

# CONFERENCE ABSTRACT

## 2024 7th International Conference on Mathematics and Statistics (ICoMS 2024)

June 23-25, 2024 | Amarante, Portugal  
Business and Innovation Center,  
Instituto Empresarial do Tâmega (IET)

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[www.icoms.org](http://www.icoms.org)

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# Welcome Letter

Dear esteemed participants,

On behalf of the organizing committee, it is with great pleasure that we extend a warm welcome to all participants of the 2024 7th International Conference on Mathematics and Statistics (ICoMS 2024). This conference, sponsored by Polytechnic Institute of Porto and Instituto Empresarial do Tâmega (IET), supported by the Center for Innovation and Research in Business Sciences and Information Systems (CIICESI), Leipzig University of Applied Sciences, University of Technology of Compiègne, and Universidade NOVA de Lisboa, and Puget Sound Energy (PSE) (the Start-up Sponsor), is scheduled to be held in Amarante, Portugal during June 23-25, 2024.

ICoMS 2024 aims to provide a platform for leading academic scientists, researchers, and scholars to exchange insights, share experiences, and present their latest research findings in the field of Mathematics and Statistics. We are confident that this gathering will foster meaningful discussions, collaborations, and advancements in these critical areas of study.

Throughout the conference, attendees can look forward to engaging with keynote speakers, invited speakers, industry and academic workshops, and parallel sessions. We encourage participants to actively participate in oral and poster sessions, presenting their high-quality original research and technical contributions, thereby enriching the conference with diverse perspectives and expertise.

We are honored to host leading researchers and industry experts from around the globe, and we are excited to witness the exchange of knowledge and ideas that will shape the future of Mathematics and Statistics.

Once again, welcome to ICoMS 2024. We wish you a fruitful and enriching conference experience and hope that your time with us in Amarante will be both professionally rewarding and personally fulfilling.

Best regards,

General Chairs of ICoMS 2024

Ding-Geng Chen, Arizona State University, USA  
Jochen Merker, HTWK Leipzig, Germany

## Conference Venue

Main Building, Auditorium, Business and Innovation Center, Instituto Empresarial do Tâmega (IET)

Website: <https://iet.pt/en/centre-for-innovation-and-businesses/presentation/>

Address: Tâmega Park-Edifício Mercúrio-Fração AC, Agração- Telões, 4600-758 Amarante



Instituto Empresarial do Tâmega (IET), is a non-profit association of private law with a scientific and technical nature. The constitution of the association is the result of a set of intentions from institutional entities (municipalities, universities and schools), enterprises and entities who support competitiveness, which led to its constitution on August 20th, 2010. It was established based on the regional development triple helix model aiming to transform, in a 10-year horizon, the main area of intervention in an entrepreneurial valley of excellence, by increasing significantly indicators such as qualified employment, productivity and the rate of medium/high technological intensive start-ups creation.

How to arrive at IET: it takes 47 minutes from Porto airport to IET, 7 minutes from IET to Amarante City Center.

### Recommended Hotels

Hotel Navarras Amarante

Web: <https://www.hotelnavarras.pt/en/>

Email: [reception@hotelnavarras.com](mailto:reception@hotelnavarras.com)

Addr. Rua António Carneiro 84, 4600-049 Amarante, Portugal

### Notes:

1. The registration fee does not cover the accommodation. It is suggest that an early reservation be done because of peak season.
2. The hotel will not contact any participants for hotel booking, and please be careful when anyone asks you to provide your credit card information to reserve room for you.

## Conference Committee

### Advisory Chairs

Ding-Geng Chen, Arizona State University, USA

João Tiago Praça Nunes Mexia, NOVA University of Lisbon, Portugal

### General Chairs

Cristina Delerue Matos, Polytechnic Institute of Porto, Portugal

Jochen Merker, HTWK Leipzig, Germany

### Program Chairs

Ana Borges, Polytechnic Institute of Porto, Portugal

Dario Ferreira, University of Beira Interior, Portugal

Dietrich von Rosen, Swedish University of Agricultural Sciences and Linköping University, Sweden

Nikolaos Limnios, University of Technology of Compiègne, France

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### Oral Award Chair

Flora Ferreira, Minho University, Portugal

### Poster Award Chair

Maria João Polidoro, Polytechnic Institute of Porto, Portugal

### Publicity Chairs

Carla Santos, Polytechnical Institute of Beja, Portugal

Maria Luz Gamiz, University of Granada, Spain

Sandra Nunes, Polytechnic Institute of Setúbal, Portugal

### Regional Chair of Brazil

Paulo Canas Rodrigues, Federal University of Bahia, Brazil

### Regional Chair of Saudi Arabia

Vinoth Raman Rangan, Imam Abdulrahman Bin Faisal University, Saudi Arabia

### Regional Chair of Slovakia

Viktor Witwosky, Slovak Academy of Sciences, Slovakia

### Local Organizing Chair

Ana Borges, Polytechnic Institute of Porto, Portugal

### Local Organizing Committee

Aldina Correia, Polytechnic Institute of Porto, Portugal

Eliana Costa e Silva, Polytechnic Institute of Porto, Portugal

## Technical Program Committee

Adjabi Smail, University of Bejaia, Algeria  
 Alberto Cabada Fernández, Santiago de Compostela, Spain  
 Alberto Manuel Tavares Simões, Universidade da Beira Interior, Portugal  
 Alexander Plakhov, Universidade de Aveiro, Portugal  
 Amilcar Oliveira, Universidade Aberta, Portugal  
 Ammar Al Bazi, Coventry University, United Kingdom  
 António Araújo, Universidade Aberta, Portugal  
 Asifa Tassaddiq, Majmaah University, Saudi Arabia  
 Autcha Araveeporn, King Mongkut's Institute of Technology Ladkrabang, Thailand  
 Bei Wu, NorthWestern Polytechnic University, China  
 Burhan Tiryakioglu, Marmara University, Turkey  
 Carla Santos, Polytechnical Institute of Beja, Portugal  
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 Cristina Dias, Polytechnical Institute of Portalegre, Portugal  
 Dia Zeidan, German Jordanian University, Jordan  
 Dimple Chalishajar, Virginia Military Institute, USA  
 Dina Salvador, Centro de Matematica e Aplicacoes da FCT/UNL, Portugal  
 Eliana Ibrahimi, University of Tirana, Albania  
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 Frederico Caeiro, FCT Universidade Nova de Lisboa, Portugal  
 George Tsaklidis, Aristotle University of Thessaloniki, Greece  
 Gilda Ferreira, Universidade Aberta, Portugal  
 Giovanni Mastroleo, University of Salento, Italy  
 Hristina N. Kulina, University of Plovdiv Paisii Hilendarski, Bulgaria  
 Hüseyin Budak, Düzce University, Turkey  
 Ibraheem Abu-Falahah, Hashemite University, Jordan  
 Imam Mukhlash, Institut Teknologi Sepuluh Nopember, Indonesia  
 Jana Pasackova, University of Economics, Czech Republic  
 Jingyuan Shen, Nanjing University of Science & Technology, China  
 Kamon Budsaba, Thammasat University, Thailand  
 Leandro R. De Luna, National University, Philippines  
 Maalee Almheidat, University of Petra, Jordan  
 Marjualita Theresa T. Malapo, National University, Philippines  
 Masaomix Kimura, Shibaura Institute Technology, Japan  
 Mate Soos, National University of Singapore, Singapore  
 Ming-Chi Wei, National Taipei University of Business, Taiwan  
 Mohammad A. AlQudah, German Jordanian University, Jordan  
 Mohammad Iqbal, Institut Teknologi Sepuluh Nopember, Indonesia  
 Nikola Kasprikova, Charles University, Czech Republic  
 Nuno M. Brites, ISEG- CEMAPRE, Portugal  
 Paria Assari, Islamic Azad University Hamedan Branch, Iran  
 Paulo Jorge Canas Rodrigues, Federal University of Bahia, Salvador, Brazil  
 Poom Kumam, King Mongkut's University of Technology Thonburi, Thailand

