers are using Probability models, Reliability block diagrams, Weibull analysis, Markov analysis Fault tree analysis (FTA), Failure mode and effects analysis (FMEA): Markov models, Monte Carlo simulation, RCM (reliability centered maintenance),Reliability and availability optimization using Heuristic, Mata heuristic and artificial intelligence techniques, Spare part optimization, Design for reliability (DFR),Root cause Analysis(RCA),Six Sigma. Dhiya and Garg (2022) improved the reliability of manufacturing plants by using some by novel heuristic techniques by 63.10%. Hence It is required to make RAM analysis and optimization a critical component of management. RAM analysis increases the production, profit, safety of workers. It also decreases the risk of failure, environmental hazards.

Vijay Kumar

Manav Rachna International Institute of Research and Studies, Faridabad Haryana India

Applications of Multi Criteria Decision Making Techniques for the Medical Diagnosis of Vector-Borne Diseases

In this talk, a decision making support system has been discussed that provides hand held support to the doctors for the medical diagnosis of different diseases. With the assistance of the experts, information about the state and the type of vector borne disease of four patients has been collected from Delhi based health care center with the help of three medical experts. MCDM techniques have been used to rank the diseases among the patients according to the infomation. It seems that the conclusive outcomes of the investigation are same as diagnosed by specialists.

Gabriel S. Mbokoma[1,*] Sunday A. Reju[1], Nnenesi A. Kgabi[2], Benson Obabueki[1]

[1]*Namibia University of Science and Technology, Namibia*
[2]*North-West University, South Africa*

Variational Optimisation Method and Applications to Meteorological modelling

Water scarcity has been a perennial problem in Namibia in recent years. Changing hydro- climatic regimes require a unified model to track changes and obtain optimal representation of the highly unsteady climatic regimes. These problems require more research to investigate the various factors characterising the Namibian atmosphere and its contribution of evaporation to moisture for cloud formation. Data assimilation techniques, for example, provide the best estimate of the state of a system by incorporating observational data into a numerical model and uses observational data to generate an analysis that best estimates the present state of the atmosphere (Johnson, 2003). This study in particular aims to employ an appropriate variational data assimilation technique to develop a mathematical optimal representation model of the key meteorological parameters associated with the Namibian atmosphere. Due to the complexity of the Namibian atmosphere, an appropriate variational data assimilation technique was employed to develop the mathematical models as it enables the assimilation (or acclimatisation or accommodation) of non-linear observations of the analysis variables. Among the two alternative variational data assimilation methods of 3-dimensional variational data assimilation (3D-Var) and 4-dimensional variational data assimilation (4D-Var), the latter was employed in the development of the optimal model as it is time dependent. The key meteorological parameters considered in this study are temperature, humidity and wind speed from the data selected from 14 Southern African Science Centre for Climate Change and Adaptive Land Use (SASSCAL) weather stations in Namibia, rep- resenting five climatic environments of the country. Particular optimal models for each parameter were developed from the general optimal representation model and were solved by using a numerical Limited-Memory Broyden-Fletcher-Goldfarb- Shanno (L-BFGS) iterative method to obtain the optimal solutions. Using 2015 monthly average data for meteorological parameters may seem uncommon but the results were very revealing of the complexity of the Namibian climatic environments and its aridity. Overall best optimal estimates for temperature, humidity, and wind speed at most weather stations, more specifically, at Wlotzkasbaken, Windhoek-NBRI, Narais and Omatako weather stations were observed. The humidity optimal model yielded better optimal estimates compared to the temperature and wind speed optimal models.

Adetayo Samuel Eegunjobi[1], **Oluwole Daniel Makinde**[2]

[1]*Namibia University of Science and Technology, Namibia.*
[2]*Stellenbosch University, South Africa.*

Unsteady Buoyancy-Driven MHD Couette Flow with Variable Viscosity: A New Perspective

In this study, we present a comprehensive investigation of the unsteady buoyancy-driven magnetohydrodynamic (MHD) Couette flow with fluctuating viscosity. The objective of this research is to provide a new perspective on the underlying fluid dynamics and its potential applications in various industries, such as power generation, cooling systems, and materials processing. To accomplish this, we formulate a set of governing equations incorporating the effects of unsteadiness, buoyancy forces, magnetic fields, and variable viscosity. Numerical method with appropriate boundary conditions solves the problem. We then perform a parametric analysis to determine how crucial parameters like the Hartmann number, Grashof number, and viscosity variation affect fluid velocity and temperature profiles. To assure accuracy and reliability, we also analyse numerical scheme stability and convergence. We found that buoyant forces, magnetic fields, and changing viscosity cause complex flow behaviour with velocity and temperature oscillations. The magnetic field suppresses velocity variations and improves fluid heat transfer. We also show that varying viscosity can stabilise or destabilise flow conditions. In conclusion, this study sheds light on unsteady MHD Couette flow with changing viscosity and shows how physical factors interact to determine flow behaviour. Our discoveries may enable new applications and optimisation tactics in linked domains, advancing engineering and technology.

Kapil Toor[1], **Kalyan Das**[1,*]

[1]*National Institute of Food Technology Entrepreneurship and Management, India.*

Impact of Mathematical Modelling for Control Strategies of Listeriosis Diseases in RTE Food

Listeria monocytogenes, which causes listeriosis, is a severe worldwide health issue, especially regarding ready-to-eat (RTE) food products. Establish efficspreadingontrol methods to reduce the possibility of spread and offer food safety due to the possibility of the seriousness of Listeriosis and the challenges involved in identifying and managing L. monocytogenes through food processing methods. Mathematical modeling has grown as a valuable tool to analyze the complicated processes of Listeria disease in RTE food items and point to developing control strategies. The objective of the systematic review is to investigate how mathematical modeling contributes to creating listeriosis control methods in RTE food products. Existing studies that applied mathematical models to explore the dynamics of such diseases in RTE foods are analyzed. The results of this review demonstrate the various applications of mathematical modeling for comprehending the causes of Listeria disease and the efficiency of control measures. To predict L. monocytogene's progress, perseverance, and infection in RTE processing situations, these mathematical models provide the investigation of essential variables like pH, temperature, time, and hygienic practices. Additionally, mathematical models shed light on how different control measures, such as hygienic procedures, temperature regulation, and antimicrobial treatments, affect the levels of Listeria infections contamination. The review also offers the challenges and limitations associated with mathematical modeling applications in the context of listeriosis disease control strategies. These include the requirement for precise and complete information for model parameterization, consideration of variability in food production situations, and incorporating consumer and human behavior into models. The study's findings considerably impact food safety experts, policymakers, and scientists working on listeriosis control measures in RTE food products. This review provides better insights into the significance of mathematical modeling in efficiently reducing the potential hazards of listeriosis in RTE food processing environments by synthesizing current understanding, identifying deficiencies in the literature, and making suggestions for future studies.

Kornelia N. David, Sunday A. Reju, and Serge N. Neossi

Namibia University of Science and Technology, Namibia

Penalised Markowitz Portfolio Model with Augmented Lagrangian

This article formulates and solve the Markowitz Portfolio model using the Augmented Lagrangian optimisation method. Our portfolio consists of a set of financial assets from different financial markets including the local Namibian market. Historical market prices of these assets are used to formulate the Markowitz Portfolio model. The research investigates how the Augmented Lagrangian method together with the use of penalty parameters improves solutions to portfolio optimisation models in terms of asset allocation, minimising risk and maximising returns, which are all major aspects of portfolio optimisation.

Krishan Kumar Yadav, Ajay Singh Yadav and Shikha Bansal
SRM Institute of Science and Technology, India.

A Partially Backlogged Two-Warehouse Inventory Model For Deteriorating Items With Selling Price and Time Sensitive Demand and Carbon Emission Under Green Technology Investment

Since global warming has become a contentious topic, many nations are making investments in several projects and supporting environmentally friendly business practices in an effort to reduce carbon emissions. The present study analyses a two-warehouse inventory model for deteriorating items with carbon emission. The firm has invested in green technologies to reduce emissions. The demand rate is price and time sensitive. Partially backlogging is considered in this model. A profit-maximizing strategy is taken into account in this model. The model can be solved using an algorithm. Using a numerical example, the model is described. Also carried out is a sensitivity analysis.

A. K. Malik
UP Rajarshi Tandon Open University, India

Inventory Model with Non-instantaneous Deteriorating Items

The current presentation discusses the development of an Inventory model with non-instantaneous deteriorating items. Here we assume demand is time dependent and establish a new scheme for maximum lifetime product, their deterioration rate is consider as a function of maximum lifetime. The main conception behind the planned inventory model is time dependent demand and time dependent sales revenue cost for finding the optimal total profit with the optimal cycle. Finally, numerical example and sensitivity analysis are demonstrate that the proposed mathematical model result and realize the effect of variation in optimal total profit function with respect to several parameters used.

Sapana Sharma[1,*] and Rakesh Kumar[2]
[1]*Maharishi Markandeshwar Deemed to be University, India*
[2]*Namibia University of Science and Technology, Namibia*

Transient Solution of A Multi-Heterogeneous Servers' Queuing System with Impatience and Catastrophes

In this paper we consider a Markovian queuing system with heterogeneous servers, balking and catastrophes. The time-dependent behavior of the system is analyzed by using generating function technique. The expressions for mean and variance of the system are obtained in transient state. At last, some special cases of the model are derived and discussed.

Vashali Saxena, Rakesh Gupta, Bhupendra Singh

Ch. Charan Singh University, Meerut,India

A BYESIAN STUDY OF A TWO NON-IDENTICAL UNIT COLD STANDBY SYSTEM WITH PREPARATION FOR REPAIR AND CORRRELATED FAILURE AND REPAIR TIMES

The system comprises of two non- identical unit (unit-1 and unit-2). Unit-1 gets priority in operation over the unit-2 so system initially starts functioning the operation of unit-1 and unit-2 is kept as cold standby. Each unit has two possible modes- Normal (N) and total failure (F). Upon failure of a unit it is sent for preparation before starting its repair. A single repairman is always available with the system for the preparation of a failed unit for repair and to perform the repair. Unit-1 gets priority for preparation and for repair of a failed unit over the unit-2. The preparation time follows exponential distribution with different parameters for both the units. The failure and repair times of each unit are correlated random variables having their Joint distribution as Bivariate exponential with different parameters for unit-1 and unit-2. Each repaired unit work as good as new. The maximum likelihood approach and Markov chain Monte Carlo techniques, respectively, are used to estimate the unknown parameters that are utilised to assess the measure of system effectiveness, such as the MTSF and Profit function of the composite system. Gamma priors have been utilised in the Bayesian approach to produce Bayes estimates of unknown parameters under squared error loss functions. The Fisher informational matrix and Bayesian approach are used to derive the interval estimates of the baseline reliability function. A quick simulation study is done to look at how such a system behaves.

Deep Kamal Sharma and Ompal Singh

SRMIST Delhi NCR Campus,India

Stock Chain Management for Inventory Models

Loads of raw substances and finished things are found in all units of task systems and require enormous money-related techniques for the board. In this manner, logically upheld ways of managing stock administration and cost minimization ought to be explored. Despite the presence of numerous such techniques recorded as a hard copy, each situation has its own unique specifics and practices, to which stock administration models should be changed. In this article, the mark of the journalists is to propose a method for managing to conclude ideal store sizes from different kinds of stocks (more than one is alluded to in the composition as multi-phrasing) that limits simply the expense of stock administration. The expense of stock is prohibited. Stock administration to a predetermined number of stock-keeping units is the level of the models discussed in the article. data for the time series of passed-on sums and time series data for the expenses of stock administration are used. Both time series use a comparable time frame. The created unequivocal nonlinear mathematical models for propelling the absolute expense of stock administration are approbated considering test data and the results got are bankrupt down. The made mathematical models and techniques for overhauling the complete expense of stock administration may be used by composed task overseers to restrict the absolute expenses of stock administration.

Nakul Vashishth, Doorgeshwaree Devi Heeramun and Deepika Garg

GD Goenka University, India

Opposition-Based Learning and Biogeography Based Optimization: Application for Reliability Optimization.

