Irak math day
December 3, online event

Organizers: Fatima Aboud (Department of Mathematics-College of Science-University of Diyala, Irak), Herish Omer Abdullah (Salahaddin University-Erbil, Irak), Christophe Ritzenthaler (université de Rennes, université de Nice, CIMPA), Michel Waldschmidt (Sorbonne university), Bernadette Chéhu (ambassade de France en Irak).

Purpose: this day will present some snapshots of the current mathematical research in Irak. We hope that it will help to foster the collaborations between the Iraqi and French communities.

Zoom Link: https://us06web.zoom.us/j/89144848874?pwd=bcW68CwydMqr8HIk209gs8TW3rq8gd.1
ID: 891 4484 8874
Secret code: 812115

Timetable

Planning December 3 (Paris/Bagdad times):

9.30-10.00 (11.30-12.00)

- Fatima Aboud: Overview of Mathematics departments in the Colleges of Sciences in Iraqi Universities
- Herish Omer Abdullah: Overview of Mathematics departments in Kurdistan universities

10.00-10.30 (12.00-12.30)

- Christophe Ritzenthaler: how to communicate?

10.30-11.00 (12.30-13.00)

- Bernadette Chéhu (French embassy in Irak), Frédéric Hérau (Deputy Scientific Director CNRS Mathematics - Insmi), Christophe Ritzenthaler (CIMPA): opportunities for collaborations and training between France and Irak

13.30 - 14.30 (15.30-16.30) session algebra and number theory

- **Density of the "quasi r–rank Artin problem",** Andam Ali Mustafa
- ***Cantor Set from a Nonstandard Viewpoint,*** Ala Omer Hassan
- **Axial Algebras: An Introduction,** Sanhan Khasraw

14.30 - 15.30 (16.30-17.30) session numerical analysis

- **Numerical identification of timewise dependent coefficient in Hyperbolic inverse problem,** Mohammed S. Hussein
- **Numerical Methods for Solving Different Classes of Fractional Problems,** Osama H. Mohammed
- **A novel approach for solving partial integro-differential equations using optimal perturbation iteration method,** Noor S. Rahmah

15.30 - 16.30 (17.30-18.30) session PDE/ODE and statistics

- **Reconstruction and identification problems: a scientific collaboration with Iraqi researchers,** Abdeljalil Nachaoui
- **Modeling Non-Homogenous Poisson Process and estimating the intensity function,** Khwazbeen Saida Fatah
- **Robust Tests for the Mean Difference in Paired Data using Jackknife Resampling Technique,** Ghufran G Ali

Abstracts

Morning Session

Overview of Mathematics departments in the Colleges of Sciences in Iraqi Universities, Fatima Aboud, Department of Mathematics-College of Science-University of Diyala, Irak

Abstract
The general aim of this presentation is to give an idea about the scientific research situation in the different Mathematics departments in the colleges of Sciences in the Federal Iraqi Universities. This overview is based on resuming the responses done by the head of Math departments in different Iraqi Universities, benefiting from a template prepared by Michel Waldschmidt (Sorbonne University) and Christophe Ritzenthaler (University of Rennes and University of Côte d'Azur, CIMPA).

Overview of Mathematics departments in Kurdistan universities, Herish Omer Abdullah (Salahaddin University-Erbil, Irak

Abstract
I will talk about an Overview of Mathematics departments in Kurdistan universities with highlights about the presence of 15 mathematics departments across three types of colleges—Science, Education, and Basic Education. Key research areas include algebra, numerical analysis, and applied mathematics, driven by faculty and postgraduate students.

How to communicate? Christophe Ritzenthaler, University of Rennes and University of Côte d'Azur, CIMPA

Abstract
We will give an elementary introduction to the principles of error-correcting codes according to Claude Shannon. This mathematical tool is now at the core of all communication device and we will see how various mathematical fields interplay to find the most efficient way to carry information.

Session algebra and number theory

Density of the "quasi r–rank Artin problem", Andam Ali Mustafa, Salahaddin University-Erbil, Irak

Abstract
For a given finitely generated multiplicative subgroup of the rationals which possibly contain negative numbers, we derive, subject to GRH, formulas for the densities of primes for which the index of the reduction group has a given value. We completely classify the cases of rank one torsion groups for which the density vanishes and the set of primes for which the index of the reduction group has a given value, is finite. For higher rank groups we propose some partial results. Finally, we propose some computations of examples comparing the approximated density computed with primes up to 10^10 and that predicted by the Riemann Hypothesis.