Puntipa Wanitjirattikal, King Mongkut's Institute of Technology Ladkrabang, Thailand  
Renzo Roel Perez Tan, Nara Institute of Science and Technology & Kyoto University, Japan  
Salim Bouzebda, University of Technology of Compiègne, France  
Sandra Monteiro, ESCE/Instituto Politecnico de Setubal, Portugal  
Schehrazad Selmane, University of Science and Technology Houari Boumediene, Algeria  
Sergio Adriani David, Universidade de São Paulo, Brazil  
Snezhana Gocheva-Ilieva, University of Plovdiv Paisii Hilendarski, Bulgaria  
Xueli Wang, Beijing Technology and Business University, China  
Yu-Chaio Yang, Kaohsiung Medical University, Taiwan  
Tareq Hamadneh, Al Zaytoonah University of Jordan, Jordan  
Teresa A. Oliveira, Universidade Aberta and CEAUL, Portugal  
Tzee-Ming Huang, National Chengchi University, Taiwan  
Vandna Jowaheer, University of Mauritius, Mauritius  
Viani Djeundje Biatat, University of Edinburgh, UK  
Vinodh Kumar Chellamuthu, Dixie State University, USA  
Volodymyr Anisimov, Center for Design & Analysis at Amgen Inc., UK & National Academy of Sciences of Ukraine, Ukraine  
Xuekui Zhang, University of Victoria, Canada

## Presentation Guidelines

### Presentation Requirement

- At least one author should present for each abstract/full paper during the session.

### Tips for Presentation

- English is the official language.
- Get your presentation PPT/Slides prepared.
- Keynote Speech: about 40 minutes of presentation and 5 minutes of Q&A.
- Invited Speech: about 20 minutes of presentation and 5 minutes of Q&A.
- Oral Presentation: about 12 minutes of presentation and 3 minutes of Q&A.
- One Best Oral Presentation will be selected from each session and announced at the end of the session.

### Onsite Presentation Instructions

- Devices Provided by the Conference Organizer
- Laptop Computer (MS Windows Operating System with MS PowerPoint and Adobe Acrobat Reader). (b) Digital Projectors and Screen. (c) Laser Pointer. (d) Materials Provided by the Presenters: PowerPoint or PDF Files (Files should be copied to the Conference laptop at the beginning of each Session.)
- Instructions for Poster Presentation  
Materials Provided by the Conference Organizer: The place to put posters. Materials Provided by the Presenters:  
(a) Home-Made Posters: Submit the poster to the staff when signing in. (b) Maximum poster size is A1. (c) Load Capacity: Holds up to 0.5 kg.
- Conference Material  
All presented papers will be issued with hard copy of conference materials: Receipt/Invoice, Participation and presentation certificate, Conference program book, etc.
- Dress Code  
Please wear formal clothes or national representative of clothing.

### Personal Insurance

- Along with your registration, you will receive your name badge, which must be worn when attending all conference sessions and activities. Participants without a badge will not be allowed to enter the conference venue.
- For your safety, please do not lend your name badge to the persons who are not involved in the conference and bring the unregistered persons into the conference venue.
- The conference organizers cannot accept liability for personal injuries, or for loss or damage of property spacing to conference participants, either during, or as a result of the conference. Please check the validity of your own insurance.



## Online Presentation Instruction

### Equipment Needed:

A computer with an internet connection (wired connection recommended). (b) USB plug-in headset with a microphone (recommended for optimal audio quality). (c) Webcam (optional): built-in or USB plug-in. (d) Please set up your laptop time in advance.

### Download the ZOOM:

<https://zoom.us/download>;

<https://www.zoom.com.cn/download>.

### Learn the ZOOM skills:

<https://support.zoom.us/hc/en-us/articles/201362033-Getting-Started-on-Windows-and-Mac>

### How to use ZOOM:

Set the language. (b) Test computer or device audio. (c) Join a meeting: Join the meeting with the "meeting ID" provided in the program, tap the name as "paper ID+name", eg.: "C0001-XX", then click "Join". (d) Get familiar with the basic functions: Rename, Chat, Raise Hands, Start Video, Share Computer Sound and Share Screen, etc.

### Environment Requirement:

Quiet Location. (b) Stable Internet Connection. (c) Proper Lighting.

### Test Session:

On May 24, there are test sessions. On that day, all the above functions will be taught including how to use ZOOM. If you don't know how to use, please do not worry. However, please do download ZOOM and log in the meeting room in advance, then, you can join the conference.

### Voice Control Rules during the Presentation:

The host will mute all participants while entering the meeting. (b) The host will unmute the speakers' microphone when it is turn for his or her presentation. (c) Q&A goes after each speaker, the participant can raise hand for questions, the host will unmute the questioner. (d) After Q&A, the host will mute all participants and welcome next speaker.

### Conference Material:

All presented papers will be issued with soft copy of conference materials: Receipt/Invoice, Participation and presentation certificate, etc.

### Notes:

Log in the meeting room 15 minutes ahead of the session. (b) Learn the zoom skills. (c) Your punctual arrival and active involvement in each session will be highly appreciated. (d) The conference will be recorded; we will appreciate your proper behavior.

## Contact Us

Contact us by email: [icoms@cbees.net](mailto:icoms@cbees.net) or WeChat for any inquiries



Tips: Please arrive at the Conference Room or log in the ZOOM Room 15 minutes before session. The duration for Keynote Speech: about 40 minutes of presentation and 5 minutes of Q&A. The duration for Invited Speech: about 20 minutes of presentation and 5 minutes of Q&A. The duration for Regular Presentation: about 12 minutes of presentation and 3 minutes of Q&A.

## ➤ Day 1, June 23, 2024, Sunday (GMT+1)

Duration	Venue: Main Building, Auditorium, Business and Innovation Center, IET
10:00-17:00	<b>Arrival Registration &amp; Conference Materials Collection</b> Note: This can also be done on June 24, 2024
Duration	Zoom Link: <a href="https://us02web.zoom.us/j/85824346060">https://us02web.zoom.us/j/85824346060</a> , Zoom ID: 85824346060
10:00-11:00	Test for: PT0002, PT0006, PT0009, PT0028, PT2012, PT0017, PT0021