Biogeography-based optimization (BBO) is a powerful optimization algorithm inspired by the principles of biogeography. It mimics the process of migration and colonization of different species, where the behaviour of species is determined by their habitats and the available resources. However, BBO can suffer from slow convergence and premature convergence in high-dimensional optimization problems. To address these issues, opposition-based learning (OBL) has been integrated into BBO. OBL uses the concept of generating an opposite solution to an existing solution and combining them to form a new search direction. This helps to improve the diversity of the population and accelerate the convergence speed of the algorithm. The combination of BBO and OBL has shown promising results in solving various optimization problems, including engineering design, scheduling, and feature selection. This approach has proved to be efficient and robust, making it an attractive alternative to other optimization algorithms. As a case study, the redundancy Allocation Problem is solved with BBO and OBL-BBO. Further, comparison in results show better performance of OBL-BBO.

Vijay Kumar Gahlawat[1,*] Mohit Malik[1], Rahul S Mor[2,*] Vijay Dahiya[3]

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Artificial Intelligence Integrated Queuing Model for the Dairy Industry: A Conceptual Approach

Queuing theory analyzes waiting queues, the length of queues, waiting time, and service time. Operational activities from production to distribution in the dairy industry are complex. Industries implement queuing theory to develop their actions to balance customer serving costs with waiting-in-line disruption. Four major factors contribute to the results of the queuing approach, which are the arrival method, operational functionality of the queue, service method, and departure method. The integration of queuing theory and artificial intelligence (AI) can optimize the operations of the dairy industry efficiently. The main objective of the research is to optimize existing service methods in collection centers of the dairy industry. This study proposes a theoretical concept of AI integration with existing queuing models. The proposed model will optimize the waiting time, service time, and cost and automate the process using IoT sensors. The proposed model can automate the process with minimal human intervention and transparency. This research can be expanded toward real-time implementation to provide a transparent, cost-effective, and sustainable solution for the dairy industry. The proposed framework will enhance dairy operational capacity significantly by optimizing the collection process. The merger of AI and queuing theory can revolutionize the dairy industry, and the proposed study can serve as a roadmap for adopting this method in practice.

Anu Gupta Aggarwal

University 0f Delhi, India

Electronic-Word-of-Mouth in Online Markets

In this age of internet, Electronic-word-of-mouth (eWOM) has emerged as an important source of information not only for the online marketers but also for the customers. The marketers analyze eWOM for extracting the valuable information with respect to consumer needs, experiences, and choices. It also supports the marketer in connecting with their customers in a cost-time effective manner. The prospective customers access and read eWOM for analyzing the performance as well as quality of services/products on the basis of review text and ratings shared by the customers. The eWOM act as WOM available online and impact the buying decisions of majority of the adopters. Many e-commerce websites such as TripAdvisor.com, Amazon.com, etc. manage their electronic review systems for monitoring the market pulse so as to plan important marketing policies related to the quality of product, retailer monitoring, advertising, promotion etc. In addition, it is also an exciting research field for studying the level of importance that eWOM put on the customers buying behavior. In this talk, we will discuss the econometrics and Predictive modeling approaches to understand the role and influence of the eWOM text, ratings, and reviewer characteristics on the product sales and hotel bookings.

Ritu Gupta[1], Gurpreet Kaur[2] and Shashi Kant[3]

[1,2]*Amity University, Uttar Pradesh, India*
[3]*Ministry of Earth Sciences (India)*

Markov Chain Analysis for Rainfall Pattern Distribution: A Case Study

This study develops an objective of describing rainfall pattern of two cities of India – Bareilly and Lucknow. Both the cities Bareilly and Lucknow are located in the state of Uttar Pradesh. Lucknow is the capital city of Uttar Pradesh. A three state Markov chain analysis was employed to assess rainfall pattern using daily rainfall data from 2001 – 2020, a period of 20 years for both cities. We take three different classification of rainfall – Heavy Rain, Moderate Rain, and Dry / No Rain. By using successive probabilities, we compute transition matrices for each state and then steady using state transition matrices. A day was regarded as dry if the rainfall was 0 mm, as a moderate rainy day if it is between 0 to 64.5 mm and as a heavy rainy day if it is more than 64.5 mm. We construct matrix of order three (taking three parameters into consideration) and then applied concept of Markov chain to obtain result. We determine rainfall trends. Bareilly on an estimate receives 1135 mm precipitation for the year on average while Lucknow receives 915 mm precipitation for the year on average. So, chances of rainfall in Bareilly is slightly higher than that in Lucknow. We derive weekly data analysis for both the cities. We derive the mean of monthly average for both the city from data available. It was done to know which month receives the maximum rainfall and which month receives the minimum rainfall. We discover patterns of rainfall and distributions in detail.

K. Baby Saroja, V. Suvitha,

SRM Institute of Science and Technology, India.

An investigation on M/PH/1 queueing model with single working vacation, breakdown, repair and standby Server.

We consider a single server queueing model with three service types, each with three phases. In which the customers arrive according to a Poisson process and the service time of each customer follows Hyper-Erlang distribution. We analysed the model with interruptions, such as breakdown, repair and single working vacation. The standby server works whenever the main server under breakdown. Using the matrix geometric method, the Steady-state probability vector of the model is examined and finally, some numerical examples are presented.

Krishan Pal, Ajay Singh Yadav, Seema Agarwal

SRM Institute of science and Technology NCR Campus Modinagar Pin code – (201204)

Defective items with cyclic time of Economic Production quantity with two ware house

The buyer is compelled to order more than the warehouse can hold in today's business transactions for several reasons, including bulk purchase discounts, reordering costs, the seasonality of the products, inflation-induced demand, etc. Such circumstances necessitate more storage space to house the extra units bought. Typically, a rented warehouse serves as this extra storage space. Here, inflation plays a very intriguing and important role: The price of items goes up as a result. The organization chooses to maintain a bigger inventory during the inflationary period to protect against rising prices, which raises aggregate demand. A rented warehouse provides the extra storage space required for these additional goods. Ignoring the effects of inflation and the time worth of money could lead to false conclusions.

Ashish Mor, Kalyan Das*

National Institute of Food Technology Entrepreneurship and Management, India.

Bridging the Gap: Mathematical Modelling and Climate Change in Marine Ecosystems - A Systematic Examination

Climate change raises severe risks to aquatic environments, impacting their dynamics, structure, and overall functionality. Awareness of the intricate interactions inside such ecosystems and determining how these ecosystems will respond to the effects of climate change is essential to make accurate choice-making and efficient conservation approaches. Mathematical models have become an effective tool for investigating and modeling the complex behavior of aquatic ecosystems in varying climate conditions. The study's main objective is to investigate and explore the potential applications of mathematical modeling in evaluating and predicting the climate change impacts on marine ecosystems. The authors used the Web of Science database to analyze the literature using a systematic review approach. The studies on climate change's effects on marine biodiversity, species distribution, food webs, and ecosystem functioning were identified and analyzed. The findings show that mathematical modeling can be used to gain insight into the complicated behavior of marine ecosystems. These mathematical models offer an understanding of marine life's and ecosystems' responses to various climate change factors, such as rising temperatures, acidification of the oceans, and transformed circulation trends, through the integration of biological, chemical, and physical processes.
Additionally, mathematical models allow us to investigate potential mitigation approaches and assess conservation initiatives' efficiency in decreasing climate change's effects on marine ecosystems. This systematic review also highlights the challenges and limitations of mathematical modeling in the context of marine ecosystem climate change studies. This involves model parameter uncertainties, the requirement for robust validation and calibration, and the incorporation of socioeconomic variables into ecosystem models. This review's findings have significant implications for decision-makers, environmentalists, and scholars interested in climate change and its impact on marine ecological management. This review provides a better understanding of the importance of mathematical modeling to address the various difficulties posed by climate change to marine ecosystems by synthesizing current literature, determining research gaps, and making recommendations for future studies.

Ilenikemanya D. Ndadi and Sunday A. Reju

Namibia University of Science and Technology Windhoek, Namibia

Wavelet Application to Geomagnetic Disturbances Modelling and Monitoring in Power Networks

Geomagnetic disturbances (GMDs) are events caused by significant effects in the earth's magnetic field as a result of occurrence of solar flares on the surface of the sun from time to time (Lee, 1997). They can have adverse effects on man-made equipment and systems including air traffic control systems, pipelines and electric power systems through Geomagnetic Induced Currents (GIC). For example, GMDs can have a serious effect on power systems when currents induced in power lines flow to the ground through substation transformers causing saturation of the transformer core which can lead to a variety of problems. An increasing interest in the investigation of GICs in the Southern African power transmission networks has initiated an interdisciplinary research towards having better understanding of the GIC profiles in the sub-regional networks. As part of the growing efforts of the GIC research team in Namibia, more recently, Gope et al (2015) specifically provided an improvement on the GIC model for the 220kV-400kV NamPower network. Wavelets are powerful tools in signal processing and data compression. The wavelet transforms constitute excellent alternatives to Fourier transforms in many situations and they are ideal when signals are not periodic as in GIC signals. This paper specifically employs the Haar wavelet transform to investigate the optimal GIC energy in selected NAMPOWER substations' GIC data during two GMD events in 2013 and 2015. The results reveal some significant events during specific times of the day to suggest appropriate network disturbance mitigation strategies for the selected stations.

Laxmi Raghuwanshi, Rakesh Gupta and Pradeep Chaudhary

Ch. Charan Singh University, India

COST-BENEFIT ANALYSIS OF A THREE NON-IDENTICAL UNIT STANDBY SYSTEM WITH WEIBULL FAILURE AND REPAIR LAWS

The paper deals with the reliability and cost-benefit analysis of a three nonidentical units namely-super priority(sp), priority (p) and ordinary (o) cold standby system model. A single repairman is always available with the system to repair a failed unit. The priorities in respect of operation and repair are being given to sp-unit over p, o-units and to p-unit over o-unit. All failure and repair time distributions of the units are assumed to follow weibull with different parameters. Several measures of system effectiveness are obtained by using regenerative point technique.

Mamta Keswani and U.K. Khedlekar

Dr Harisingh Gaur Central University, India

Optimal Policies for Replenishment, Pricing, Promotional efforts, and Preservation Investments for Deteriorating Items with Price-dependent Stochastic Demand

In the modern era, there are various reasons for uncertainties, like trade barriers due to global wars, pandemics, climate change, and inflation due to many reasons. Due to these factors, the market may go into a declining mode. To improve the market, we developed a stochastic inventory model for deteriorating items, and to make the model realistic. We considered stochastic price-sensitive demand and incorporated the promotional effort to boost product sales and enhance the market potential. In the model, shortages are partially backlogged at a negative exponential rate with the waiting time up to the arrival of the next replenishment. Our efforts are to obtain the optimal replenishment policies for deteriorating items in the market and minimize the total inventory cost. The mathematical model is explored with numerical examples to validate the proposed model and the sensitivity of the optimal solution. We have also shown optimality analytically and graphically both. The practical applications, managerial insights, and suggestions are provided in the conclusions with the future scope of this study.

R. S. Yohapriyadharsini, V. Suvitha,

SRM Institute of Science and Technology, India.

M/M/c Heterogeneous Arrivals Queue with Two Kinds of Working Vacations and Impatient Customers.

In this paper, we deal with multi-server queueing system with two kinds of Working Vacations (WVs) and impatient customers. A random timer is started whenever a customer arrives at the system. The customer may leave the system if the service is not finished before the impatience timer perishes. Each time after serving all the customers, the system becomes empty and then the server starts 1st kind of vacation. On returning from 1st kind of WV, the server begins 2nd kind of WV whenever a system has no customers. When the server comes back from either 1st kind or 2nd kind of WV, if there is at least one customer in the system, the server changes to busy period. The steady state probabilities have been derived using the Probability Generating Functions (PGFs) method. Various measures of performance are presented and numerical illustrations are also provided.

