SORBONNE UNIVERSITY ABU DHABI

Conference:

5th edition of International Women in Mathematics day 2025

Tuesday 20 May 2025

9:00 am – 5:30 pm

Marie Curie Amphitheatre, SUAD Campus

Organised by Dr. Lama Tarsissi

Abstract:

Every year on 12th May, the Committee of Women in Mathematics (CWM) celebrates Women in Mathematics Day, which is a delightful occasion. The day is celebrated globally with the aim of inspiring women to recognize and commemorate their accomplishments in the field of mathematics. The ultimate goal is to promote an environment that is open, welcoming, and inclusive for everyone. This special day is dedicated to honoring Maryam Mirzakhani, who was born on 12th May 1977 and became the first woman to receive the Fields Medal, the highest recognition in mathematics.

The conference will feature distinguished female mathematicians presenting cutting-edge research in fields such as discrete geometry, combinatorics, high-dimensional probability, and AI applications. Attendees can look forward to engaging discussions, knowledge exchange, and networking opportunities designed to empower the next generation of mathematicians. Under Dr. Tarsissi's leadership, this event will highlight the vital role of women in advancing mathematical sciences while addressing challenges and opportunities in the field, making it a landmark occasion for celebrating excellence and diversity in mathematics.

Dr Lama Tarsissi, Associate Professor- Mathematics at Sorbonne University Abu Dhabi and CWM Ambassador in Lebanon and in the UAE, is organizing the fifth edition of International Women in Mathematics Day 2025

Programme :

9:30-10:00: Yusra Abdulrahman :

Title:
Transforming Aerospace Inspections: Integrating Vision Systems, NDT (Infrared Thermography), AI, and the Latest Technological Trends

Abstract:
This talk explores the evolving landscape of aerospace inspection, focusing on the integration of advanced vision systems, non-destructive testing techniques—particularly infrared thermography—and artificial intelligence. The session will highlight recent technological innovations that enhance defect detection accuracy, streamline inspection processes, and support predictive maintenance in aerospace systems. Emphasis will be placed on interdisciplinary approaches and the role of intelligent automation in meeting the increasing demand for safety, reliability, and efficiency in the aviation industry. The presentation also aims to showcase how women researchers are contributing to these cutting-edge developments and redefining the future of aerospace engineering.

10:00 am-10:30 am: Arwa Abdallah

Title:
Mathematical Modelling of Reovirus in Cancer Cell Cultures.

Abstract:
Oncolytic virotherapy has emerged as a potential cancer therapy, utilizing viruses to selectively target and replicate within cancer cells while preserving normal cells. In this project, we investigate the oncolytic potential of unmodified reovirus T3wt relative to a mutated variant SV5. In animal cancer cell monolayer experiments it was found that SV5 was more oncolytic relative to T3wt. SV5 forms larger sized plaques on cancer cell monolayers and spreads to farther distances from the initial site of infection as compared to T3wt. Paradoxically, SV5 attaches to cancer cells less efficiently than T3wt, which lead us to hypothesize that there might be an optimal binding affinity with maximal oncolytic activity. To understand the relationship between the binding process and virus spread for T3wt and SV5, we employ mathematical modelling. A reaction-diffusion model is applied, which is fit to the available data and then validated on data that were not used for the fit. Analysis of our model shows that there is an optimal binding rate that leads to maximum viral infection of the cancer monolayer, and we estimate this value for T3wt and SV5. Moreover, we find that the viral burst size is an important parameter for viral spread, and that a combination of efficient binding and large burst sizes is a promising direction to further develop anti-cancer viruses

11:00 am-11:45 am: Lisa Brashear

Title:
From Equations to Oceans: Women Leading with Data, Design, and Sustainability

Abstract:
How can mathematics help us rethink the way we live — not just theoretically, but tangibly, sustainably, and off-grid?