## ➤ Day 2, June 24, 2024, Monday (GMT+1)

Duration	Venue: Main Building, Auditorium, Business and Innovation Center, IET
08:50-08:55	<b>Welcome Address</b> Prof. João Tiago Praça Nunes Mexia, NOVA University of Lisbon, Portugal
08:55-09:10	<b>Opening Remarks</b> Prof. Jochen Merker, HTWK Leipzig, Germany Prof. Ana Borges, Polytechnic Institute of Porto, Portugal Prof. Vanda Limam, Vice president of School of Management and Technology of Polytechnic of Porto, Portugal
09:10-09:55	<b>Keynote Speaker I</b> Prof. Peter Cameron, University of St Andrews, UK Speech Title: "The ADE Affair"
09:55-10:40	<b>Keynote Speaker II</b> Prof. R. A. Bailey, University of St Andrews, UK Speech Title: "Designs on Strongly-regular Graphs"
10:40-11:05	Coffee Break & Group Photo
11:05-11:30	<b>Invited Speaker I</b> Prof. Teresa A. Oliveira, Universidade Aberta, Portugal Speech Title: "Synergies between Data Science, Information Geometry, and Artificial Intelligence: An Interdisciplinary Study"
11:30-11:55	<b>Invited Speaker II</b> Prof. Clara Cordeiro, University of the Algarve and CEAUL, Portugal Speech Title: "Time Series Forecasting with Bootstrap Magic"
11:55-12:20	<b>Invited Speaker III</b> Asst. Prof. Flora Ferreira, University of Minho, Portugal Speech Title: "Statistical and Machine Learning Approaches in Gait Data Analysis for Disease Diagnosis and Monitoring"
12:20-13:30	Lunch-O Moinho Fronteirodisseia, IET
13:30-13:55	<b>Invited Speaker IV</b> Assoc. Prof. Adelaide Freitas, University of Aveiro, Portugal Speech Title: "Comparing Ordinary and Robust Decompositions of the Trajectory Matrix to Explore Features of Univariate Time Series"
13:55-15:55	<b>Session 1-Mathematical Models and Optimization Calculations</b> PT0004, PT0007, PT0008, PT0027, PT0011, PT3002, PT0024, PT0025
15:55-16:15	Coffee Break
16:15-16:40	<b>Invited Speaker V</b> Asst. Prof. Miguel Fonseca, NOVA University Lisbon, Portugal Speech Title: "Singular Covariance Matrix Models with Random Effects"
16:40-18:55	<b>Session 2-Basic Mathematics and Applied Mathematics</b> PT0001, PT0010-A, PT0012, PT1002, PT0029, PT2011, PT0014-A, PT0026-A, PT0013-A
19:10-20:40	Dinner-Terrassa Restaurant

➤ Day 3, June 25, 2024, Tuesday (GMT+1)

Duration	Zoom Link: <a href="https://us02web.zoom.us/j/85824346060">https://us02web.zoom.us/j/85824346060</a> , Zoom ID: 85824346060
10:00-11:45	<b>Online Session-Mathematical Modeling and Engineering Mathematics</b> PT0002, PT0006, PT0009, PT0028, PT2012, PT0017, PT0021

Duration	Social Program
10:00-12:30	Visit some emblematic sites in Amarante Note: The details can be found at Page 32.

# Welcome Address

08:50-08:55, June 24, 2024, Monday (GMT+1)

Main Building, Auditorium, Business and Innovation Center, IET



**Prof. João Tiago Praça Nunes Mexia**

**NOVA University of Lisbon, Portugal**

## Biography

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João Tiago Praça Nunes Mexia, born on June 2, 1939, had a career as a researcher until joining FCT UNL where he completed his doctorate in Mathematics, Statistics on April 14, 1982, having defended a thesis with the title: Controlled Heteroscedasticity, Quotient Vector Spaces and F Tests for hypotheses about Average Vectors. He obtained the title of aggregate on February 14, 1992 in Mathematics, Statistics having presented a report on the Teaching of the Chair of Econometrics and a Synthesis Lesson entitled F Tests in Sub-Normal Models. His main Research Area: Linear Statistical Inference. He supervised more than 50 doctoral theses and more than 20 master's theses. His university teaching career ended on June 2, 2009 in the category of Full Professor in the Department of Mathematics at the Faculty of Science and Technology/UNL. Director of the Center for Mathematics and Applications at Universidade Nova de Lisboa, having led the CMA to a Very Good classification. He continues his research career and has been part of Nova Math until now.

# Opening Remarks

08:55-09:10, June 24, 2024, Monday (GMT+1)

Main Building, Auditorium, Business and Innovation Center, IET



**Prof. Jochen Merker**

HTWK Leipzig, Germany

## Biography

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Jochen Merker has been professor of “Analysis and Optimization” at the HTWK Leipzig since 2015. He received his PhD in Mathematics from the University of Hamburg in 2005. Afterwards he worked as a Postdoc in “Applied Analysis” at the University of Rostock, received his Habilitation in 2012 and became a professor at the Applied University of Stralsund in 2013, before he moved to Leipzig. His research focuses on doubly nonlinear evolution equations, degenerate and singular parabolic PDEs and Hamiltonian systems on manifolds.



# Keynote Speaker I

09:10-09:55, June 24, 2024, Monday (GMT+1)

Main Building, Auditorium, Business and Innovation Center, IET



## Prof. Peter Cameron

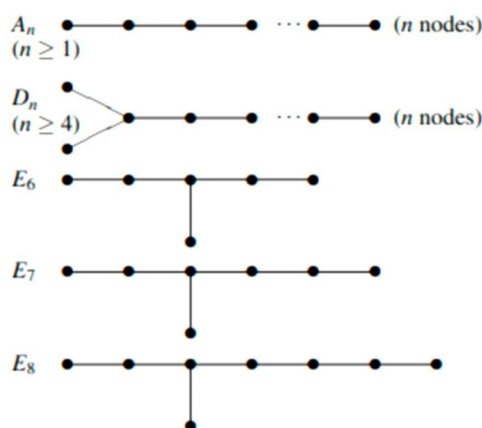
University of St Andrews, UK

### Biography

Peter Cameron is professor of Mathematics at the University of St Andrews, and professor emeritus at Queen Mary University of London, having previously held a position at Oxford University. He was awarded both the Junior and Senior Whitehead Prizes of the London Mathematical Society and the Euler Medal of the Institute of Combinatorics and its Applications. He has worked in various parts of combinatorics, group theory, logic and statistics, and has written more than 350 papers with over 200 coauthors (including Paul Erdős). He has recently been involved with a large project with mainly Indian mathematicians studying graphs defined on groups.

### Speech Info

Speech Title: "The ADE Affair"



Abstract: The Coxeter–Dynkin diagrams of type ADE (shown above) are almost ubiquitous in mathematics, arising in areas from Lie algebras to general relativity, representation theory to finite graph theory, regular polyhedra to singularity theory. In 1978, Vladimir Arnold proposed the problem of explaining their extremely wide range as a “modern Hilbert problem”. This problem is by no means solved, and recent developments have added more occurrences such as cluster algebras. In my talk I will explain some of the many occurrences of these diagrams, and some of the connections between them. A highlight is the observation of John McKay (the person who originated “monstrous moonshine”) on a direct connection between quivers for the binary polyhedral groups and the ADE root systems. It must be said, though, that there is much still to do!

# Keynote Speaker II

09:55-10:40, June 24, 2024, Monday (GMT+1)

Main Building, Auditorium, Business and Innovation Center, IET



## Prof. R. A. Bailey

University of St Andrews, UK

### Biography

R. A. Bailey is Professor of Statistics at the University of St Andrews, and a Fellow of the Royal Society of Edinburgh. She worked for the Medical Research Council's Air Pollution Research Unit before studying at the University of Oxford, where she obtained a BA in Mathematics and a DPhil in Group Theory. As a post-doctoral fellow at the University of Edinburgh she learnt how to apply group theory to problems in design of experiments. She spent ten years applying this knowledge in the Statistics Department at Rothamsted Experimental Station, before moving to academia, being Head of Department or School at Goldsmiths College and at Queen Mary College, both in the University of London. She was President of the then-British Region of the International Biometric Society from 2000 to 2002, and has also served on various committees of the London Mathematical Society, the Royal Statistical Society and the Institute of Mathematical Statistics.

### Speech Info

Speech Title: "Designs on Strongly-regular Graphs"

Abstract: Some particularly nice graphs are the strongly-regular graphs. Their edges and non-edges form the associate classes of an association scheme. The corresponding Bose–Mesner algebra (linear combinations of the adjacency matrices) has three common eigenspaces, one of which is  $V_0$ , which consists of the constant vectors. In classical work on design of experiments, the experimental units are grouped into  $b$  blocks of size  $k$ . This corresponds to the strongly-regular graph consisting of  $b$  complete graphs of size  $k$ , with no edges between them. In some other experiments, the experimental units are all pairs of individuals who have to undertake a given task together. If all such pairs are used exactly once each, then the set of pairs forms a triangular association scheme. Two types of design are particularly important. In *balanced* designs, the variance of the estimated difference between any two treatments is the same. In *orthogonal* designs, the linear combination of responses which gives the best unbiased estimator of any difference between treatments is obtained by simple averaging. Such designs are often said to have *commutative orthogonal block structure*. I will give some constructions for balanced designs and some for designs which have commutative orthogonal block structure, in each scenario.



