



International Women in Mathematics Day 2022

Monday 13 June 2022

Online and at Sorbonne University Abu Dhabi Campus

10:00am – 4:00pm

10:00am - 10:10am

Introduction of the event (Lama Tarsissi)

Welcoming all online and on campus present attendees and especially speakers

10:10am - 10:50am

Grace Younes

Title: Certified computation of the L^∞ -norm of finite-dimensional linear systems --
Extension to the parametric case

Abstract: In this presentation, we study the computation of the L^∞ -norm of finite-dimensional linear time-invariant systems. This problem is first reduced to the computation of the maximal y -projection of the real solutions (x, y) of a bivariate polynomial equations system $\Sigma = \{P = 0, \partial P / \partial x = 0\}$, where $P \in \mathbb{R}[x, y]$. Then, we use standard computer algebra methods to solve this problem. In particular, we alternatively study a method based on rational univariate representations, a method based on root separation, and finally, a method first based on the sign variation of the leading coefficients of a signed sub resultant sequence (Sturm-Habicht) and on the identification of an isolating interval for the maximal y -projection of the real solutions of Σ . We then compute the worst-case bit complexity of each method and compare their theoretical behavior. We also implement each method in Maple and compare their practical behavior (average complexity). A generalization of the above algorithms is finally proposed for the case where the polynomial P also depends on a set of parameters $\alpha = [\alpha_1, \dots, \alpha_d] \in \mathbb{R}^d$. To do that, we solve the problem using the notion of the Cylindrical Algebraic Decomposition, well-known in algebraic geometry.

10:50am - 11:30am

Rola Kiwan

Title: Sharp eigenvalues of the Dirichlet Laplacian

Abstract: Given the Dirichlet Laplacian eigenvalue problem: $\Delta u + \lambda u = 0$ in Ω , $u(x) =$

On $\partial\Omega$ For a plane domain Ω , the eigenvalues represent the frequencies of vibration for a drum having the shape of Ω . The zero set for each eigenfunction is called a nodal line (the points that remain fixed during the vibration), and it makes a partition of the domain Ω in subdomains called nodal domains. An eigenvalue λ is said to be Courant-sharp when the number of associated nodal domains is equal to the order of λ . There was a conjecture that there are always a finite number of these sharp eigenvalues, but there is no general proof for that claim. The trend is to consider different shapes of the domain and find the "sharp" eigenvalues. In my presentation, I will introduce the topic and present two of my recent papers

11:30am - 12:10pm

Lena Sasal

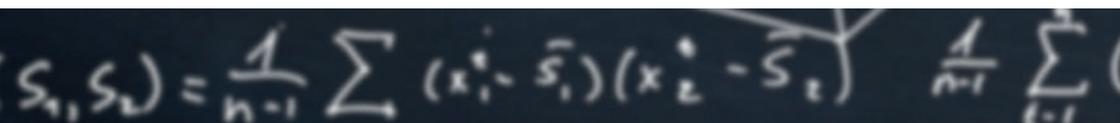
Title: A journey into AI

Abstract: Nowadays big data is everywhere. Data is continuously collected everywhere and stored for multipurpose and one way to use such amount of data is through artificial intelligence (AI).

AI already has changed our society by automation, prediction, and analysis capabilities. As a lot of people from various backgrounds now try to bring AI in their area, you can find AI in healthcare, geosciences, automotive industry and much more. But still for many, AI looks like a black box with too many capabilities. It is indeed hard to trust the predictions of AI without better understanding, and it raises a lot of questions: Can we really rely on computer intelligence? What will be the impact of AI in our society? What is the basis for the decisions made by AI? But the biggest question might be: what is really AI? This presentation will take you to a journey from September 1955 where everything begins to nowadays commonly used models.