Pradeep Singh

Maharishi Markandeshwar Deemed to be University, India

Topological indices of zero-divisor graph of Z_n

Topological indices are numerical parameters of a graph which characterize its topology and are usually graph invariant. Topological indices based on the distances between vertices of a graph or vertex degrees are widely used for characterizing molecular graphs, establishing relationships between structure and properties of molecules, predicting biological activity of chemical compounds, and making their chemical applications. In this paper we discuss three topological indices: Wiener index, Laplacian energy and Zagreb indices of zero-divisor graphs.

Dibaba B. Gemechu[1], Legesse K. Debusho[2], and Linda M. Haines[3]

[1]*Namibia University of Science and Technology*
[2]*University of South Africa, South Africa*
[3] *University of Cape Town, South Africa*

Algorithmic construction of Bayesian optimal block designs using the linear mixed effects model

One of the focuses of experimental block design is to obtain an optimal way of allocating treatments to the block and an optimal labelling of the treatments in order to obtain accurate data to estimate the parameter of interest as precisely as possible. Under the linear mixed effects model setting, where the block effects are assumed to be random, the treatment information matrix (C-matrix) is dependent on the unknown parameter ρ (ratio of unknown variance components of random error and block effects). The best-guess approach has been used in literature to obtain optimal or near-optimal designs and the resultant designs can be considered as locally optimal. A locally optimal design does not account for uncertainty in the variance components. A Bayesian optimal design extends the locally optimal approach by specifying a prior distribution for the unknown parameter ρ. In this study, an algorithmic approach for construction of Bayesian optimal block designs under the linear mixed effects setting was introduced and applied to the two-colour cDNA microarray experiments, where arrays are treated as a block effect. The result of the study indicates that the resultant Bayesian optimal block designs are insensitive to the shape of the prior distributions.

Khedlekar, U. K. and Kumar, L*

Dr. Harisingh Gour Vishwavidyalaya Sagar, India

Stochastic Inventory Model for Imperfect production with FRW Scheme under uncertainties

The aim of the proposed work is to design an optimal production strategy for imperfect production with stochastic demand as well as price. The research incorporates machinery failure during the production runtime, a free repairable warranty scheme for defectiveness generated in the products, and complete backlogging. In addition, work has been developed in a stochastic environment, including random selling prices, stochastic demand, and random failure times. Unpredictability is analysed using different types of distributions. The proposed model separately discusses the behaviour of random demand in additive and multiplicative cases. Research has proposed an optimal production lot size with an optimal price by demonstrating the concave behaviour of the objective function with respect to optimal demand and optimal price. In the end, a numerical example and sensitivity helped to validate the findings.

Renu Bala, Madhu Aneja and Tania Bose

Chitkara University Institute of Engineering and Technology, India

Upper bounds for the complex growth rates in the Darcy-Brinkman convection in a binary viscoelastic fluid saturated porous layer

In the present paper we mathematically establishes that the complex growth rate (σ_r, σ_i) of an arbitrary neutral or unstable oscillatory perturbation of growing amplitude, in the Darcy-Brinkman convection in a Binary viscoelastic fluid saturated porous layer heated from below must lie inside a semicircle in the right- half of the (σ_r, σ_i)-plane whose centre is origin and radius equals $|\sigma| <$ min. $\left\{ \left(\frac{\lambda R_T P_r}{1+\epsilon} \right)^2, \frac{R_S}{\chi^{4\pi*2}\epsilon D_a} \right\}$ where R_T and R_S are the thermal and solute Rayleigh number and P_r is the Prandtl number. The bounds obtained herein, in particular, yield a sufficient condition for the validity of 'the principle of the exchange of stability'. Further, it is proved that above result is uniformly valid for quite general nature of the bounding surfaces.

Shubham Prakash, Begishev Vyacheslav Olegovich and Shubham Prakash

Peoples' Friendship University of Russia , (RUDN University)

Exploration of autonomous vehicles in smart city environment

Our project "Exploration of autonomous vehicles in smart city environment" is based on the Internet of Things. In this project, we aim to create simple radar that detects all objects within its range using an ultrasonic sensor. The main component of this project is the Arduino board, which is used to model the system for collecting data from the ultrasonic sensor and transmitting it to the processor that implements a graphical application to simulate the radar screen. A technical system has been assembled for the practical use of the sensor by detecting objects and obstacles that appear in front of the radar. Further in this study we are working on network model in NB-IoT . NB-IoT technology uses much narrower channels at 200 kHz, allowing devices to have approximately 10% complexity compared to LTE-M. NB-IoT and LTE-M technologies have the ability to cover up to 30 km and connect with more than 50,000 devices per cell and it is also battery efficient. LTE-M, NB-IoT are being deployed on the LTE infrastructure, which enables the provision of advanced security features.

S Mathangi and Sharmila Mary Arul

Saveetha School of Engineering, SIMATS, India

On the Power Dominator Star Coloring of path like Graphs

In this paper we propose a new concept called power dominator star coloring by combining the concepts of power domination and star coloring. It aims to find a proper coloring of the graph where each vertex has control over all vertices of at least one-color class, and every path of length four uses at least three different colors. The power dominator star chromatic number chi_pds of a graph G is the minimum number of colors required to achieve a power dominator star coloring of G. The notion of star chromatic number was introduced by Branko Gr¨unbaum in 1973. A star coloring [1, 2, 3] of a graph G is a proper vertex coloring in which every path on four vertices uses at least three distinct colors. Equivalently, in a star coloring, the induced subgraphs formed by the vertices of any two color classes has connected components that are star graphs. The star graph is a tree with at most one vertex with degree larger than 1. Star coloring is a strengthening of acyclic coloring [2], i.e. proper coloring in which every two color classes induce a forest. The star chromatic number chi^s (G) of G is the least number of colors needed to star coloring of G. Guillaume Fertin et al. [3] gave the exact value of the star chromatic number of different families of graphs such as trees, cycles, complete bipartite graphs, outerplanar graphs, and 2-dimensional grids. hypercubes,d-dimensional grids ($d \geq 3$), dimensional tori ($d \geq 2$), graphs with bounded treewidth, and cubic graphs. Studying power dominator star coloring involves developing algorithms, exploring the computational complexity of the problem, and investigating its applications in various domains such as network routing, task scheduling, or resource allocation. It offers a unique perspective on graph coloring problems and provides opportunities for both theoretical research and practical applications. Overall, power dominator star coloring is an intriguing and challenging area of study within graph theory, offering insights into the complex interplay between power domination and star coloring conditions while providing valuable applications in real-world scenarios. In this paper, we find the power dominator star coloring of path and cycles.

Elisia Dula

University of Namibia, Namibia

The Determinants of Housing prices in Namibia

In this research, the relationship between the property prices and the factors that are influencing these prices in the Namibian real estate markets. The housing prices are affected by factors such as interest rates, unemployment, poverty, population growth rate, National debt, GDP per capita and Gini coefficient. The study is analyzing the time series of housing prices data obtained from the Deeds office and data for these control variables for the period from 1990 to 2022. The multivariate regression model will be used for the analyses.

Cyr-Séraphin Ngamouyih Moussata and Benjamin Mampassi
Marien Ngouabi University,Congo

Numerical simulation of a phenomenon of silting up of river banks

River silting is the cause of degradation of the banks of river and their environments. The causis and origins of river silting are varied and complexes. After having developed the equations which govern the sedimentation of rivers, we propose a formulation for the identification of the parameters and the source function of bank's silting phenomenon. In this paper we have placed a particular emphasis on the construction of the algorithmic scheme leading to the codes to indentify the parameters of the silting of the banks of the rivers. To overcome the lack of real field data, we generated experimental data by solving a carefully chosen partial differential equation. All the codes obtained were executed on the MATLAB interface ans the results of the simulation were satisfactory.

Comfort Reju[1] and Loyiso Jita[2]
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Learners' Perceptions of the Challenges and Improvement Strategies in Distance and Online Undergraduate Mathematics Learning in Nigeria

In order to address the diverse needs of the present-day distance and online mathematics learners, it is necessary to obtain the opinions of the learners on the improvement strategies of the programme. In distance and online learning (DOL) education in Nigeria, different strategies to improve mathematics learning have been incorporated. The aim of this paper is to provide students' standpoint on the challenges and improvement strategies of learning mathematics through the distance and online method of education. The study explores how internet connectivity issues, institutional strategies and facilitation skill development impacted upon mathematics students' engagement in distance and online mode of learning. In this study, distance and online mathematics learners from two Open and Distance Learning (ODL) universities who were in the third-year of their study was interviewed. A thematic analysis and a word-for-word narrative inquiry approach that encourages students to tell their story was adopted in analysis. The findings indicated among others a need for provision of efficient, viable and affordable internet connectivity in their schools, inclusion of several online mathematics activities for students learning in this mode and provision of relevant mathematical resources for effective learning. It was recommended that the school in collaboration with the government should provide cost-less personal computers equipped with mathematical functions for effective mathematics learning. The students' opinion presented in this paper can be used as informed improvement strategies designed to enhance distance and online mathematics learning in ODL universities in Nigeria.

Tilak Sharma[1] **and Rajesh Kumar**[2]

[1]*Himachal Pradesh University Regional Centre, India*
[2]*Government College Dharamshala(HP), India*

Intuitionistic Fuzzy $k-$Ideals of Intra Regular Gamma semirings

In this paper, we introduce the notions of anti fuzzy ideal, anti fuzzy $k-$ideal and intuitionistic fuzzy $k-$ideals of a $\Gamma-$ semiring R. We investigate their properties and connections with $k-$ideals and fuzzy $k-$ideals. Finally, intuitionistic fuzzy $k-$ ideals of intra regular $\Gamma-$ semirings and intuitionistic fuzzy $k-$ideals of homomorphisms of $\Gamma-$ semirings are studied.

Susan Maposa, Alphonce Bere, Caston Sigauke and Charles Chimedza

University of Venda

A comparison of the discrimination and calibration performance of the Logit-power and Pareto Families of Links in discrete survival models

The discrete survival model expresses the hazard of an event at a given time as a function of the covariates through a link function. In most cases the link function is an arbitrary choice between the (inverse) cumulative distribution functions of the logistic, Gompertz, and standard normal distributions. It is however known that incorrect specification of the link function can result in inaccurate estimated covariate effects and predicted hazards. The chances of incorrectly specifying the link function can be reduced if the link function is embedded into a family of link functions or if the link function is estimated non-parametrically. Several families of link functions applicable have been proposed. We report the results of a simulation study to compare the discrimination and calibration performance of two recently proposed families of link functions.

Bhupender Kumar Som[1], Sunny Seth[2], Himanshu Goel[3]

[1] *GNIOT Institute of Management Studies (GIMS), India*
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Transient analysis of M/M/1/N queue with encouraged arrivals

In order to ace in any business the prime requirement of the firms is to boost the sales. Eventually, firms release offers and discounts from time to time for attracting more customers. Black Friday sales, Festival sales are few examples of such offers and discounts. Encouraged by these offers and discounts the customers arrive in larger numbers for shopping on e-commerce websites and physical stores both. These customers are termed as encouraged arrivals in queuing literature. Encouraged arrivals result in larger queues and longer waiting times. If the performance measures of such system that is influenced by the encouraged arrivals can be studied theoretically, a better planing and control of the system can be ensured. So far the systems with encouraged arrivals are discussed in steady state. In this paper we study a single server queuing system with encouraged arrivals in transient state. The necessary performance measures are derived. Sensitivity analysis of the system is also performed.

Vishakha Chaudhary

SRM Institute of Science and Technology, India

Two-Warehouse Inventory Models for Decaying Items with Inflation and Partial Backlogging

We considered an order level inventory model for decaying items with inventory level dependent demand rate. We have considered two cases: first is, model started with no shortages and second is model started from shortages. We have also taken the concept of inflation in this study. Finally, a numerical example for illustration is provided with sensitivity analysis

Priyanka Arora

SRM, Institute of Science and Technology, NCR Campus, Modinagar

Inventory Control System for Seasonal Products for Small Retailers

This paper uses probability and forecasting method to provide retailer a decision supporting system to plan its ordering policy for seasonal products. The basic aim is to cut as much expenses of the retailer and provide him with the maximum benefit. It helps the retailer in stating which season is best for which product and then how he has to plan its inventory during that season, so as to receive the best possible outputs. Thus, it helps a small retailer to make decisions for ordering the lot according to the probability of the sales of the product in that season and the forecasting of the seasonal sales of that particular product on the basis of last year's sales. It helps a retailer in managing its inventory with the best possible results and hence to extract as much profit he can.