# Invited Speaker I

11:05-11:30, June 24, 2024, Monday (GMT+1)

Main Building, Auditorium, Business and Innovation Center, IET



## Prof. Teresa A. Oliveira

Universidade Aberta, Portugal

### Biography

Teresa A. Oliveira is Associate Professor with Habilitation in Mathematics-Statistics, at DCeT-UAb, in Lisbon, Portugal. She obtained MSc and doctoral degrees in Statistics and Operations Research at the University of Lisbon and is a senior member of the CEAUL, <http://ceaul.org/o-centro/membros-ceaul/>. Her research interests include Experimental Design, Statistical Quality Control, Risk Analysis, Statistical Modeling, Computational Statistics, Stochastic Models, Data Analysis, and e-Learning Methodologies. She actively participated in many Erasmus+ Bilateral and Teaching Programs and was selected by the National Agency as an evaluator for Erasmus+ during 2021/2027. She is the Chair of the ISI-CRA International Statistical Institute - Committee on Risk Analysis, and was appointed as a founding member of the ISI Working Group on Data Science. With extensive editorial experience, she is Associate Editor of JAS - Journal of Applied Statistics and MPS - Mathematical Population Studies, as well as of other prestigious Journal Editorial Boards. She has publications in several peer-reviewed international and national papers, books, special issues, and proceedings, and her main research results were presented in many conferences worldwide. Her contributions to Mathematics-Statistics continue to inspire new research and innovation, which is clearly reflected in theses and dissertations under her supervision, in various courses, and in several universities.

### Speech Info

Speech Title: "Synergies between Data Science, Information Geometry, and Artificial Intelligence: An Interdisciplinary Study"

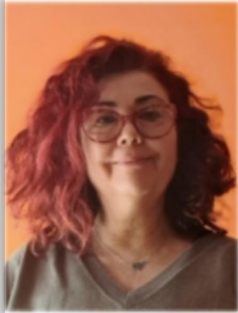
**Abstract:** This work presents an interdisciplinary study of the synergies between the emerging fields of data science, information geometry, and artificial intelligence. Data science involves the extraction of insights, meaningful patterns, relationships and knowledge from complex data sets, while information geometry provides a mathematical framework for studying the geometric properties of information spaces, leading to improved data visualization and dimensionality reduction techniques. Artificial intelligence aims to develop systems that can perform tasks typically requiring human intelligence and, combining these techniques will impact on the development of more accurate and efficient artificial intelligence models. Some examples will be referred, which demonstrate the benefits of integrating diverse perspectives and methodologies in advancing the frontier of intelligent systems. By pushing boundaries and integrating diverse perspectives, new possibilities can be unlocked, fostering innovations in the field.



## Invited Speaker II

11:30-11:55, June 24, 2024, Monday (GMT+1)

Main Building, Auditorium, Business and Innovation Center, IET



### Prof. Clara Cordeiro

University of the Algarve and CEAUL, Portugal

#### Biography

Clara Cordeiro holds a PhD in Mathematics and Statistics from the Technical University of Lisbon, specialising in forecasting time series with Bootstrap. She is an Assistant Professor in the Department of Mathematics at the University of the Algarve. Clara is also a member of the Research and Development unit - Centre of Statistics and Applications (CEAUL) at the University of Lisbon. Her scientific interests are bootstrap for dependent data, exponential smoothing methods, and forecasting time series. Additionally, she has developed statistical models and algorithms to address scientific inquiries across various scientific domains. Recently, her research has been driven by collaborative projects with non-academic partners.

#### Speech Info

Speech Title: "Time Series Forecasting with Bootstrap Magic"

**Abstract:** Predicting the future is, and will always be, a huge challenge. Many researchers, using different forecasting methods, have tried to develop and update their knowledge to make their procedures more competitive than those already existing. Let us remember the phrase by George E. P. Box: 'Statisticians, like artists, have the bad habit of falling in love with their models.' In my previous studies, the combination of exponential smoothing methods and the bootstrap methodology has proven to be a promising association. Both are versatile and very popular procedures used in various research fields. The effectiveness of such a partnership will be illustrated through an empirical study demonstrating the utility of the bootstrap in forecasting time series. **Acknowledgements:** This work is partially financed by national funds through FCT – Fundação para a Ciência e a Tecnologia under the project UIDB/00006/2020. DOI: 10.54499/UIDB/00006/2020 (<https://doi.org/10.54499/UIDB/00006/2020>)

## Invited Speaker III

11:55-12:20, June 24, 2024, Monday (GMT+1)

Main Building, Auditorium, Business and Innovation Center, IET



**Asst. Prof. Flora Ferreira**

**University of Minho, Portugal**

### Biography

Flora Ferreira holds positions as an Invited Assistant Professor in the Department of Mathematics and a researcher at the Centre of Mathematics at the University of Minho, along with serving as a Data Analyst at BERD - Bridge Engineering Research & Design. She completed her Ph.D. in Mathematics at the University of Minho in 2014. Her research focuses on mathematical modeling, dynamical systems, data analysis, and machine learning, driven by practical inquiries and multidisciplinary collaborations. She has contributed to numerous collaborative research projects and has publications in various peer-reviewed international journals, book series, and proceedings. Her primary research findings have been presented at numerous meetings and conferences worldwide, garnering recognition through awards and distinctions. Additionally, she has served on the review boards of several scientific journals and on the program committees of international conferences.

### Speech Info

Speech Title: "Statistical and Machine Learning Approaches in Gait Data Analysis for Disease Diagnosis and Monitoring"

Abstract: This talk showcases the outcomes of employing different approaches utilizing statistical and machine learning techniques for disease classification based on gait data. Gait analysis is increasingly recognized as a valuable tool for diagnosing and monitoring various neurological disorders. By harnessing statistical methods and machine learning algorithms, we explore the intricacies of interpreting gait data and emphasize the effectiveness of different methodologies in accurately classifying diseases. From conventional statistical techniques to cutting-edge machine learning methods, we examine how these tools can be customized and refined to improve disease classification precision, thereby facilitating early detection and personalized treatment strategies. The talk will also address lingering questions in the field, fostering discussion and exploration of future research directions.



## Invited Speaker IV

13:30-13:55, June 24, 2024, Monday (GMT+1)

Main Building, Auditorium, Business and Innovation Center, IET



**Assoc. Prof. Adelaide Freitas**

**University of Aveiro, Portugal**

### Biography

Adelaide Freitas has a bachelor's degree in Mathematics (University of Aveiro, UA), a master's degree in Probability and Statistics (University of Lisbon) and a PhD in Mathematics (UA). She is currently an Associate Professor in the Department of Mathematics at UA, and serves as the scientific leader of the Probability and Statistics Group at the Center for Research & Development in Mathematics and Applications (CIDMA, UA). Her research interests include Multivariate Statistics (Dimensionality reduction, Analysis of compositional data and Analysis of other multidimensional complex data), Extreme Value Theory, and Teaching Probability and Statistics. She holds over 35 publications indexed in SCOPUS. Presented over 50 communications at international conferences. Served on the local organizing committee for one national and two international conferences in Statistics, as well as recently serving as president of the scientific committee for a national congress. Realized teaching mobility missions (Erasmus, 6). Adelaide Freitas has supervised master's dissertations (28 completed), curricular internships (6 completed), and doctoral theses (1 in Education and 2 in Mathematics). Currently she is supervising 2 PhD students and 3 master students.