In this talk, I'll share the story behind Layla Del Mare, a 2007 catamaran we converted into a fully self-sufficient liveaboard vessel in the UAE. This real-world case study applies mathematical thinking — from budget modeling and system optimization to cost-benefit analysis — to guide complex decisions about solar energy, desalination, and lifestyle design. It's an example of how women in STEM can lead bold, data-informed projects that bridge academic insight with hands-on impact.

We'll explore:

- How mathematical modeling supported the boat's off-grid transformation
- Cost-benefit analysis comparing apartment living in Dubai vs. sustainable life at sea
- The role of data in decision-making for energy use, water systems, and resource planning
- How this grassroots project promotes SDGs, women's leadership, and sustainability education

This is not about theory — it's about lived experience, applied mathematics, and the power of women creating new narratives through numbers. I'll also share how this work now lays the foundation for future academic research and collaborative innovation in the region.

11:45 am-12:15 pm: Mireille Hantouche

Title:
From Equations to Explanations: A Journey Through Uncertainty Quantification to Data-Driven Insights

Abstract:
Scientific discovery in the modern era increasingly relies on our ability to model, predict, and explain complex phenomena under uncertainty. Dr Hantouche's journey has spanned this evolving landscape – from developing rigorous uncertainty quantification (UQ) techniques for high-fidelity mathematical models to applying machine learning (ML) and large language models (LLMs) to derive actionable insights from diverse, real-world datasets.

In the first part of the talk, she will discuss her early work in UQ for physical models, focusing on reactive flow simulations in combustion systems. These systems are critical in energy applications, where modeling accuracy and the quantification of uncertainty in predictions are vital for design and safety. She will highlight how probabilistic approaches, such as polynomial chaos expansions and Bayesian inference, helped characterize model uncertainty and guide simulation-based decision-making.

Transitioning from physical modeling to data-driven approaches, the second part of the talk will explore how ML and explainable AI tools are being used to extract insights from complex biological and human-centered datasets. These include genomic and clinical data related to type 2 diabetes (T2D) and coronary artery disease (CAD), refugee health and resettlement data, and electronic health records (EHR). She will share case studies where various models were combined with interpretability frameworks to uncover predictive features and domain-relevant patterns, enabling more transparent and ethical AI applications in sensitive domains.

Throughout the talk, Dr Hantouche will reflect on the challenges and opportunities of navigating between mathematical rigor and data-driven insight, and how uncertainty quantification remains a guiding principle in building trustworthy and interpretable AI systems.

12:15 pm-1:00 pm: Ghada AlObaidi

Title:
Integral Equation Methods to Analyze the Valuation of American Options

Abstract:
Options are derivative financial securities whose value is based on the underlying security. In this work, we have used Laplace transform techniques to study the valuation of American call and put options with constant dividend yield and to derive an integral equation giving the location of the optimal exercise boundary for an American call option. Because of the presence of the free boundary, it is necessary to modify the definition of the transform. The main result of this paper is a nonlinear Fredholm-type integral equation for the location of the free boundary. The equations differ depending on whether the dividend yield is less than or exceeds the risk-free rate.

LUNCH BREAK

2:00pm - 2:45 pm: Marwa Banna

Title:
Notions of Non-Commutative Independence

Abstract:
In the noncommutative realm, there are five distinct notions of independence: tensor (classical), free, Boolean, monotone, and anti-monotone. In this talk, I will explore the interplay between noncommutative probability theory and random matrix theory, illustrating these notions of independence through matrix models. These notions of independence play a key role in studying joint distributions of noncommutative random variables, which in turn are crucial for analyzing the limiting distributions of the corresponding random matrix models. I will particularly highlight recent advancements in the context of monotone independence.

Much like in the classical setting, each notion of independence is associated with a central limit theorem (CLT). I will showcase the CLT in each of these settings and discuss the corresponding quantitative Berry-Esseen estimates. Finally, I will shift the focus to the operator-valued framework, where I will present quantitative results related to operator-valued central limit theorems.
This talk is based on collaborations with Arizmendi, Mai, and Tseng.