Ayyappan G and Kalaiarasi S

Puducherry Technological University, India

Flexible group service, Bernoulli Feedback and Bernoulli Vacation

Queueing models in which the services are provided in groups (or blocks or batches) have found to be very useful in real-world applications and such queues been extensively analysed in the literature. In this paper we see one such group service queueing model with Bernoulli vacation and Bernoulli feedback. The arrival processes follows Markovian. Customers are provided service in groups of varying size from 1 to the fixed constant, say, N. The service time of a batch follows the phase type distribution corresponding to the each size of the group. A group's service time is taken as the highest of the service times of each customers who make up the group. The group of customers who are dissatisfied with the service then that group will get the reservice with probability d. The satisfied customer will leave the system with probability c. Here, the feedback of a group is defined as the average of the feedback of each customers who make up the group. After a service The server may go for a vacation with probability q or provide service to the next customer block with probability p. We calculated the steady state probabilities by using the matrix geometric method, then, by using it we computed few performance measures. We have studied the busy period and the distribution of waiting time is derived. Results are illustrated with some graphical representations.

Ayyappan S and Meena S

Puducherry Technology University, India

Numerical investigation on MAP/PH/1 Inventory Retrial Queueing System With Constant Retrial Rate, Single Vacation, Breakdown and Repair

This study investigates a retrial queueing inventory system with the constant retrial rate, single vacation, breakdown and repair. We have assumed that the customers arrive according to Markovian arrival process and the server to provide the phase type services to the customers. The inventory is replenished according to an (s, S) policy and the replenishing time is assumed to follow the exponential distribution. If either inventory level zero or no customers in the orbit or both, then the server goes for a vacation. At any time the server may breakdown, the server immediately go for a repair process and the customer joins the innite size of orbit. The vacation time and repair time follows the phase type distribution. The stability condition and the steady state probability vector analysis are given.

Nega Chere

Namibia UNiversity of Science and Technology

V-modules, SSI-modules and Idempotent of hereditary pretorsion classes in $\sigma[M]$

A module M is called a V -module (cosemisimple module) if every simple module in $\sigma[M]$ is M-injective and a module M is an SSI-module if every semisimple module in $\sigma[M]$ is M-injective. The main objective of this paper is to prove that a module M is an SSI-module if and only if M is a locally noetherian V -module. We also show that an R-module M over a commutative ring R is semisimple if and only if every hereditary pretorsion class in ptors-M is an idempotent radical.

Leta N M, Rakesh Kumar, Adetayo S Eegunjobi and David Iiyambo

Namibia University of Science and Technology, Windhoek, Namibia.

M/M/1/N Queueing Model with Reverse Balking, Catastrophe and Restoration

In this paper, we have incorporated the concepts of catastrophe and restoration in a finite capacity, single server Markovian queueing model with reverse balking. The steady-state solution of the model has been obtained using matrix method. Numerical illustrations have been provided using MATLAB software. The sensitivity analysis of the model has also been carried out. The queueing model with reverse balking find the potential applications in managing insurance business, mutual funds, reputed banks, famous restaurants and so on.

Karthick V and Suvitha V

SRM Institute of Science and Technology, India

AN M/M/2 Queueing System with Differentiated Vacations Subject to Servers Breakdown

In this work we investigated a heterogeneous two server queueing system with differentiated vacations and server breakdowns. The steady state probability vector of the number of customers in the system was evaluated as a Quasi-birth and death (QBD) process, and the stationary condition was obtained using the matrix geometric method. Some system performance measures are obtained. The effects of parameters on the performance measures are shown through graphs and tables.

Janani B

Rajalakshmi Institute of Technology, India

M/M/1 queue with soft failures and N-Policy

The N-policy has drawn a lot of attention in the field of queue design and control. Consideration is given to a single server queueing system with soft failure and vacation. Failures are fixed right away, and as soon as they are, the system returns to its busy state. The server will wait until every customer has been served before serving any more, if any. The server will go into a dormant condition if it is idle for a prolonged period of time, and it won't be activated again until N customers have accumulated. Through the use of generating function and Laplace transform techniques, the system size probabilities in the transient state are determined in closed form.

Patatchona Keyela[1], Oksana Streltsova[2], Tatevik Bezhanyan[2], Yuri Severyukhin[2], Inna Kolesnikova[2]

[1]*Russia RUDN University,* [2]*Russia Joint Institute for Nuclear Research (MLIT JINR)*

Deep learning classification algorithm for small laboratory animals' trajectories in Morris Water Maze

The Morris Water Maze (MWM) is an effective test often used to assess hippocampal-dependent learning, including acquisition of spatial memory and long-term spatial memory. The behavioral MWM test plays an important role in the validation of rodent models for neurocognitive disorders. It is known that depending on its central nervous system damage, a small laboratory animal (SLA) would have one of eight behaviors in MWM. To make the MWN tests analysis faster and more precise, this project aims to build an online framework to process the tests' data by firstly reconstructing the SLA trajectory in the maze and then identifying the type of the reconstructed trajectory. In this paper we present a deep learning approach to detect the trajectory type of a given SLA in the MWM using a convolutional neural network model. Despite the challenges of data quality, the dataset size, and data disbalance the model learns quite good. As result of this study the built model will be integrated in the online framework at the final phase of the MWM data analysis automation.

Miyanawathura Ihala Suranga Gamage Sampath

Wayamba University of Sri Lanka, Sri Lanka

Steady-State Analysis of an M/M/1 Queue with Differentiated Vacations, Reverse Balking and Retention of Renege Customers

This paper analyzes a single server queueing system with differentiated vacations, reverse balking, reneging, and retention of reneged customers. The steady-state solution of the model is obtained, and various measures of effectiveness are derived. The study investigates the impact of differentiated vacations, explores reverse balking dynamics, examines the effects of reneging, and considers the retention of reneged customers. By obtaining the steady-state solution, the system's long-term behavior and stability are evaluated. The derived measures of effectiveness, such as waiting times, queue lengths, and server utilization, provide insights for system optimization.

Sanchita Aggarwal and Abhishek Tandon
University of Delhi, India

Understanding the impact of review and reviewer characteristics on reviewer popularity

In this digital era where the power of the web is growing daily, all the services are moving towards social platforms. Many fields like movies, books, markets, etc. have already penetrated the internet and have established a strong base. The hospitality and tourism industry has also adopted the growing technology and has entered digital platforms through Online Travel Agencies (OTA). These provide a one-stop solution to the users for booking, inquiries, and discussions related to any travel or accommodation query. OTA platform also enables the customers to share their experiences with the masses in the form of numerical ratings and textual reviews known as electronic Word of Mouth (eWOM). These feedbacks contain tremendous information which can be tapped and utilized for a better understanding of the travel product and services. eWOM also holds the capability to work as the deciding factor for future customers which leads to the need for understanding the importance of reviewers. This paper uses customer-provided feedback on OTA websites to study the factors impacting reviewer popularity. A dataset from TripAdvisor.com is used for evaluation purposes. This research utilizes several eWOM and reviewer features for analysis using econometric modeling. The findings provide a detailed understanding of the factors governing reviewer popularity which yields insightful information for customers and hoteliers. The study is summarized with a discussion of theoretical and practical implications.

Rakesh Kumar[1], Amanpreet Kaur[1], Ajender Kumar[2]
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Dynamics of a virally infected phytoplankton and zooplankton system with delay

In this article, a three-dimensional system with susceptible phytoplankton, infected phytoplankton and zooplankton populations have been proposed. For the infection transmission from susceptible to infected class, the Holling type IV functional response has been considered where the predation by zooplankton for the phytoplankton follows the linear functional response. The time delay period as the incubation period for the infection transmission has also been considered. All the basic preliminaries: positivity, boundedness has been investigated. The steady states stability analyses of all possible steady states have been explored. The role of incubation period has been observed as a significant parameter in obtaining limit cycle in the system. Finally, the analytical results have been justified by numerical computations.

Himanshi Sharma and Gulab Singh Bura

Banasthali Vidyapith, Jaipur, India

Maximum Likelihood and Bayesian Estimation on M/M/1 Queueing Model with Balking

In this paper, a single-server Markovian queueing model with balking is closely considered. Balking is a behaviour of impatient customers in which upon arrival, customers decide not to enter the queue and leave the system without getting served. The focus of this paper will be to obtain maximum likelihood (ML) and Bayesian estimation of traffic intensity (ρ), average size of system (Ls), and average size of queue (Lq). Bayesian estimates are obtained by using four different prior distributions, namely, Beta, Gamma, Uniform, and Jeffreys' prior. Simulation study, for distinct sample of sizes: 10, 20, 50, 80, 100, and 150 generated from the Poisson density, is also performed to support our findings. Further, numerical results obtained through simulation technique are illustrated graphically to make the interpretation attractive.

Kornelia David, Sunday Reju and Serge Neossi

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Penalised Portfolio Optimisation Models with Augmented Lagrangian

The research focuses on formulating three portfolio optimisation models, namely the Markowitz portfolio model, the index tracking model, and the enhanced indexation model. Our portfolio consists of a set of financial assets from different financial markets including the local Namibian market. Historical market prices of these assets are used to formulate the three models which are then solved using the Augmented Lagrangian method. The research investigates how the Augmented Lagrangian method together with the use of penalty parameters improves solutions to portfolio optimisation models in terms of asset allocation, minimising risk and maximising returns, which are all major aspects of portfolio optimisation. The Generalized Reduced Gradient (GRG) optimization method is employed in the study to solve the models and the results are compared to that of the Augmented Lagrangian method. From the results of our study, the index tracking model tends to improve the global minimum obtained by the Markowitz portfolio model by reducing the risks and increasing the expected returns while providing a fair distribution of assets within the portfolio. The study's results prove that the index tracking model is best recommended over the Markowitz portfolio model. Although the index tracking model provides better results when compared to the Markowitz portfolio model, it can further be improved by enhancing the returns of the benchmarks which leads to a new model known as the enhanced indexation model. By using the three above-mentioned models of portfolio optimisation, the study proved some general assumptions on investors' behaviours made by the pioneer of portfolio optimisation Harry Markowitz.

G Ayyappan and Thamizhselvi P

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Analysis of $M[X1], M[X2]/G1, G2/1$ Retrial Queueing System with Priority Services, Breakdown Delayed Repair and Bernoulli Vacation

In this paper we analysed the batch arrival retrial queueing system with two class non-preemptive priority units, Bernoulli vacation schedule for an unreliable server, which consists of a break-down period and delay period. Here we assume that customers arrive according to compound Poisson process in which priority customers are assigned to class one and class two customers are of low-priority type. If the server is free at the time of any batch arrivals, the customers of this batch begins to be served immediately. The priority customers that find the server busy are queued and then served in accordance with FCFS displine. While the server is serving to the customers, it may break-down at any instant and server will be down for short interval of time. Further concept of the delay time to repair is also introduced. After the completion of each service, the server either goes for a vacation of random length with probability θ or may continue to serve for the next customer; if any with probability $(1-\theta)$. The service time, vacation time, delay time and repair time all are follows general(arbitrary) distribution. Finally, we obtain some important performance measures of this model.

Sudeep Kumar[1], Anu G Aggarwal[2] and Ritu Gupta[1]

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Integrating Testing Coverage, Effort and Change Point in a Software Reliability Growth Model: A Comprehensive Analysis

Software reliability growth models (SRGMs) play a crucial role in predicting and managing the reliability of software systems. In this research article, we propose an enhanced SRGM that incorporates three important factors: testing coverage, testing effort, and change point detection. We introduce a novel testing coverage function that captures the delayed S-shaped behaviour commonly observed in software reliability growth. Weibull distribution is utilized to model the testing effort. Finally, we address the impact of change points in software reliability. To evaluate the effectiveness of our proposed model, we conducted experiments using real-world software failure data provide by Tandem computers. The results demonstrate that our model outperforms existing SRGMs by providing more accurate predictions and a better understanding of the interplay between testing coverage, testing effort, and change points.