### Speech Info

Speech Title: "Comparing Ordinary and Robust Decompositions of the Trajectory Matrix to Explore Features of Univariate Time Series"

Abstract: The Singular Spectrum Analysis (SSA) method is a powerful technique for time series analysis. In the basic version of SSA, the trajectory of the original univariate time series is mapped into a Hankel-type matrix. We obtain the decomposition of this matrix using two different approaches of the NIPALS algorithm: one approach is classical (based on L2-norm) and the other is robust (based on L1-norm). Then, the difference matrix is computed. In this talk, we explore the interpretation of this difference matrix and discuss how it can be advantageous for detecting temporal patterns and facilitating clustering tasks in time series analysis. (It is a joint work with Alberto Silva (CIDMA, UA) and Filipa Santana (CIDMA, UA).

## Invited Speaker V

16:15-16:40, June 24, 2024, Monday (GMT+1)

Main Building, Auditorium, Business and Innovation Center, IET



### Asst. Prof. Miguel Fonseca

NOVA University Lisbon, Portugal

#### Biography

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Miguel Fonseca is a member of the NOVA Math research center and holds a position of assistant professor in the department of Mathematics of the NOVA School of Science and Technology. His main research interests are multivariate statistics, statistical inference and machine learning. With a PhD in Mathematics, specialty of Statistics, he has vast activity in the academia with publications in statistics and applications in biostatistics and other areas. He also has experience in data analysis and software programming, both for public and private sector.

#### Speech Info

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Speech Title: "Singular Covariance Matrix Models with Random Effects"

Abstract: In this paper, we consider multivariate mixed models with a dispersion matrix that is singular. We derive estimates for both fixed and random effects using maximum likelihood, considering several conditions restricting the fixed effects of the model. The efficiency of the estimators is ascertained with simulation studies.

# Session 1

13:55-15:55, June 24, 2024, Monday (GMT+1)

Main Building, Auditorium, Business and Innovation Center, IET

**Topic: Mathematical Models and Optimization Calculations**

**Chair: Assoc. Prof. Adelaide Freitas, University of Aveiro, Portugal**

S1-1	PT0004 13:55-14:10	<p>Forecasting Models for Total Crude Palm Oil Productions in Thailand  <b>Somsri Banditvilai</b> and Autcha Araveeporn            King Mongkut's Institute of Technology Ladkrabang, Thailand</p> <p>Abstract: This research aims to find a suitable forecasting model for Thailand's total crude palm oil production. The monthly total crude palm oil production in Thailand was gathered from the Office of Agricultural Economics, Ministry of Agriculture, and cooperatives from January 2010 to December 2022. The data were divided into two sets. The first set, from January 2010 to December 2021, was used for constructing and selecting the forecasting models. The second one, from January 2022 to December 2022, was used to compute the accuracy of the forecasting model. Since the total crude palm oil production has trend and seasonal variation, the research used the Holt-Winters method with different initial settings for trend and seasonal influence, the Bagging Holt-Winters method, and the Box-Jenkins method to construct the forecasting models. The Minimum Mean Square Error (MSE) and Residuals have normal distribution used to select the appropriate forecasting model, and Mean Absolute Percentage Error (MAPE) was used to compute the efficiency of the forecasting model. According to the results of the three forecasting methods, the Box-Jenkins method was suitable for forecasting Thailand's total crude palm oil production. The ARIMA(2,1,2)(0,1,1)<sub>12</sub> model was the best model for forecasting Thailand's total crude palm oil production and yielded the MAPE =13.49%</p>
S1-2	PT0007 14:10-14:25	<p>Modeling the Beer Market in a Competitive Environment with Principal Component Analysis and Machine Learning Techniques: A Case Study  <b>Hristina Kulina</b>, Polina Yaneva, and Snezhana Gocheva-Ilieva            University of Plovdiv Paisii Hilendarski, Bulgaria</p> <p>Abstract: This study models and examines the influence of the most important market factors on the sales of one of the four strongest brands in the brewing industry in Bulgaria. The monthly observations include sales volume, average price, distribution, and television advertising for each of the four brands. The data are modeled using Principal Component Analysis (PCA) and ensemble machine learning (ML) method based on classification and regression trees (CART). We are comparing two models built on different time periods of the data. The created models with a coefficient of determination of over 96% and a MAPE of less than 7% determine the most important factors influencing the sales of one of the beer brands in the competitive environment of the others. The models are employed for predicting beer sales two months ahead.</p>
		On Stability Properties in a Stochastic Controlled Lotka-Volterra Model



S1-3	PT0008 14:25-14:40	<p><b>Cutberto Romero-Melendez</b>, David Castillo-Fernandez, and Leopoldo Gonzalez-Santos Metropolitan Autonomous University, México</p> <p>Abstract: We study stability properties of the solutions of a controlled stochastic Lotka-Volterra one-predator-two-prey model with Lévy jumps. We also establish and solve, by means of the Stochastic Maximum Principle, the corresponding optimal control problem in a population modeled by a Lotka-Volterra system with two types of stochastic environmental fluctuations: white noise and Lévy jumps. Our study shows, assuming standard linear growth and Lipschitz conditions on the drift and diffusion coefficients, that the solutions present three kinds of stability: exponential stability, probability stability and Turnpike stability.</p>
S1-4	PT0027 14:40-14:55	<p>A Mathematical Model of the Electrical Power Management Systems Jabbar Abbas Ghafil and <b>Mohammed Musa</b> University of Technology, Iraq</p> <p>Abstract: The aim of this paper is to apply a mathematical model to modeling cooperation among power stations and fuel supply producers. We use the cooperative game to show the potential cost in case of cooperation through an optimization algorithm to find the most feasible solution using Python program as working procedure. Then, we employ an application of the methodology to a study case for the fuel supply and electric power production in the Wassit thermal station in case of cooperation. The obtained results of the proposed methodology will strongly help professionals to formulate and improve well-organized strategies for the electrical power management systems of the future.</p>
S1-5	PT0011 14:55-15:10	<p>Individual Water Consumption Forecasting: Evaluating SARIMA and TBATS Methods Tatiana Cunha, <b>Eliana Costa e Silva</b>, and Flora Ferreira Instituto Politécnico do Porto, Portugal</p> <p>Abstract: Understanding and forecasting residential water consumption patterns are critical in the context of sustainable resource management. This study aims to address the challenge of water consumption forecasting by implementing and comparing two time series methods: Autoregressive Integrated Moving Average (SARIMA) and Trigonometric Box-Cox transform, ARMA errors, Trend and Seasonal components (TBATS). Employing a dataset that includes hourly consumption values from individual meters of six consumers over one year, the study first applies the TBATS method, recognizing its effectiveness in handling multiple seasonalities. Following this, a comparative analysis with the SARIMA model is conducted to assess performance variations in forecasting water consumption patterns. Preliminary findings indicate distinct seasonal consumption patterns among consumers, especially during peak hours and in terms of volume. Both TBATS and SARIMA models demonstrate potential in accurately forecasting individual water consumption, with TBATS showing particular strength in handling multiple seasonalities. The comparative analysis of the TBATS and SARIMA models provides valuable insights into their applicability for individual water consumption forecasting. The findings are expected to guide water companies in selecting appropriate forecasting methods for integrating into their monitoring systems, thereby contributing to more efficient and sustainable water resource management.</p>
		<p>Harness the Unreal: Evaluating State-of-the-Art Lane Detection with Synthetic Data <b>Pedro A. Costa</b> and Arnaldo J. Abrantes Lisbon School of Engineering (ISEL/IPL), Portugal</p>