Cantor Set from a Nonstandard Viewpoint, Ala Omer Hassan, Salahaddin University-Erbil, Irak

Abstract
This paper proposes a fresh perspective for visualizing the Cantor set and explores its shading characteristics through the utilization of nonstandard tools and techniques. Our investigation reveals that the measure of the Cantor set is infinitely close to zero but not identically zero, and we validate the properties of the Cantor set using an assortment of nonstandard methodologies. These findings have far-reaching implications for enhancing our understanding of mathematical approximations and exact

measurements. Furthermore, we correlate our nonstandard perspective outcomes regarding the Cantor set with some specific applied models.

Axial Algebras: An Introduction, Sanhan Khasraw, Salahaddin University-Erbil, Irak
Abstract
TBA

Session numerical analysis

Numerical identification of timewise dependent coefficient in Hyperbolic inverse problem, Prof. Dr. Mohammed S. Hussein, Department of Mathematics-College of Science-University of Baghdad
Abstract
This article investigates the nonlocal inverse initial boundary-value problem in a rectangular domain, hyperbolic second order inverse problem. The main objective is to find the unidentified coefficient and offer a solution to the problem. The hyperbolic second-order, nonlinear equation is solved using finite difference method (FDM). However, the inverse problem was successfully solved by the MATLAB subroutine lsqnonlin from the optimization toolbox after being reformulated as a nonlinear regularized least-square optimization problem with a simple bound on the unknown quantity. Given that the studied problem is often ill-posed and that even a minor error in the input data can have a large impact on the output. Tikhonov's regularization technique is used to generate stable and accurate results.

Numerical Methods for Solving Different Classes of Fractional Problems, Prof. Dr. Osama H. Mohammed, Department of Mathematics and Computer Applications, College of Science Al-Nahrain University
Abstract
Fractional calculus, also known as calculus of fractional order or fractional differential calculus, is a section of mathematics that transacts with differentiation and integration of fractional order. It generalizes the concepts of differentiation and integration to include fractional powers. Since fractional calculus is an active area of research the mathematicians and scientists continue to explore its theoretical foundations and practical applications. It provides a powerful tool for modeling and analyzing systems with memory effects, long-range interactions, and fractal-like behavior in Engineering, Biology, Epidemiology, Chemistry, Physics, Control Theory, electrical and electromechanical systems, Fluid Mechanics, viscoplasticity, etc. This presentation focuses on the most cited papers of my work which related to fractional problems

A novel approach for solving partial integro-differential equations using optimal perturbation iteration method, Noor S. Rahmah, Department of Mathematics and Computer Applications, College of Science, Al-Nahrain University
Abstract
We present a novel and effective algorithm to solve non-linear fractional order partial integro 11 differential equations which is based on the optimal perturbation iteration transform method. The fractional order derivative will be in the Caputo-Atangana-Baleanu sense. The optimal perturbation iteration transform method is a combination between the Laplace transform and the perturbation iteration algorithm. The solution is described by the suggested method as a quickly convergent series. To demonstrates the applicability of the proposed technique, two model examples are solved. The present paper also unveils that optimal perturbation iteration transform method quickly converges to the precise answers of the provided equations at a reduced iteration value.

Session PDE/ODE and statistics

Reconstruction and identification problems: a scientific collaboration with Iraqi researchers,
Abdeljalil Nachaoui, Laboratoire des Mathématique Jean Leray-Nantes Université, France.
Abstract
TBA

Modeling Non-Homogenous Poisson Process and estimating the intensity function, Khwazbeen Saida Fatah, Salahaddin University-Erbil, Irak
Abstract
A Poisson process is a stochastic process used to model the occurrence of random events over time or space. It possesses key properties that make it suitable for such applications. The Non-Homogeneous Poisson Process (NHPP), characterized by time-dependent intensity functions, is widely used to model scenarios involving the counting of events within a given time interval. Identifying the process depends on determining the functional form of the intensity function, which can be challenging. Accurate parameter estimation is essential for achieving a good model fit. While various techniques have been developed over the decades for parameter estimation, heuristic approaches, including intelligent methods, have gained prominence since 1995, when Kennedy introduced Particle Swarm Optimization (PSO). PSO has been shown to outperform traditional methods, establishing itself as a cornerstone of modern estimation strategies, especially in real-world applications.

Robust Tests for the Mean Difference in Paired Data using Jackknife Resampling Technique, Ghufran G Ali, Department of Mathematics-College of Science-University of Diyala
Abstract
The paired sample t-test is a type of classical test statistics that is used to test the difference between two means in paired data, but it is not robust against the violation of the normality assumption. In this paper, some alternative robust tests are suggested by combining the Jackknife resampling with each of the Wilcoxon signed-rank test for small sample size and Wilcoxon signed-rank test for large sample size, using normal approximation. The Monte Carlo simulation experiments were employed to study the performance of the test statistics of each of these tests depending on the type one error rates and the power rates of the test statistics. All these tests were applied on different sample sizes generated from three distributions, represented by Bivariate normal distribution, contaminated Bivariate normal distribution, and Bivariate exponential distribution.