C K Anjali and Sreekanth Kolledathr

Amrita School of Physical Sciences, India

Transient Analysis of a Machine Repair Model with Hot Standbys and Retention of Reneged Machines

The main objective of this investigation is to study the transient state behaviour of machine repair queuing model with K machines, h hot standbys and r repairmen. The notion of retention of reneged machines is also incorporated to make the system more realistic. The time dependent probabilities of the model are obtained by implementing the R-K method of order (4,5). To examine the efficiency of the queuing system we obtain various performance metrics. A sensitivity analysis is also carried out and the numerical results are given in a tabular form. Finally, a comparative study of the performance indices is done by considering the number of repairmen and standbys.

Godlove Suila Kuaban[1], Tadeusz Czachórski[1], and Piotr Czekalski[2]

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Markov Models for Dimensionning and Provisioning of Battery Energy Storage Systems (BESS) for Off-Grid Green Mobile Network Base Station Sites

Mobile communication technologies are playing a significant role in the socio-economic development of every society worldwide. Their widespread adoption has led to the deployment of massive numbers of base station sites to handle the growing number of users, increasing the carbon footprint, especially in off-grid areas where base station sites are powered using diesel generators. Stochastic models such are Markovian models have been applied to size Battery Energy Storage Systems (BESS) for Green base station sites in mobile networks. These models are based on the discretisation or quantisation of energy delivered to BESS into energy packets and then analysed using well-known Markovian modelling methods used to analyse computer networks. This paper proposes Markovian models for dimensioning battery energy storage systems. We derive the probability that for a given capacity of BESS, mean energy harvesting rate and mean energy consumption rate, the energy stored in BESS will be completely depleted. We also investigate the influence of the design parameters, such as the energy supply-demand ratio and the capacity of BESS, on the distribution of the time required to charge BESS to its full capacity (for a supply-demand ratio greater than one) and the time required to completely deplete the energy stored in BESS (for supply-demand ratio less than one). We also analyse the behaviour of the battery energy storage system during the blackout period when the energy generated by the renewable energy system is very low (negligible) or when the renewable energy source has failed, and the base station relies entirely on the energy stored in BESS.

G Ayyappan and N Arulmozhi

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Optimizing inventory in business environments: Combining matrix analytical techniques with a cancellation policy, working vacation and working breakdown

The inventory system of the single-server Markovian arrival process with working vacations, working breakdowns under a Bernoulli schedule, and cancellation policy are all aspects discussed in the following paper. The server begins to go on a working vacation(low service) when there is no customer in the system even if the inventory level is positive. If any customers arrive while he is end of his working vacation time, a normal busy period begins. If not, he will simply remain idle in regular mode. When a system breaks down, it either offers slow service to the current customers with probability p or immediately undergoes a repair phase with probability $q = 1 - p$. In that order, we derive the invariant vector and computation of performance measures using the matrix analytic technique.

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Analysis of a Single Server Queueing Model with Working Vacation, Customer Impatience and Bernoulli Interruption

Queueing models wherein the server is unavailable to provide service for some time forms the core of vacation queueing models. Vacation queues serve as a useful tool for modelling and analyzing computer systems, communication networks, manufacturing and production systems. To cover a broad range of practical applications, it is reasonable to assume that an alternate server could replace the primary server during the vacation period. For example, in a production inventory system, the facility produces products to fulfil the customer's demands while simultaneously maintaining sufficient products in the inventory to meet the future demands. However, between any two production cycles, the idle time of the machines will be effectively used to perform maintenance action in the facility. This time period can be viewed as the period of vacation during which secondary task are performed at a slower rate. Another crucial aspect in the study of queueing models is customer impatience, which occurs due to the slow rate of service. The analysis of the impatience behaviour in queuing models with vacation and its variants have attracted many researchers in recent times
This paper deals with a queueing model subject to working vacation and customer impatience followed by Bernoulli scheduled vacation interruption. Customers are assumed to arrive according to a Poisson process and the single available server provides service to the arriving customers according to exponential distribution. When there are no waiting customers in the system, the server will go on a working vacation, during which the server will provide the service at a reduced rate. Customers may become impatient as a result of the slow pace of service. Depending on the demand, the server vacation may also be interrupted to enter the busy state. When the system becomes empty during the working vacation period, the server goes on a extended vacation during which no service is provided. However, customers continue to join the queue. Explicit expressions for the transient state probabilities of the model are obtained using continued fraction, generating function, and Laplace transform methods. As a special case, the theoretical results are verified with the existing results in the literature.

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Mathematical Analysis of Foot and Mouth Disease with Optimal Control: A Case study of FMD in Namibia

This study aims to comprehensively analyse Foot and Mouth Disease (FMD) by formulating two mathematical models specifically tailored for confined and unconfined environments in Namibia. The models composed for this research incorporate essential compartments that capture the intricate dynamics of livestock populations, including their susceptibility to FMD, latent exposure, infectiousness, and recovery. Furthermore, the models account for the implementation of optimal control measures by farmers and the disease control mechanisms employed by national institutions. This study uses mathematical modelling, stability analysis, historical data integration, and numerical simulations to provide insights into the behaviour and control of FMD in Namibia. The findings contribute to existing knowledge and can inform decision-making and policy formulation.

Sharvan Kumar and Indra

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Cost and Profit Analysis of Two-Dimensional state M/M/2 Queueing Model with Correlated Servers, Multiple Vacations, Balking and Catastrophes

The present study obtains the time-dependent solution of a two-dimensional state M/M/2 queueing model with correlated servers, multiple vacations, balking and catastrophes. Inter arrival times and service times follow an exponential distribution with parameters λ and μ respectively. The server goes on vacation with probability one when there are no units in the system. Units are ejected from the system when catastrophes occur and the system becomes temporarily unavailable. The system reactivates when new units arrive. Occurrence of catastrophes follows Poisson distribution with rate ϵ. Laplace transform approach has been used to find the time-dependent solution. The efficiency of a queuing system has been verified by evaluating some key measures along with total expected cost and total expected profit. Numerical analyses have been done by using Maple software.

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Modelling of flood hazards in Zambezi Kwando Linyanti Basin, Namibia; A 1D Flood Hazard Model

Assessment, Monitoring and Predicting of flood occurrences, frequencies and intensities involve two important things, one is modelling of an observed event from historical data and second is designing a flood event. In this study, a 1- Dimensional Revitalized Rainfall-Runoff Model (1D ReFH Model) in Flood Modeller Version 6.1 will be used to study flood hazards and mapping in the North-Eastern part of Namibia. The Flood Modeller V 6.1 software developed by HEC and JACOBS in the UK will be used to model flood event from the observed historical data from 1950 to 2018 (rainfall, stream flows data e.t.c) in Zambezi Linyanti Kwando Basin. Whilst in designing flood event the model will compute the return periods estimates of maximum flood peaks that exceed a certain threshold limit (mean) in every T time.

Ayyappan Govindan[1] and Thilagavathy Karthikeyan[2]

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Analysis of phase type queueing system with startup times and single vacation

In this paper, we examine a single server queueing model in which customers arrive based on the Markovian Arrival Process (MAP) and their corresponding service process is based on phase-type (PH) distribution. When the service completion epoch, the server goes on vacation. Then, after completion of vacation who return to the system and will do the startup process for offering service whether the customer is present in the system or not. If any customer is available in the system will get service immediately otherwise the service will be idle until the customer arrives at the system. The model is solved in steady-state using Matrix-Analytic Method (MAM). We have established the stability condition for the model. Some important performance measures of the system have been presented. Further, the busy period analysis of the model is discussed.

Ayyappan Govindan and G. Archana Alias Gurulakshmi

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Analysis of MAP1, MAP2/P H1, P H2/2 with Working vacation, Re-service, Interrupted closedown, Unreliable server, Feedback and Impatient customers

A system with two heterogeneous servers with working vacation, re-service, feedback, breakdown, repair, interrupted closedown, balking and reneging is considered. The Markovian Arrival Process (MAP) is used for the customers arrival and phase type distribution are used for the service and repair time of the servers. In this paper, the study of two heterogenous servers where one server is the primary server and another one is secondary server. Customers who are gets the service from the primary(main) server will give the feedback of their service and it is taken into the account. If the customers are satisfied with positive/negative feedback, they may leave the system completely. Otherwise if the customers are unsatisfied service with negative feedback, they have an option to get re-service from the second server. Second server will serve the service for feedback customers only that is those who need re-service after completed the primary service, then that customers will be receive the re-service from the second server. The main server is considered as unreliable server, during the service time the server may get breakdown and immediately goes to the repair process. By using matrix analytic method, the steady state probability vector was analyzed. Busy period and cost analysis are also evaluated. By using few system performance measures, we represent the numerical illustration with graphically and numerically.

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Neural Networks Application to Ecological Modelling

Ecological modelling is among the widely researched areas in applied mathematics and one that always inspires new ideas. In this study, we extend the concept of ecological modelling using neural networks beyond conventional methods of modelling ecological data by employing various approaches such as ecological proximity prediction, inter/cross-ecological prediction, sensitivity analysis and high precision prediction using adjusted neural networks.

In this research project, the theoretical mathematical structure of a Long Short Term Memory (LSTM) neural network is investigated with the behaviour of a neural network model when the Levenberg-Marquardt algorithm is used as a learning algorithm to train, validate and test the neural networks. The performance of each neural network was assessed by the mean square error between targeted output data and the predicted values of the neural network which, specifically was the overall aim of this study.

In the study, the daily data from selected weather stations across selected ecological zones were used to predict selected meteorological parameters, namely, air temperature, humidity, wind speed, precipitation and solar irradiance for selected weather stations in Namibia over a period of one year from 01 July 2021 to 31 June 2022.

Amongst the two prediction approaches used in this study, the ecological proximity prediction yielded good results in predicting air temperature, humidity, wind speed and solar irradiance and gave us good ground to accept the conjecture that the ecological characteristics within the ecological zones are homogeneous. A number of important findings were discovered in this study, including the conditions under which humidity and precipitation can be predicted with high levels of precision. The results of the high-precision prediction of wind speed and surface temperature at Sachinga and Bagani weather stations, for example, presented strongly suggest that a choice of an appropriate neural network structure should be made by the researcher based on the size of the dataset to avoid model overfitting or model underfitting and in turn increasing the model performance.

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Comparison of the WENO and RBF Methods for the Numerical Solution of the 2D Burgers Equation.

Burgers equation represents the simpler form of the Navier-Stokes Equations (NSEs) which still exhibits some of their main properties. In order to develop or study appropriate numerical schemes for the NSEs, it is of a paramount importance to start with the Burgers equation. In this paper, we compare two important numerical methods namely the Weighted Essentially Non-Oscillatory (WENO) and the Radial Basis Function methods applied to the two-dimensional Burgers equation. Qualitative comparison between the shock capturing nature of WENO and the meshless nature of RBF are exhibited, and conclusions are drawn.

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Magnetohydrodynamic Nanofluid Flow Over Convectively Heated Plate 0n Radially Stretching Sheet Embedded on Porous Media

Any material containing pores is termed a Porous media. Fluid flow through this media is a key component in a wide range of activities like generation of fluids from subsurface reservoirs and the subterranean water resource restoration. The findings from this study will provide beneficial theoretical insight on what parameters should be varied for maximum profit in a number of sectors like, power engineering sector, aerodynamic combination, drug recovery systems and water solar heating system. Extensive research has been conducted on MHD nanofluid flow through porous materials. Included in these experiments are parallel-rotating plates surrounded by a porous channel and the influence of rotation on unstable couette flow. MHD nanofluid flow across a plate heated by convection atop a stretching sheet immersed in a porous medium has not been taken into account in any of this research. Consequently, the study's goal is to investigate the motion of MHD nanofluids across a convectively heated plate superimposed on a radially expanding sheet embedded in a porous media. The model is formulated and non dimensionalised using similarity variables. By employing shooting technique to transform the boundary conditions and, R-K scheme in MATLAB bvp4c, the system of ODEs are solved. The results obtained are displayed in graphs and others in tables. The results indicate that with increasing porosity, magnetism and surface rotation, the flow primary velocity decreases while the temperature profile surges.