S1-6	PT3002 15:10-15:25	<p>Abstract: Autonomous driving systems are highly dependent on lane detection. Therefore, ensuring its robustness and reliability is crucial for road safety. This work proposes to validate one of the leading lane detection models in the CULane benchmark with an alternative synthetic dataset with full (automatic) ground truth labeling from Epic Games' Unreal Engine 5, a dynamically enriched, photorealistic simulation environment. The aim is to provide a range of variations (circadian, climatic, and road types) to analyze the algorithm's performance and collect reference indicators of the domain gap versus the original training dataset based on real-world driving. The results support the validity of synthetic data as part of an enhanced testing strategy that expands coverage and minimizes the imbalance of training datasets for safety-critical applications.</p>
S1-7	PT0024 15:25-15:40	<p>Enhancing Real-Time Analytics: Streaming Data Quality Metrics for Continuous Monitoring Eliana Costa e Silva, <b>Óscar Olivera</b>, and Bruno Oliveira Instituto Politécnico do Porto, Portugal</p> <p>Abstract: In today's data-driven landscape, the quality of streaming data is crucial for ensuring the reliability and effectiveness of real-time analytics and decision-making. This article proposes data quality metrics designed specifically for monitoring and assessing data quality in streaming data block systems. The metrics can incorporate data quality dimensions such as timeliness, accuracy, completeness, and consistency to provide a comprehensive evaluation of data quality in dynamic and continuous data streams. The metrics are presented and discussed, along with a case study demonstrating its practical application and impact.</p>
S1-8	PT0025 15:40-15:55	<p>Evaluating the Bioequivalence of Treatments Using t-Ratios Tests <b>M. Filomena Teodoro</b>, Marina A. P. Andrade, and Teresa Oliveira Instituto Universitário Miitar, Portugal</p> <p>Abstract: The main objective of the work is the application of experimental design and some simple tests (t-ratios) in the evaluation of bioequivalence of two treatments. It is performed the assessment of the effectiveness of different treatments administered to two groups of patients: the control group and the test group. The comparison of the control group that received the reference medication with the control group test, which received the drug under study, using a crossover experimental design and it was performed an analysis using t-ratios and considering and inter-subject variability formulation of the probabilistic model, where the specification of tests for effects detection carry-over and period were considered. The application to a practical case consisted in the validation of the hypothesis of the proposed model took place, where the effects carry-over and period were not significant when considering usual levels of significance. About the treatments, we could conclude that there was statistical significance to affirm that the studied pharmacos were not bioequivalent.</p>

# Session 2

16:40-18:55, June 24, 2024, Monday (GMT+1)

Main Building, Auditorium, Business and Innovation Center, IET

**Topic: Basic Mathematics and Applied Mathematics**

**Chair: Asst. Prof. Miguel Fonseca, NOVA University Lisbon, Portugal**

S2-1	PT0001 16:40-16:55	<p>Comparison of Machine Learning Methods for Binary Classification of Multicollinearity Data</p> <p><b>Autcha Araveeporn</b> and Puntipa Wanitjirattikal King Mongkut's Institute of Technology Ladkrabang, Thailand</p> <p>Abstract: This study examines the effectiveness of binary classification performance in multicollinearity. Four machine learning methods, namely backpropagation neural network, Naïve Bayes, support vector machine, and random forest, are compared in terms of their efficiency in handling multicollinear data. The evaluation of binary classification performance efficiency considers multicollinearity in independent variables, considering both a constant correlation model and the Toeplitz correlation. Correlation coefficients of 0.1 and 0.9 are explored in the analysis. The independent variables in this study are simulated from a multivariate normal distribution with 10, 20, 30, and 40 variables, respectively. The dependent variable is constructed using the logit function with sample sizes of 100 and 200. The simulation and data analysis are performed using the R Studio program and repeated 1,000 times for each scenario. The findings of this research reveal that the backpropagation neural network and Naïve Bayes methods exhibit superior performance in determining the mean accuracy percentage under constant correlation. On the other hand, the backpropagation neural network and support vector machine are the most effective methods in determining the mean accuracy percentage when dealing with multicollinearity in the form of Toeplitz correlation.</p>
S2-2	PT0010-A 16:55-17:10	<p>On the Existence of Setwise Stable Hypergraphs of Relationships</p> <p><b>Jérôme Dollinger</b> UCLouvain, Belgium</p> <p>Abstract: In game theory, the coalition structures are often formalised as partitions of the set of players. The purpose of this work is to model coalition structures as weighted hypergraphs of relationships, where each agent can belong to several coalitions of different strengths. In parallel of developing their relationships, the agents can play some strategic game. In that setting, the existence of stable weighted hypergraphs of relationships is proven under the classical assumptions of continuity and quasiconcavity of the payoffs. I then allow players to simultaneously form two independent hypergraphs of relationships. Substituting quasiconcavity by an assumption satisfied, in particular, by all the monotonous and quasiconcave payoff functions, I prove that there exists stable pairs of hypergraphs of relationships.</p>
		Spike It Up: Enhancing STL with Spike Detection for Intraday Volatility and Liquidity



S2-3	PT0012 17:10-17:25	<p>Forecasting</p> <p><b>Greeshma Balabhadra</b> Stony Brook University, USA</p> <p>Abstract: RobustSTL is a recent seasonal-trend decomposition method to efficiently estimate, forecast, and detect anomalies for time series with complicated patterns. Our framework extends the RobustSTL method by incorporating spike detection and integrating these known regular spike occurrences with the traditional components. By modeling these known spikes, the enhanced STL approach significantly improves the accuracy of these complex time-series estimations and forecasting. Intraday volatility and liquidity in high-frequency trading data exhibit such complex patterns with trends, seasonality, outliers (jumps), spikes, and noise. Our empirical analysis demonstrates the improved efficiency of our method in forecasting applications, offering valuable implications for traders, risk analysts, and portfolio managers.</p>
S2-4	PT1002 17:25-17:40	<p>Revisiting the Problem of Uniqueness in Sparse Reconstruction</p> <p><b>Zoltan Domokos</b> University of Szeged, Hungary</p> <p>Abstract: Finding sparse representations of signals in general dictionaries is a key research topic, with many applications in signal processing and machine learning. In the sparse recovery literature, k-sparsity is a widely accepted assumption. In this work, we strive to reach beyond the standard uniqueness conditions by considering a novel constraint that can be viewed as a generalization of k-sparsity. The proposed formalism enables the selection of a set of indices. When it is known that none of the ground truth vectors can have a support included in this set, guarantees of exact recovery can be extended. In this work, we define the rules for constructing the set mentioned above. Furthermore, the guarantees of an accurate reconstruction will be presented, establishing compatibility with our novel constraints.</p>
S2-5	PT0029 17:40-17:55	<p>MSM.app: An Interactive Web Tool for Survival Analysis and Advanced Multi-State Modeling</p> <p><b>Gustavo Soutinho</b> and Luís Meira-Machado Portucalense University, Portugal</p> <p>Abstract: The development of applications aimed at providing interpretable results in a concise and user-friendly manner within the framework of multi-state models represents a promising research avenue, particularly when leveraging open-source tools adaptable to biomedical contexts. This paper introduces MSM.app, an interactive web application constructed using the Shiny package for the R language. MSM.app is structured into two main components, each addressing distinct facets of survival analysis and its extension to intricate multi-state models. The first component allows users to perform classical survival analysis techniques using standard functions from R packages such as survival. The second component supports users in achieving key objectives in multi-state analysis, including the inference of regression models and the estimation of transition probabilities, by integrating with the survdm and mstate R packages. The web application employs dynamic web forms, tables, and graphics, harnessing the capabilities of the Shiny package. This</p>