2:45 pm-3:15 pm: Fatma Taher

Title:
Artificial Intelligence Systems using Medical Image Ana

Abstract:
Artificial intelligence (AI) is reshaping medical diagnostics by enabling early, non-invasive detection of critical diseases through advanced image analysis. This presentation highlights six AI-driven computer-aided diagnosis (CAD) systems designed to address pressing challenges in healthcare: Lung Cancer Screening,4D-CT for Lung Injury, Acute Renal Rejection, Prostate Cancer Detection, Big Data in Autism, Cerebrovascular Segmentation.
These systems emphasize scalability, interpretability, and seamless integration into clinical workflows, demonstrating AI's potential to reduce healthcare costs, minimize invasive procedures, and improve patient outcomes. The presentation underscores the synergy between cutting-edge AI methodologies and clinical needs, paving the way for next-generation precision medicine.

3:15 pm-3:45 pm: Giulia de Masi

Title:
Multi-Agent Collective Intelligence for Marine Environmental Monitoring"

Abstract:
Underwater monitoring is essential for assessing marine ecosystem health. However, this environment is extremely complex due to the lack of GPS, limited communications and environmental factors. Typically, monitoring relies on divers missions or a single teleoperated vehicle or autonomous vehicle (AUV).

To address these challenges and enhance the monitoring mission, we propose a Multi-Agent Reinforcement Learning (MARL) framework to enable cooperation among multiple AUVs, mitigating the limitations of the underwater environment. The numerosity of the agents, and most importantly their collaboration, helps overcome underwater constraints completing the mission faster and more efficiently than non-cooperative baseline models of non-interacting agents. Compared to other methods, our model guarantees explainability. We analyze learned strategies, evaluate them in quantitative way, and provide a visualization method that allows the interpretation of the learned policies.

4:15 pm-4:45 pm: Aysha Pulakkal

Title:
Nonlinear Coupling in Klein-Gordon Systems: New Insights into the α-FPUT Model

Abstract:
This study examines the modulational dynamics of wavepackets in a one-dimensional (1D) hybrid α-Fermi-Pasta-Ulam-Tsingou / Klein-Gordon (α-FPUT-KG) lattice, focusing on quadratic coupling nonlinearity in the presence of an arbitrary onsite potential. The system is analyzed through the framework of the Klein-Gordon equation, with the nonlinear coupling from the α-FPUT model treated as a perturbation. Applying Newell's multiple scales method, we derive a nonlinear SchrÅNodinger-type equation (NLSE) that governs the envelope evolution of wavepackets. Explicit analytical expressions for the dispersion (P) and nonlinearity (Q) coefficients are obtained as functions of the carrier wavenumber k and system parameters. A key focus is identifying conditions that lead to focusing or defocusing behavior, which determine the nature of possible envelope-soliton solutions. This analysis provides insight into the interplay between dispersion and nonlinearity in hybrid nonlinear lattices, offering a bridge between classical discrete models and continuous wave dynamics.

4:45 pm-5:15 pm: Hebatallah AlSakaji

Title:
The Impact of Stochastic Perturbations on Disease Dynamics and Tumor–Immune Models

Abstract:
This study explores how stochastic perturbations and environmental changes influence both infectious disease spread and tumor–immune system interactions. For disease modeling, a time-delayed Susceptible–Exposed–Infectious–Unreported–Removed (SEIUR) framework incorporates unreported cases, environmental noise, and sudden external events such as hurricanes. Random regime switching is analyzed, with conditions for ergodicity and disease extinction established using Lyapunov functions and validated through numerical simulations.
In parallel, a stochastic delay differential model is developed to capture tumor–immune interactions under random fluctuations and external treatments. An optimal control strategy is formulated to minimize tumor cells, revealing that the interplay between white noise and time delays significantly impacts system behavior. Theoretical findings, including conditions for tumor extinction and the existence of a stationary distribution, are supported by numerical experiments demonstrating effective control strategies.
Together, these models highlight the critical role of stochastic effects and delays in shaping complex biological dynamics and guiding control interventions.