Sushil Dhaneliya[1] and Manoj Sharma[2]

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A Generalization of Truncated S-Fractional Derivative and Applications to Fractional Differential Equations

In this paper, our aim is to study the work of Ilhan and OnurKiymaz (2020) regarding generalization of truncated M-fractional derivative and applications to fractional differential equations which based on generalization of the truncated M-fractional derivative which was recently introduced Sousa and de Oliveira [2018] , A new truncated M-fractional derivative type unifying some fractional derivative types with classical properties, Inter. of Jour. Analy. and Appl., 16 (1), 83–96, 2018. To do that, we used generalized S-series , which has a more general form in comparison with generalized M-series, Mittag-Leffler function and hypergeometric functions. We called this generalization as truncated S-series fractional derivative. This new derivative generalizes several fractional derivatives and satisfies important properties of the integer order derivatives. Finally, we obtain the analytical solutions of some S-series fractional differential equations

Frans Nghinaundiyele Ndinodiva and Sunday A Reju

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Constrained Optimisation Modelling of Economic Problems: A Multi-Sector Capital Accumulation Model

Despite the vast research on capital accumulation models, no model which is applicable to all situations in place yet. This study used the logarithm and Cobb-Douglas utility and the Cobb-Douglas production functions to introduce an alternative approach to consumer decision to examine a consumer savings decision for a two-sector economy. This means there are two distinct sectors that produce two different commodities, namely, consumption and capital goods. Then the study developed a two-sector capital accumulation optimal control model. This study used two examples to demonstrate the characteristics of the model practically and showed that a two-sector economy's production structure with a capital accumulation can be summarised by an aggregate production structure (i.e. a one-sector economy). This is a major result of the study.
This study also found that the consumer is indifferent to consuming today versus in the future. The results from the model show that a low discount factor β will tend to be associated with higher consumption and low capital accumulation. In addition, the change in interest rate r brings about a change in relative prices of consumption at different periods. Moreover, a change in present value income, specifically an increase in r will cause a rise in consumption at all periods and a rise in capital accumulation in the near future. The study also derived all the necessary steps leading to the results of Zhang (2007) to study the behaviour of the models and calculate the equilibrium values of the economy under study.
Finally, the study recommends that policies that clearly highlight the importance of saving as opposed to consumption which should be accessible to every citizen should be put in place. Moreover, investment in skills (which determine the rate of human capital accumulation) and in the technology sector should be encouraged.

Krishan Pal, Ajay Singh Yadav and Seema Agarwal

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Model of partial backlog inventory for deteriorating goods in two warehouses with quadratic demand under inflationary conditions

The buyer is compelled to order more than the warehouse can hold in today's business transactions for several reasons, including bulk purchase discounts, reordering costs, the seasonality of the products, inflation-induced demand, etc. Such circumstances necessitate more storage space to house the extra units bought. Typically, a rented warehouse serves as this extra storage space. Here, inflation plays a very intriguing and important role: The price of items goes up as a result. The organization chooses to maintain a bigger inventory during the inflationary period to protect against rising prices, which raises aggregate demand. A rented warehouse provides the extra storage space required for these additional goods. Ignoring the effects of inflation and the time worth of money could lead to false conclusions.

Wilbert Nkomo, Broderick Olusegun Oluyede and Fastel Chipepa

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Type I Heavy-Tailed Family of Generalized Burr III Distribution with Applications

We introduce a new family of distributions called Type I Heavy-Tailed Odd Burr III-G (TI-HT-OBIII-G) distribution. Some statistical properties of the new family of distributions are derived. Risk measures such as value at risk, tail value at risk, tail variance and tail variance premium are also derived and their numerical simulations are studied. Model parameters are estimated using the maximum likelihood method and the performance of the estimates is evaluated basing on mean square errors and bias via Monte Carlo simulation framework. Applications of the developed model to heavy-tailed data sets is done and compared to some well known competing heavy-tailed distributions.

Tilak Sharma[1] and Anuj Sharma[2]

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[2]*Government College Shillai, India*

Gaussian and Weak Gaussian Gamma Semirings

In this paper, we study content of a polynomial in $\Gamma-$ semirings and prove some results with ideal generated by content of a polynomial. Finally, we introduce Gaussian $\Gamma-$ semirings, weak Gaussian $\Gamma-$ semirings and prove that a $\Gamma-$ semiring is weak Gaussian if and only if each prime ideal of this $\Gamma-$ semiring is k-prime ideal.

Khushbu Antala, Sudeep Singh Sanga and Khushbu Antala

NIT-SURAT, India

Customer Discouragement in Unreliable Single Server Double Orbit Retrial Queue

The research investigated a queueing system known as the single unreliable server double orbit Markovian retrial queue, which takes into account customers' discouragement behavior. In this system, customers may choose not to proceed with the service if they perceive that the system is overcrowded. If the server is busy when customers join the system, they are compelled to join either the ordinary orbit or the executive orbit based on their demand. The server is assumed to be unreliable and subject to breakdowns and repairs. To analyze the system's steady-state behavior, the researchers formulated Chapman-Kolmogorov steady-state equations, which were then solved using a probability-generating function. Furthermore, the study derived explicit performance metrics to evaluate the system's performance. An illustrative example was utilized to analyze how different system parameters impact these performance metrics.

Preeti Wanti Srivastava and Satya Rani

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Spares Parts Optimization of a Phased Mission Systems

A phased mission system involves several different phases or tasks that must be accomplished in sequence. The system task success criteria, configuration, and component failure characteristics may vary from phase to phase. Phased mission spare parts include all components for replacement and repair during the mission. The availability of spares lessens the chance that the system will be down due to failed component. The study of optimal number of spares is necessitated due to constraints on cost, weight, volume and storage space. For a system with non-identical components, a mixture of spares, referred to as the spares package, must be based on the practical constraints. The present paper deals with maximization of phased mission system reliability with constraints on cost and weights. Components within a phase of a phased mission system are assumed to be independent with dependency across the phases. The cumulative exposure model has been used to model a PMS and the dependency is modelled using Gumbel-Hougaard copula. The method developed has been illustrated using numerical examples with special reference to Fire Fighting PMS.

Kiran Sharma[1] and Manoj Sharma[2]

[1]*Shri Venkateshwara University,India*
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Fractional Calculus Approach in RLC Circuit Using Miller and Ross Function

The aim of paper is to find solution of fractional integro-differential equation associated with the electrical circuit i.e RLC Circuit by using Miller and Ross function

G Ayyappan and S Nithya

Puducherry Technological University, India

Single server bulk service priority queue with Differentiate Breakdown, Repair, Close down, Set up and Multiple vacation

This study deals with the steady state analysis of single server non preemptive priority queueing system with differentiate breakdown, repair, close down, setup and multiple vacation. For this purpose, customers were grouped into two various categories priority and ordinary customers. These customers arrived according to poisson arrival processes. The server consistently afforded single service for priority customers and the general bulk service for ordinary customers, and the service were based on general distribution. Ordinary customers were served only if the batch size was greater than 'a' or less than or equal to 'b', else the server would not start service until the accumulation of 'a' customers. In this study, Supplementary variable technique and probability generating function are generally used to solve the Laplace transforms of time-dependent probabilities of system states. Finally, performance measures are evaluated and expressed in numerical values.

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The correlation between depression and attitudes towards suicide amongst students of the University of Namibia Main Campus Windhoek

This study aimed to determine the levels and relationship between depression and students attitudes towards suicide amongst undergraduate students of the University of Namibia Main Campus. It used a quantitative approach and data about depression levels and students attitudes towards suicide were retrieved using the Beck Depression Inventory self-report scale and the Suicidal Attitude Scale (SAS). Study sample consisted of 250 undergraduate students enrolled at University of Namibia main Campus. Results revealed that there is an intermediate positive correlation between depression and suicide across the different academic years and age groups. On Beck Depression Scale Majority of the participants (n=203), 81.2% of the population were classified as mild depressed, (n=46) with a percentage of 18.4 slightly less but moderately depressed and only (n=1) for 0.4% of the population were classified as severely depressed. On the Suicidal Attitude Scale, majority of participants 42.6% (n=106), classified as having high suicidal attitudes, whereas 28.8% (n=72), classified as having very high suicidal attitudes. Key recommendations of this study emphasizes, awareness campaigns or workshops, effective support systems, quality care by effectively utilising the social and psychological resources within the academic community and an emphasis on peer inclusion.

Beata Dongwi

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Gesturing as a problem solving strategy in mathematics: The case of nonverbal reasoning

While nonverbal communication often goes unnoticed and is subtly ignored in our mathematics classrooms, bodily movements are essential to mathematics problem solving, as they constitute mental processes such as thinking, reasoning and sense making. This abstract reports on a smaller aspect of a bigger qualitative case study that examined the impact of gesturing as a visualization process in problem solving, whereby selected Grade 11 students' thinking and reasoning processes were probed in task-based interviews. Thus, the analysis of the students' non-verbal communication made available through video-recorded data collection, is vital in revealing the meaning behind their utterances. Therefore, the task-based interviews were video-recorded for transcription as a part of data collection process. This was essential in revealing the meaning behind the participants' nonverbal utterances in problem solving. Thus, their worked out solutions, of which I provide one, in given worksheets were analyzed. The findings demonstrate how gestures and gesturing played an important role in mathematical (word) problem solving, which was prevalent in all selected students' responses. Further, students engaged different types of gestures such as, inter alia beat, deictic, iconic and metaphoric to construct mathematical meaning, which was strongly embedded in their bodily actions. That is, no amount of technological advancement shall be able to replace the human effect of gesturing as a thinking and reasoning process in mathematical problem solving.

Rahul Shukla and Rekha Panicker

Walter Sisulu University, South Africa

Approximating Fixed Points of Nonexpansive Type Mappings via General Picard–Mann Algorithm

The aim of this paper is to approximate fixed points of nonexpansive type mappings in Banach spaces when the set of fixed points is nonempty. We study the general Picard–Mann (GPM) algorithm, obtaining the weak and strong convergence theorems. We provide an example to illustrate the convergence behaviour of the GPM algorithm. We compare the GPM algorithm with other existing (well known) algorithms numerically (under different parameters and initial guesses).

Nidhi Nidhi

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Service control for an M/M/1 queueing system with a single unreliable server

The present study focuses on the investigation of customers' impatience in a Markovian queueing system with an unreliable server operating under an N-policy. The repair of the broken-down server in this system follows a threshold policy, which means that the repair process starts when the system's capacity is reached. To obtain the steady-state queue size distribution, a recursive technique is used. Various performance indices are established, and numerical experiments are conducted to understand how different system parameters affect the behavior of these indices.

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Dynamical analysis of a phytoplankton- zooplankton model with time delay

The phytoplankton and zooplankton has great contribution in aquatic environment. By the means of this paper, a system of phytoplankton and zooplankton with time delay has been proposed mathematically and analysed to explain interaction between two populations in aquatic ecosystem. As both the populations have biological feasibility, so it is important to check the system for positive and bounded solution. The occurrence of various equilibrium points along with their stability conditions has been discussed. The system is integrated with respect to time delay parameter τ and observed that the periodic oscillations in populations of phytoplankton and zooplankton occur when the parameter τ is increased by certain critical value. The existence of Hopf bifurcation has been shown by inspecting the associated characteristic equation. At the last, Numerical simulation is carried out to justify the correctness of outcomes with analytical results.