		architecture ensures that users, regardless of their level of expertise in informatics, can seamlessly engage in dynamic analyses encompassing critical aspects of multi-state models.
S2-6	PT2011 17:55-18:10	<p>Enhancing Spatially-Disaggregated Simulations with Large Language Models  <b>Ilya Zaslavsky</b>, Jiaxi Lei, Rishi Graham, Mark Handcock, and Eliah Aronoff-Spencer  University of California San Diego, USA</p> <p>Abstract: We present our experience integrating large language models (LLMs) and simulation engines to enhance spatially-disaggregated simulation, taking advantage of the spatial knowledge and spatial reasoning capabilities of LLMs. The examples illustrate LLM integration with different variations of compartmental epidemiological models, including agent-based models (ABM) in the context of modeling COVID-19 infection spread in a school setting, and LLM integration with a system dynamics model which supports a serious game focused on strategies for responding to disease outbreaks at the county level. We present the architecture of the integrated LLM-simulation system, demonstrate the initial results, and discuss the challenges of the current approach, related to LLM's understanding of spatial information and spatial relationships, their reasoning capabilities, and model performance and scalability.</p>
S2-7	PT0014-A 18:10-18:25	<p>Regularization Methods for Solving Inverse Problems: A Comprehensive Review  <b>Omar Alsayyed</b>  The Hashemite University, Jordan</p> <p>Abstract: The importance of regularization techniques in solving ill-posed inverse problems cannot be overstated. Regularization methods play a pivotal role in addressing the challenges associated with the sensitivity and instability of these problems. Given the tendency of ill-posed inverse problems to produce unreliable solutions due to noise or inaccuracies in measurements, regularization techniques act as a stabilizing force. By incorporating additional information or imposing constraints on the solution space, regularization helps prevent overfitting and guides the optimization process towards more realistic and meaningful solutions. Techniques such as Tikhonov regularization, total variation regularization, and sparsity-promoting methods provide a structured framework for balancing the fidelity to observed data and the stability of the solution. Recently, powerful classes of regularization procedures have gained significant prominence and found noteworthy applications across various domains. These advanced regularization methods go beyond traditional techniques, offering more nuanced and effective ways to address the challenges associated with ill-posed inverse problems. Techniques such as machine learning-based regularization, Bayesian regularization, and deep learning regularization have emerged as cutting-edge approaches. In this work, we search the application of regularization techniques as a powerful methodology for addressing the challenges posed by ill-posed inverse problems. Additionally, the work explores the crucial aspect of choosing an appropriate regularization parameter, shedding light on methodologies for parameter selection that contribute to the method's adaptability and overall effectiveness. Through this investigation, we aim to provide insights that advance the understanding and application of regularization in the context of ill-posed</p>

		inverse problems, contributing to the broader landscape of computational science and mathematical modeling.
S2-8	PT0026-A 18:25-18:40	<p>The Power-Pareto Probability Distribution: Properties and Inference  <b>Frederico Caeiro</b>  NOVA University Lisbon, Portugal</p> <p>Abstract: Probability distributions play a fundamental role in various fields of study. The Power-Pareto distribution is a versatile and flexible probability distribution that has gained significant attention in recent years due to its ability to model a wide range of phenomena with heavy-tailed characteristics. This paper provides a comprehensive overview of the Power-Pareto distribution, including its mathematical properties, estimation techniques and applications.</p>
S2-9	PT0013-A 18:40-18:55	<p>Innovative High-Order Methods for Nonlinear Fractional Differential Equations  <b>Fadi Awawdeh</b>  The Hashemite University, Jordan</p> <p>Abstract: In this presentation, we introduce an innovative fully discrete, high-order, and adaptive time stepping method to address nonlinear fractional differential equations (FDEs) of the form <math>D_t^\alpha y(t) = f(t, y(t))</math> <math>y(0) = y_0</math>, where <math>0 \leq t \leq T</math>, <math>y_0, y(t) \in \mathbb{R}^d</math>, <math>f: [0, T] \times \mathbb{R}^d \rightarrow \mathbb{R}^d</math>, and <math>D_t^\alpha</math> denotes the Caputo fractional derivative of order <math>\alpha</math> with respect to <math>t</math>. Solving FDEs presents a formidable challenge in the realm of mathematical analysis and computational science. Unlike their integer-order counterparts, FDEs encompass non-local, memory dependent behaviors that introduce complex temporal dependencies. The inherent non-locality and the presence of fractional derivatives demand specialized numerical techniques and analytical methods, often exceeding the computational capabilities of conventional algorithms. These equations find widespread applications in diverse fields, from physics to engineering, biology, and finance, making the challenge of solving FDEs a fundamental obstacle in advancing our understanding of real-world phenomena. Our research encompasses a systematic transformation of FDEs into integral forms, followed by a meticulous separation of the fractional integral into two essential components: the history term and the local term. At the core of our methodology lies the powerful kernel compression scheme, employed to accurately approximate the history term. Simultaneously, we leverage the integral deferred correction method (IDC) to approximate the local term, effectively increasing the order of the local approximation with each correction iteration. The robustness and effectiveness of our approach are substantiated through rigorous theoretical analysis. To emphasize the practicality of our methods, we provide numerical examples that not only validate our theoretical findings but also showcase the remarkable efficiency of our approach. Furthermore, we demonstrate the versatility of our schemes by solving well-known models, including the fractional Vander Pol equation and the fractional Telegraph equation. This work represents a significant advancement in the field of solving FDEs, promising improved accuracy and computational efficiency across various scientific and engineering applications..</p>

# Online Session

10:00-11:45, June 24, 2024, Monday (GMT+1)

Zoom Link: <https://us02web.zoom.us/j/85824346060>, ID: 85824346060

**Topic: Mathematical Modeling and Engineering Mathematics**

**Chair: Prof. Volodymyr Anisimov, Center for Design & Analysis, Amgen, UK**

OS-1	PT0002 10:00-10:15	<p>Antecedents of Mathematics Performance among University Students: A Moderation Analysis Using PLS-SEM</p> <p>Mark Dustin R. Andonaque, Rob Hedwig S. Chumacera, Ezekiel J. Nacion, <b>Leandro R. De Luna</b>, and Marjualita Theresa T. Malapo</p> <p>National University, Philippines</p> <p>Abstract: This research focuses on how academic procrastination affects the relationship between students' performance in mathematics and mathematical resilience at National University-Laguna. The purpose of this study is to examine whether mathematical performance and resilience are positively correlated. Additionally, the study's purpose is to ascertain if academic procrastination moderates the connection between mathematical resilience and mathematics performance. The study's sample consisted of 210 second-year college students enrolled in various degree programs from NU Laguna. The convenience sampling method is applied due to practical considerations of time, accessibility, and participant availability within the parameters of the research study. G*Power was used to compute the sample size (effect size = 0.15, <math>\alpha</math> = 0.05, and statistical power = 0.95). Partial least squares – structural equation modeling (PLS-SEM) was used to measure the hypothesized connections of the present study. The findings showed that with a small effect size (<math>f^2</math> = 0.016), mathematical resilience has a substantial and beneficial effect on mathematical performance (<math>\beta</math> = 0.128, <math>p</math> = 0.029). The result suggests that higher mathematical resilience among students leads to better mathematical performance. H1 is therefore supported. Moreover, the results also revealed that procrastination has no moderating role on the connection between mathematical resilience along with mathematical performance (<math>\beta</math> = 0.041, <math>p</math> = 0.274). This means that, whether a student will procrastinate or not, it has no influence on the direction and strength of the connection between mathematical resilience and mathematical performance. Therefore, H2 is not supported. Thus, we conclude that mathematics performance and mathematical resilience have a favorable and substantial relationship from one another. This suggests that improved mathematical resilience among students leads to better mathematical performance. However, results further indicated that procrastination does not have a moderating role on the link between mathematical resilience and mathematical performance. This indicates that procrastination is no longer an issue when a person or a student is resilient.</p>
OS-2	PT0006 10:15-10:30	<p>Modeling Carbon Dioxide Emissions with Green Finance-Using Beijing, Chongqing, and Shanghai as Cases</p> <p><b>Junting Wang</b></p> <p>Peddie School, USA</p>