12:10pm - 1:30pm

Lunch break or coffee break


$$s_{x_1, x_2} = \frac{1}{n-1} \sum (x_{1i} - \bar{x}_1)(x_{2i} - \bar{x}_2) \quad \frac{1}{n-1} \sum (x_{1i} - \bar{x}_1)^2$$

1:30pm - 2:00pm

Lama Tarsissi

Title: Synchronisation of three Christoffel words

Abstract: In this presentation we study the synchronization of 3 Christoffel words to construct finite balanced words, on each letter coupled with a*, of a 3 letters alphabet. Using some arithmetical tools, we introduce the term Seed that is the starting column of the synchronized matrix for the Christoffel words. This seed helps us to determine whether the synchronization is possible or not. In addition to that, we use some techniques based on Cayley graphs associated with Christoffel words. These techniques of combinatorics on words could be used to attack the famous Fraenkel's conjecture.

2:00pm – 2:40pm

Olga Nassar

Title: Mathematics For Our Data-Oriented Modern Society

Abstract: Higher education (HE) is considered the core provider of human capital where graduates build high-value professional, technical, and information processing skills. Moreover, it is the main contributor to research that provides the foundational knowledge for innovation and production of new technology (OECD, 2019). Since human capital is the backbone of economic success, countries around the world started expanding access to HE as a response to their economic challenges. Changing admission policies to expand access to HE made such institutes suffer from challenges related to low basic skills of graduates. According to the Organization for Economic Co-operation and Development (OECD) (2019), an approximate of 30 % of HE graduates do not attain the necessary proficiency in literacy and numeracy required to process information. The United Arab Emirates (UAE) is a relatively new country, but has one of the most rapidly developing educational systems with an aim of achieving worlds' top educational model (Matsumoto, 2019). However, according to Ashour (2020), there is a discrepancy between UAE's graduate skills and the labour market needs. The challenge of HE in UAE is to supply graduates with necessary skills to be capable of being active participants in framing UAE's knowledge base (Ashour,

$$(s_1, s_2) = \frac{1}{n-1} \sum (x_1^i - \bar{s}_1)(x_2^i - \bar{s}_2) \quad \frac{1}{n-1} \sum$$

2020). In a rapidly changing world, our society is becoming data-oriented where more critical and reflective mathematical reasoning skills are essential (Tout, 2020). Individuals need to interpret and understand a broad range of data in real life and their workplace to make informed decision (Ward & Damjanovic, 2020). Quantitative Literacy is referred to the third R in literacy. It should be made a priority and vital for individuals' wellbeing in work and life in the 21st Century (Tout, 2020). QL is a key indicator of an individual's capacity to have an effective participation in social decision-making therefore a control over his/her quality of life (Steen, 2004). Democratic culture is threatened by individuals who are quantitatively illiterate (Steen, 2002). Therefore QL like reading and writing is an expected demand in college-level learning. Undergraduate education is the context to empower citizens with necessary skills including QL (Steen, 2004). Currently in the UAE most of universities are offering a calculus based approach to mathematics that might not produce individuals that are quantitatively literate which might limit students from achieving their wellbeing (Steen, 2004)

2:40pm - 3:10pm

Elena Beretta

Title: Analysis of a model of elastic dislocations in geophysics

Abstract: We consider a model for elastic dislocations in geophysics. We model a portion of the Earth's crust as a bounded, inhomogeneous elastic body with a buried fault surface, along which slip occurs. We prove well-posedness of the resulting mixed-boundary-value-transmission problem, assuming only bounded elastic moduli. We establish uniqueness in the inverse problem of determining the fault surface and the slip from a unique measurement of the displacement on an open patch at the surface, assuming in addition that the Earth's crust is an isotropic, layered medium with Lamé coefficients piecewise Lipschitz on a known partition and that the fault surface satisfies certain geometric conditions.

3:10pm - 4:00pm

Carolina Araujo

Title: Symmetries in Algebraic Geometry

Abstract: In this talk I will discuss different notions of symmetry of algebraic varieties. First, we examine automorphisms. The structure of the group of automorphisms of a projective variety encodes some relevant geometric properties. However, the notion of automorphism is too rigid in the scope of birational geometry. We are then led to consider another class of symmetries of projective varieties, its birational self-maps. Birational self-maps of the projective space are called Cremona transformations. Describing the structure of the group of Cremona transformations of the plane is a classical problem that goes back to the 19th century. In higher dimensions. I will end the talk by discussing a recent work with Alessio Corti and Alex Massarenti, which connects automorphisms of hypersurfaces and Cremona transformations.



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