Shiva[1], Neetu Gupta[2] and Anu G Aggarwal[3]

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Incorporating Dynamic Market Potential in Product Diffusion Model under Uncertain Marketing Environment

Understanding the diffusion patterns of high technological products is crucial for effective marketing strategies. However, existing diffusion models often overlook the influence of random marketing conditions and fail to capture the evolving market potential over time. This paper proposes a novel time-varying diffusion model that accounts for both factors. We employ Particle Swarm Optimization (PSO), a robust optimization algorithm, to estimate the model parameters using real-world data. We compare the proposed model's performance with a benchmark model. The results demonstrate the superior predictive power and accuracy of our model.

V. Indhumathi and Sharmila Mary Arul

Saveetha School of Engineering, India

On the Dominator Sum Coloring of certain graphs

In this paper, we introduce a new coloring concept for graphs called dominator sum coloring, denoted by χ_{ds} (G). A dominator coloring of a graph G is a proper coloring such that every vertex of G dominates all vertices of at least one-color class. The dominator chromatic number, χ_d (G), is the minimum number of color classes in a dominator coloring of G. The proposed dominator sum coloring concept aims to minimize the sum of labels assigned to each vertex while satisfying the dominator property. We present an algorithm for finding the dominator sum coloring of linear graphs, also provided pseudo code and C++ implementation for the same and discussed potential applications and future directions for this new coloring concept. The idea of dominator colorings in graphs has been around since the late 1970s when it was first introduced by Cockayne, S.M. Hedetniemi, and S.T. Hedetniemi in their work on the dominator number of a graph. This concept involves partitioning the vertices of a graph into dominating sets, which has many practical applications in real-life problems such as resource allocation and scheduling. Since its inception, the concept of dominator colorings has been further studied and refined by numerous researchers [1–3].The Dominator Sum Coloring Algorithm for Linear Graphs offers a novel and efficient approach to graph coloring that can be applied in a variety of fields such as telecommunications, computer networks, and social networks.

Sweta Yadav and Gurjeet Kaur

University of Delhi, India

Factors Influencing Adoption of UPI Payments by Indian Tourists: Extended UTAUT Model with Relative Advantage, Compatibility, Promotional Benefits, and Trust

Today, online modes of payment have witnessed significant growth among tourists in India. One such online payment mode that has experienced extensive growth is UPI (Unified Payment Interface). This paper aims to study the behavioral intentions of tourists regarding the adoption of UPI in India. The study follows a two-stage process. In the first stage, the impact of attributes of the Innovation Diffusion theory, along with promotional benefits and trust, on the factors of the Extended Unified Theory of Acceptance and Use of Technology (UTAUT 2) model, is considered. In the second stage, the proposed model assimilates and examines the role of the factors of diffusion theory and UTAUT 2 on behavioral intentions. To empirically validate the proposed model, we collected data from tourists in the Delhi-NCR region of India. The collected data was analyzed using the Partial Least Squares-Structural Equation Modeling (PLS-SEM) method with SmartPLS 4.0 software. The results indicated that behavioral intention has a positive and significant impact on the adoption of UPI.

Selma Shifotoka, Dibaba B. Gemechu, Dismas Ntirampeba and Rakesh Kumar

Namibia University of Science and Technology, Namibia

Small area estimation of consumption expenditure in Khomas region, Namibia using the Fay-Herriot EBLUP estimator

In the absence of censuses and administrative records, sample surveys are widely used to provide statistical estimates of many variables of interest. However, sample survey designs usually focus on achieving a particular degree of precision for estimates at a higher level of aggregation than that of sub-populations within the target population. Therefore, sample sizes for such sub-populations are typically small and non-representative. Small Area Estimation (SAE) techniques were developed to produce reliable estimates for sub-populations for which survey samples are either too small or just zero. This study applied a model-based SAE approach to estimate small area estimates of correlated response variables for constituencies in Khomas region, using the 2015/16 Namibia Household Income and Expenditure data, borrowing strength from auxiliary data that was obtained from the Namibia 2011 Population and Housing Census, as well as the 2017 National Atlas. Specifically, the study estimated food and non-food consumption expenditure, using a univariate and a bivariate Fay-Herriot (FH) model. Based on the results of the EBLUP-FH estimation, the distribution of food and non-food expenditure varied across the constituencies in Khomas region. The coefficient of variation (CV) of the EBLUPs was found to be lower than the CV of the direct estimators, for both response variables, and even lower for the estimates resulting from the bivariate Fay-Herriot model.

Ayyappan G[1] and Sankeetha S[2]

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Holistic Approaches in Queueing Analysis: Incorporating a Multi-Feature Queue with Failover Server, Multiple Vacations, Timely Feedback, Flexible Offering, Disruptions, and Restoration

Two types of services are explored in this paper: classic server and main server, both of which provide both regular and optional services. The Markovian Arrival Process (MAP) governs how customers come, and phase type determines how service time is distributed. The backup server covers the work of classic server at slow rate when he is subjected to breakdown due to technical issue or on vacation. Also immediate feedback will be provided under dissatisfaction of the customer. This system has been represented as a QBD Process that investigates steady state with the use of matrix analytic techniques, employing finite-dimensional block matrices. Our model's waiting time distribution has been examined in more detail during the busy times. Performance measures of the system are evaluated and also established few numerical and graphical representations.

Ruth Eegunjobi, Shihaleni Ndjaba and Rosalia Mwalundilange

The International University of Management, Namibia

Digital technologies, Fourth Industrial Revolution and mathematics education nexus in emerging economies: A systematic analysis.

The Fourth Industrial Revolution (4IR) has the potential to transform mathematics education in emerging economies to a higher developmental level by increasing personalised learning and improving students' computational thinking across multiple aspects of mathematics. 4IR will, predictably, alter traditional forms of teaching and learning in emerging economies. This disruptive technology will alter not only logical reasoning and critical thinking but also the analysis and solution of real-world problems. The Preferred Reporting Items for Systematic Literature Review and Meta-Analysis (PRISMA) of secondary data sources, primarily peer-reviewed reputable journal articles, served as the foundation for this article. The goal is to reach conclusions and identify research gaps. The findings show that the main challenge for academic institutions in emerging economies is to find dynamic ways of integrating 4IR technologies into mathematics instruction. Future researchers are encouraged to use mixed methods or experimental research designs to investigate the 4IR and teaching and learning nexus in emerging economies. The current scientific study adds to theory, practice, and future research directions.

Vijender Yadav, Ankur Saurav and Chandra Shekhar
Birla Institute of Technology and Science Pilani,India

Economical Order Inventory Policies for Perishable Items with Permissible Delay in Payment under Credit Policy and Effect of Advertisement, Time, and Price-Discount

The strategic utilization of permissible delay in payment and credit period by suppliers presents a valuable opportunity to mitigate holding costs for retailers. In the current competitive market, it serves as an attractive alternative to price discounts, benefiting retailers. This research delves into an inventory model aimed at minimizing the total cost for perishable items through the implementation of trade credit financing. Suppliers have the option to employ advertising, financial incentives, or a combination of both to stimulate sales. However, factors such as time, demand index, advertisements, selling price, and discounts collectively impact the item demand, which is thoroughly examined in this study. In the highly competitive marketing economy, the primary objective is to determine optimal ordering policies and pricing strategies. The present study encompasses three main objectives: (i) assess the benefits of permissible delay in payment and credit period in minimizing the total cost for a global supply chain; (ii) analyze real-life challenges, including deterioration, partial backlogging, and lost sales, within the inventory system; and (iii) examine the impact of demand patterns characterized by power functions over time and linear relationships for price discounts and advertisements. To validate the proposed model, numerous numerical examples are presented, compared, and solved using the meta-heuristic algorithm QPSO. The convexity of each non-linear objective problem is also visually analyzed. Furthermore, sensitivity analysis of the objective functions with respect to key parameters is conducted, affirming the efficacy of the proposed approach.

Suman Kaswan, Mahendra Devanda and Chandra Shekhar
Birla Institute of Technology and Science Pilani, India

Economic Analysis of a Retrial Queueing System with Balking, Orbit Search, Multiple Vacation, and Unreliable Server

This study focuses on examining the orbital search concept within Markovian retrial queueing systems, considering the presence of multiple vacation policies and server breakdowns. The system dynamics are characterized by an infinite number of inflow-outflow balanced equations, as stochastic processes such as arrival, service, search, repair, and vacation are involved. The probability generating function (PGF) technique is utilized to derive system characteristics and establish a theoretical foundation for this technique. Firstly, the stationary probabilities of the proposed model are investigated. Secondly, key system metrics such as mean orbit size and waiting time in orbit are derived. Finally, a total cost function is formulated for optimization purposes. Subsequently, a comprehensive analysis of the numerical results for these system characteristics is conducted, considering various system parameters. The experimental findings reveal noteworthy similarities in trends between the graphical and analytical perspectives. To minimize the total cost of the system while accounting for the service and search times of the server, a newly developed meta-heuristic technique called the social group optimization algorithm is employed.

Raina Raj

Indian Institute of Technology Delhi, India

Stochastic Modelling of a Multi-Layer HAP-LEO System for Energy Saving and Energy Harvesting through Semi-Markov Process

The sixth generation (6G) communication systems rely heavily on space-air-terrestrial networks (SAT) that integrate high altitude platforms (HAPs) and low earth orbit (LEO) satellites. LEO satellites play a crucial role in ensuring global coverage and supporting a large number of users, while HAPs are deployed to cover regions with high demand, providing a more reliable communication service to ground users. The primary objective of the proposed model is to investigate techniques for energy conservation and efficient energy harvesting in the multi-layered system for HAP. In this energy harvesting scenario, it is assumed that HAPs will store the energy units generated through solar power. Additionally, the presented model includes two energy-saving states: standby and sleep states, during which HAPs consume minimal or zero energy. To analyze the described multi-layer system, a semi-Markov model (SMM) is employed, considering the mean sojourn times of energy-saving states to follow a general distribution. Through numerical results, the significant contribution of energy-saving states in enhancing the energy efficiency of the HAP system is demonstrated. These results are graphically presented, and to validate the proposed dependability model, discrete-event simulations has been conducted.

Mahendra Devanda, Suman Kaswan and Chandra Shekhar

Birla Institute of Technology and Science, India

Optimizing Costs for the Multi-unit Machine Repair Problem with Primary and Secondary Repairer in the M/M/R+1 Configuration

This research paper explores a complex machine repair problem involving multiple operating units with the provisioning of warm spares. Whenever a unit fails, it is immediately attended to by a repairer if one is available. The problem is characterized by having a total of R primary repairers and a single secondary repairer. Primary repairers handle basic maintenance and low-skilled repairs due to their comparatively lower skill level, experience, and knowledge, while the secondary repairer possesses higher skill and experience, focusing on critical repair tasks. This division of labor ensures efficient repair operations, with critical issues being promptly addressed by the most skilled repairer available. To address this problem, a mathematical model is formulated, and the recursive method is employed to solve it. The probability distributions for different states are determined and utilized to derive performance indices. Furthermore, a cost model is developed, and decision parameters are optimized to minimize the predicted cost function per unit of time. To achieve this optimization, a metaheuristic approach, known as teaching-learning-based optimization, is implemented to identify the optimal decision parameters for a cost-effective service system.

Nisha Srivastava and D. C. Sharma

Central university of Rajasthan, India

A stochastic model for Energy saving strategy with N-Policy sleep mode in Cognitive Radio Networks using Semi Markov process

Cognitive Radio Networks (CRNs) are a potential solution to the issue of spectrum scarcity and the enhancement of spectrum utilization through opportunistic use of the spectrum. By taking advantage of the idle spectrum that is licensed to primary radio users, CRNs can operate effectively. As a result, the efficacy of CRNs is heavily reliant on the behaviour of primary radio users. The main focus of our paper is the conservation of energy in base stations (BSs) in "green" CRNs. To meet the increasing need for environmentally sustainable communication, we propose a strategy of multiple sleep modes for licensed channels in CRNs. With this approach and a dynamic spectrum access strategy, we create a semi-Markov model to analyze the unpredictable behavior of packets from both secondary users (SUs) and primary users (PUs).