		<p>Abstract: The global greenhouse effect has attracted significant attention in recent years. Most of the current models regarding carbon dioxide (CO<sub>2</sub>) emission apply multiple linear regression analyses on population, gross domestic product (GDP), and energy consumption, disregarding Green Finance Index (GFI) as a driving factor. However, the GFI measures how well a region's financial activities align with environmental goals, which should have an important impact on carbon emissions. We aim to conduct a comprehensive analysis of carbon emissions in China's big cities, highlighting the impact of GFI on carbon emissions and modeling the excessive emissions to be represented in monetary values. Specifically, we picked three cities to serve as case studies—Beijing, Chongqing, and Shanghai. This study establishes an autoregressive integrated moving average (ARIMA) model to predict future values of the four driving forces (resident population, GDP, energy consumption, GFI); a back propagation neural network (BPNN) model to predict carbon emissions; and a cost model to analyze the cost related to excessive carbon emissions based on a fictitious scenario inspired by the US's emission goals. The result shows that GFI significantly correlates with lower carbon emissions. Therefore, increasing the GFI is an effective measure to ensure the realization of peak carbon emissions before 2030, which lowers the cost caused by the risk of excessive carbon emission. This study proposes a carbon emission and cost model that can provide a reference for the control of carbon emissions in Beijing, Chongqing, and Shanghai.</p>
OS-3	PT0009 10:30-10:45	<p>Hypothesis Testing of Spatial and Temporal Weighted Ordinal Logistic Regression  <b>Margaretha Ohyver</b>, Purhadi, and Achmad Choiruddin  Institut Teknologi Sepuluh Nopember, Indonesia</p> <p>Abstract: Regression is one of the most popular statistical methods. One of the reasons for this popularity is that it can suggest which independent variable significantly affects the dependent variable. This suggestion helps decision-makers have an overview of current or past situations and compose important future actions. This research proposes Spatial and Temporal Weighted Ordinal Logistic Regression (STWOLR) as an extension of the regression method. STWOLR describes the relationships between ordinal dependent variable and a number of independent variables. In STWOLR, there are an estimated model, simultaneous test hypothesis, and partial hypothesis test. These three points are the general points that the researcher usually have when using regression as their analysis method. The objective of this research is to determine the form of simultaneous and partial tests for STWOLR using the maximum likelihood ratio test. At the end of this article, we have the statistics test and the rejection rule for both hypothesis tests.</p>
OS-4	PT0028 10:45-11:00	<p>Modelling/Forecasting Patient Recruitment in Clinical Trials using Poisson-Gamma Model with Time-Dependent Rates  <b>Volodymyr Anisimov</b>  Data Science, Center for Design &amp; Analysis, Amgen, UK</p> <p>Abstract: Modern late-phase clinical trials require hundreds/thousands of patients to be recruited across many clinical sites in different countries. Patient recruitment is a key factor for the success of clinical trials. A classic Poisson-gamma model developed</p>



		<p>earlier in the papers of the author with co-authors for modelling and forecasting patient recruitment assumes con-stant recruitment rates. However, the rates may vary over time due to various reasons, such as seasonal effects, lack of patients in some sites, etc. Therefore, a natural generalization of the original Poisson-gamma model to the Poisson-Gamma model with time-dependent rates is considered. An analytic technique for modelling and predicting over time the country and global recruitment processes is developed. A technique for Monte Carlo simulation of the Poisson-gamma model with time-dependent recruitment rates is discussed. Two criteria for testing time-dependence, non-parametric Poisson-type and parametric Poisson-gamma, are considered. The implementations to predict-ing recruitment in clinical trials using simulation are discussed.</p>
OS-5	PT2012 11:00-11:15	<p>The Pricing of Mortgage Loan Guarantee Insurance Under Fractional Brownian Motion  <b>Jie Miao</b> and Junfei Cao  Guangdong University of Education, China</p> <p>Abstract: With the development of mortgage loan business, the risks faced by banks have become increasingly complex. Mortgage loan guarantee insurance is an effective tool to address the default risks and reduce the risk level of mortgage loans. Assuming that real estate prices follow the stochastic differential equation driven by fractional Brownian motion, we have derived a more general pricing formula for mortgage loan guarantee insurance using the quasi-martingale method. Through numerical experiments, we analyzed the relationship between the model and parameters, and the results indicated that the pricing model is reasonable and effective.</p>
OS-6	PT0017 11:15-11:30	<p>Robust Covariance Matrix Estimator with Change Points for Multivariate Jump Diffusion Process  <b>Greeshma Balabhadra</b>, El Mehdi Ainasse, and Pawel Polak  Stony Brook University, USA</p> <p>Abstract: We propose a method for constructing covariance matrix estimators robust to abrupt and persistent changes in the underlying spot covariance of a multivariate jump-diffusion process. We take the consistent estimator of the increments of the integrated co-variance process and rebuild them as a group of co-occurring signals. We then construct <math>\ell_1</math>-regularized versions using the group LASSO method to detect co-occurring changes in these signals. The group LASSO method is computationally efficient and uses reduced dynamic programming to eliminate spurious change points. The algorithm is computationally fast and accurately identifies the structural common change points in the underlying integrated covariance matrix increments. We empirically demonstrate that the proposed estimator outperforms the benchmark estimators in various forecasting metrics, using different training windows and data frequencies.</p>
OS-7	PT0021 11:30-11:45	<p>Inertias of <math>M_2 \otimes M_3</math> Entanglement Witnesses  <b>Baiqing Liu</b>  Xi'an Jiaotong University, China</p> <p>Abstract: In this paper we study the inertia sets of entanglement witnesses (EW) in <math>M_2 \otimes M_3</math>. Firstly we will introduce some basic concepts related to EW. Secondly, we sorted out the results done by the pre-vios scholars that is useful for the elimination of some</p>

		<p>situations. Thirdly, we give some proofs towards a few scenarios that could not be eliminated directly. During the development of the proof, our goal is to find a product vector in the non-positive eigenspace, with vectors in positive eigenspace making contribution. Once our goal is attained, we could eliminate a specific case, since it contra-dicts with some classic results done in the previous research. At the end of this paper, we are able to give an answer towards the inertias of <math>M2 \otimes M3</math> EW with an open question left. Moreover, as a byproduct, we also gave a restriction on the inertia sets of <math>M2 \otimes M3</math> decomposable EW, with only one undecided situation left.</p>
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# Social Program

10:00-12:30, June 25, 2024 (Tuesday)

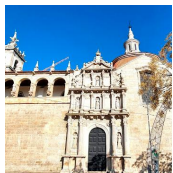
To visit Amarante is to be in unique places, with different experiences and personalities. It's about relaxing, enjoying, resting and getting away from routine.

During your visit, you'll have the opportunity to visit emblematic sites such as the Church of São Gonçalo, the Amadeo de Souza-Cardoso Municipal Museum, the historic streets and the Amarante Cine-Theatre.

## Route:



We'll start the tour in front of the Amadeo de Souza-Cardoso Municipal Museum where we'll have a first contact with some of Amarante's historical personalities: Amadeo and Teixeira de Pascoaes.



We'll follow the tour past the Church of São Gonçalo, the Church of São Domingues and through emblematic historic streets that show us the Church of São Pedro, the Caminhos de Santiago and Amarante's gastronomy.



We'll pass through the Castanheiros and Azenhas trails, where you can enjoy unique views and discover the nature tourism on offer. The renovated Avenida General Silveira will be the motto for visiting the Amarante Cine-Teatro, Casa da Calçada and Dolmen.



We'll walk along Rua 31 de Janeiro where you can enjoy the famous convent sweets and explore Arquinho. Once there, we'll cross the island of Amores and visit the Amarante Pure Termas & Spa and the municipal market.

Note - the route may change depending on the flow of the river.

## Note



[illegible]

[illegible]