Ankur Saurav, Vijender Yadav and Chandra Shekhar

BITS PILANI, Pilani campus, Pilani, Rajasthan, India

Optimal Analysis of a Sustainable Inventory Model for a Controllable Carbon Emission with Two Warehouse System and Hybrid Cash-Advance Payment

Mitigating carbon emissions while pursuing economic goals is a primary concern for organizations in today's global economy. The authorities employ carbon cap and tax policies as crucial mechanisms to regulate emissions. Recent research highlights that investing in green technology can effectively reduce carbon emissions associated with various operational inventory activities. However, to ensure uninterrupted supply during periods of high demand, organizations may adopt a two-warehouse inventory system. Additionally, retailers have found an efficient tool in the form of an effective hybrid cash-advance payment policy with discounts, which attracts more customers and boosts demand. This study considers the price sensitivity of item demand, as well as the influence of advertising frequency and timing. The contributions of this research are threefold: (i) analysing the impact of the hybrid cash-advance payment policy on carbon emissions and total cost; (ii) exploring ways to reduce carbon emissions through the implementation of green technologies; and (iii) assessing the effectiveness of a two-warehouse system in avoiding stock-out situations and meeting maximum customer demand. To validate the sustainable economic order quantity model, several numerical examples are examined using the nature-inspired optimization technique TLBO. The graphical analysis confirms the convexity of the proposed objective function. Finally, sensitivity analysis provides managerial implications by demonstrating the significant influence of key parameters on the optimal total cost in the proposed model.

Sharmila Mary Arul
Saveetha School of Engineering , India

On the Power Dominator Equitable Coloring of Wheel Graphs

The concept of power dominator equitable coloring is proposed in this paper as a novel graph coloring technique. A power dominator coloring of a graph G is a proper coloring in which each vertex power dominates every vertex of some color class. The power dominator equitable coloring is a proper k-coloring of G, in which every vertex of G power dominates all vertices of some color classes $C_1, C_2, C_3, \cdots, C_k$ such that the difference in size between any two-color classes is at most one. The author of the paper obtained the chromatic number of a power dominator equitable coloring, denoted by Chi_{pde} (G), for Wheel graphs.

In this paper we have proposed a new concept power dominator equitable coloring which is a type of proper vertex coloring in a graph. This coloring involves the proper coloring of a graph, where each vertex of the graph power dominates every vertex of some color class. In a power dominator equitable coloring, each vertex in the graph must power dominate all vertices of some color class. The color classes are chosen in such a way that the difference between the number of vertices in any two-color classes is at most one. This concept has several practical applications in computer networks, where nodes with high power dominate other nodes in the network. A proper power dominator equitable coloring can ensure that the network remains stable and robust even in the presence of failures. In recent years, several researchers have proposed algorithms and techniques for computing the chromatic number of a power dominator chromatic coloring. The development of these algorithms has enabled researchers to study the power dominator equitable coloring in greater detail and apply it to various real-world problems. Overall, power dominator equitable coloring is a fascinating and important concept in graph theory, with many practical applications in computer networks and other fields. Its study is sure to yield many more insights into the fascinating world of graph theory. Haynes et al. developed a new concept in domination called as a power domination. This concept was motivated by the difficulty of monitoring the state of an electric power system and modelling this problem by a graph with the vertices representing electrical nodes and the edges, the transmission lines. A novel idea known as a power dominator coloring proposed by Kumar et al. in their subsequent research on power domination. Power domination has been studied by several mathematicians and computer scientists, and many contributions have been made to the field since its inception [1-3].

Samuel Ndungula and Victor Katoma

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Latent Growth Mixed Model of the Progression of HIV using CD4 Counts: A Case Study of Namibia

The application of Latent Growth Models and Latent Growth Mixed Models to longitudinal data such as CD4 count data is an important extension of traditional methods of measuring clinical change. Traditional approaches such as ANOVA and Multiple Regression analyse only mean changes and treat differences in individuals as error variance. Error variances often contain valuable information which Latent class models use to predict change more accurately and can be used on CD4 count change in individuals and individual classification on antiretroviral treatment. The focus of this research was to analyse the patterns of change of CD4 counts when the patient is initiated on ART, as well as to investigate different patterns of growth caused by population heterogeneity. This study further sought to analyse how different predictors affect the initial CD4 counts of patients and how they influence the change in the counts overtime. The study employed a Latent Growth Mixed Model to account for the existence of unobserved influences on CD4 count change through unobserved population heterogeneity. Using 466 patients with CD4 counts measured at four different times, the results proved the existence of unobserved population heterogeneity with a conditional 4-class mixed model having the best fit. Age, Sex and Weight covariates had a significant effect on the intercept (initial CD4 count levels) however Only Sex and Age significantly predicted the slope (CD4 count growth rate). With regards to population heterogeneity, none of the identified predictors significantly predicted class membership.

Gaurav Kumar, Bhartendu Singh and Jagadish Behera

Mizoram University, India

The Holiday Effect on Stock Return: An Empirical Evidence from the Tourism and Hospitality Industry of India

Stock market anomalies refer to the presence of a pattern in equities return that violates any of the three forms of the Efficient Market Hypothesis (EMH) and the paradigm of the assets pricing model. The term "holiday effect" states the tendency to yield abnormally high returns on equities either before or after a specific holiday. The holiday effect is a well-explored calendar anomaly. However, the "holiday effect" on stocks of the tourism and hospitality industry in India is in an infancy stage. This study has examined the "holiday effect" on the stock return of selected ten listed companies, who are operating business in the tourism and hospitality industry in India. The present study has examined the "holiday effect" from 1st January 2013 to 31st December 2022, by using 'Diwali' as a holiday. The Diwali is a festival celebrated in India, and as per the Hindu mythology, Diwali is considered as an auspicious day for investment in gold, real estate, stocks, and bonds, etc. The non-parametric Mann-Whitney U-test has been used to examine the differences in mean return, pre and post to Diwali. This research has found that nine stocks out of selected ten yield abnormally high post-Diwali mean return, however, these differences in mean return have not been found statistically significant at 0.05 level of significance except for one stock (Royal Orchid Hotels Ltd).

Chandra Shekhar

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Sustainable EOQ Model for Weibull Deteriorating Items with Back-Ordering and Constant Demand

In spite of the numerous variations of the Economic Order Quantity (EOQ) model proposed in existing literature to enhance its alignment with reality, it still faces certain limitations. The most prominent limitation is its failure to account for the concealed costs inherent in inventory systems, particularly those related to sustainability concerns encompassing environmental, social labor, and economic impacts. In today's global economy, sustainability holds utmost importance alongside profitability. Given the socio-techno-economic competitive nature of the era we live in, curbing carbon emissions presents a significant challenge for all systems. The aim of this study is to develop a sustainable Economic Order Quantity (SEOQ) model tailored for perishable items, incorporating appropriate carbon limits and taxes. This research introduces a two-parameter Weibull distribution to represent the deterioration of perishable items over time, while considering constant demand and shortages, thereby addressing the global challenge of carbon emissions. Carbon taxes and caps are the primary tools utilized by regulatory bodies to control carbon emissions. Bearing this in mind, the research explores a sustainable Economic Order Quantity (SEOQ) model incorporating carbon taxes and caps, with the objective of achieving a manageable rate of carbon emissions through investments in green technology (GT) initiatives under various shortage circumstances. The research focuses on minimizing the expected total cost through a sustainable inventory model, employing a nature-inspired optimization technique that effectively tackles environmental concerns, while highlighting the benefits of investing in green technology.

Gajendra Pratap Singh

Jawaharlal Nehru University,India

Applications of Binary Petri nets and Binary Reachability Trees

Binary Petri nets are the special types of directed bipartite graphs whose reachability graphs based of their topologies generating four types trees namely, binary, full, complete and perfect used in several areas of sciences, engineering, decision making, etc. This class of Petri nets can also use in multi criteria decision making of day to day life problems. In this talk I will show how this class of Petri net is useful in mathematical modelling of complex system with the help of mathematical theorems and Petri net simulator tool.

Varun Shukla

PSIT, Kanpur, Uttar Pradesh, India

Need of Cryptography: Introduction and Research Aspectss

In the modern time, we live in the word of information and it can be seen as an asset. Information security is a buzz word today and is of utmost importance. For dealing with information security (and its derivatives like cyber security, data communication protocols or network /IoT security etc), one must understand the basics of cryptography very deeply. Cryptography is an art of keeping information secure. It provides secrecy, authentication, data integrity and non repudiation. They are called as goals of cryptography. On the other side, hackers or intruders always use various cryptanalysis methods to break the security and misuse the information. So it is very interesting to mention that there is always a contest between cryptographers and intruders. Needless the mention, that only deep knowledge of cryptography can safeguard the information from intruders.

Diwakar Shukla

Dr. H.S. Gour Vishwavidyalaya, India

Estimation using Graph Sampling: A New Approach

A graph is a set of vertices and edges and there exits specific relation among connectivity of vertices to characterize graph as a population. Graph has degree, length of edges, structure complexity, edge density etc. as unknown parameters of interest to know about for a researcher. On the basis of such, on can compare two or more graphs and select a few as useful and efficient strategy. If the number of vertices are large, then in order to estimate such parameters, the help of sampling techniques are required. Sampling may through vertices, on edges or on traversal direction over edges. In the era of social networking, a user may a vertex and edges represent connectivity with others. This paper presents an insight on the joint combination of application of graph theory and sampling methodologies in the area of statistical estimation of parameters.

Patrick Osatohanmwen

Pan-Atlantic University, Nigeria

A General Framework for Generating Three-component Heavy-tailed Distributions

The estimation of a certain threshold beyond which a Generalized Pareto Distribution (GPD) can be fitted to the tail of a data distribution remains one of the main issues in the theory of statistics of extremes. While standard Peak Over Threshold (POT) approaches determine this threshold graphically, we introduce in this paper a general framework which makes it possible for one to determine the threshold algorithmically using sample information. Thus, we propose a general framework for generating three-component heavy-tailed distributions. The approach involves the combination of a distribution which can efficiently model the bulk of the data with a GPD meant to model the data observations at the tail while using another distribution as a link to connect the two. Special examples of models resulting from the general framework are generated and simulations study based on the Monte Carlo method is carried out to test the efficacy of the maximum likelihood method in estimating the parameters of the model. An application of the model is also carried out.

Parmeet Kaur Chahal and Kamlesh Kumar

Central University of Jammu, India

Genetic Algorithm for Redundant Multi-server Machine Repair System under Generalized Triadic Policy

This study concerns with generalization of Triadic policy for multiple server redundant machining system. The machining system also incorporates multiple working vacation policy for servers. Subject to the number of failed machines in the system, the number of active servers are adjusted individually at each instant of service completion or arrival of a failed machine. The recursive technique is employed to derive analytic closed-form solutions of system governing steady-state probabilities. Various performance measures for the redundant machining system are obtained and their behavior with respect to various system parameters is depicted through tables and graphical figures. A cost function for the system is developed and its examination with respect to various system parameters is performed. Genetic Algorithm(GA) is deployed to obtain optimal service rates relative to other system parameters aiming to minimize the cost function.

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Turning $N_\delta-$sets into discrete dynamical systems

The $N_\delta-$sets are perfect sets which are determined by a set specific minimum δ. This piece of work was motivated by the fundamental question: How does one turn an arbitrary set into a perfect set in a rigorous way? Given an arbitrary set, we first introduce a total order in the set and define a minimum δ to be the maximum element minus the minimum element, i.e. $\delta =$ maximum element $-$ minimum element. For simplicity we restrict our attention to integers. It turns out that the above question is equivalent to the question: How does one turn a continuous function into a uniformly continuous function? In this talk, we introduce a dynam- ics into $N_\delta-$sets and study the orbits of their points. Here, the dynamics will be introduced via a pair of mappings f and g which we call companion mappings, hence the discrete dynamical system will be denoted by $(A, < f, g >)$. When the domain of f and g is $\{1; 2; 3; 4\}$, then it can be represented as a disjoint union of the images of f and g. Interestingly, the image of f is an invariant set under f, whereas the image of g, is a fixed set under g.