Journée sur l'Intelligence Artificielle & Mathématiques Appliquées (JIAMA'23)

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- JIAMA'23 -

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04 Mai 2023

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SCOOP

The goal of this first hybrid day on Artificial Intelligence and Applied Mathematics is to bring together researchers, engineers and industry experts to present recent advances in the growing research fields of artificial intelligence and the most effective multidisciplinary fields at the interface between applied mathematics and practical engineering and the growing research domains of Data Science and Artificial Intelligence. Thus, the first edition of **JIAMA** is an opportunity to discuss a number of research topics on recent developments in Applied Mathematics and Artificial intelligence.

As a tradition, the conference offers the participants a friendly environment suitable for establishing scientific collaborations and fruitful exchanges, and to promote research and is a space for scientific exchange.

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SPEAKERS

Overview of classification models in the case of supervised learning: Modelling and Limits

Abdellatif EL AFIA

National School of Computer Science and Systems Analysis (ENSIAS),
Mohammed V University in Rabat, Morocco.

Abstract: In this plenary session, we focus on classification models as well as their overview and their limit. Then, we will discover the main steps of its modelling process, namely cross validation and regularization. Simultaneously, we will discern the main mathematical tools used within its data modelling process, such as modelling optimization and statistics.

Biographical:

- Abdellatif EL AFIA is a Full Professor at the National School of Computer Science and Systems Analysis (ENSIAS), Mohammed V University in Rabat, Morocco.
- He obtained his PhD in Operation Research from the University of Sherbrooke, Canada, in 1999.
- H's Founder and Head of the engineering degree in Artificial Intelligence.
- His research areas of interest are machine learning, mathematical programming (stochastic and deterministic) and metaheuristics. He has participated in several international conferences and published many research papers in highly indexed journals.

Radial basis functions and their application to Solve partial differential equations

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Abstract: The well known definition of radial basis function is a function whose value depends only on a distance of multivariable point to the origin. They are becoming a very famous functions used both in the area of scattered data problems and the partial differential equations field during these last three decades. Since their introduction by Rolland Hardy in 1971 and their improvement by Richard Franke in 1982, they have seen more developments and applications. The RBFs' properties to generate a Native Hilbert space and the simplicity of their numerical implementation play an important role in their success use. It was in 1990 that radial basis functions have been applied by Kansa to solve partial differential equations. Since then, many meshless methods based on radial basis functions have been developed and improved.

In this talk, an overview of some properties of RBFs and the formulation of one of the most known meshless methods based on the radial basis functions will be presented.

Keywords: Radial basis functions, Meshless methods, scattered data.

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Virothérapie Antitumorale de la Bifurcation de Hopf à la Bifurcation de Turing

Radouane YAFIA

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Abstract: La virothérapie antitumorale dite aussi immunothérapie oncolytique consiste à utiliser des virus qui sont capable de répliquer, infecter les cellules tumorales et déclencher le système immunitaire. Cette approche a été découvert pour la première fois en début du vingtième siècle. Son autorisation réelle sur l'être humain a commencé en 2015 (USA, EU), avec le T-Vec, pour la thérapie du mélanome métastatique. Dans cet exposé, on présente un modèle mathématique issue de la virothérapie antitumorale tenant compte du cycle de reproduction viral (lytique) dans le cas temporel et tenant compte de la diffusion spatiale dans le cas spatio-temporel. Le modèle donne lieu au phénomène de Jeff (bifurcation de Hopf) dans le cas temporel et la formation des motifs (instabilité de Turing) dans le cas spatio-temporel en présence de la diffusion croisée. In this talk, an overview of some properties of RBFs and the formulation of one of the most known meshless methods based on the radial basis functions will be presented.

Simulation-Artificial Intelligence in Computational Fluid Dynamics

Rachid Bannari

ENSA of kenitra, Ibn Tofail University

Abstract: A mathematical model for cellulase production by *Trichoderma reesei* RUT-C30 grown in a cellulose medium with lactose as fed batch in an airlift reactor is proposed. To describe adequately the mass transfer between the air bubbles and the broth, it uses computational fluid dynamics (CFD) including multiphase Eulerian–Eulerian formulation, with a detailed description of the bubble size distribution through the partial differential equations to simulate the breakup and coalescence phenomena. The kinetics of the biomass growth is further coupled to the fluid flow conditions using partial differential equations for all the species involved, providing detailed information of important reactor conditions such as the distribution of oxygen and cellulose within the reactor over the entire period of fermentation. An artificial neural network (ANN) was built using the predicted data, to prevent injection time and injection areas of lactose and oxygen in order to maximize cellulase production through optimization of fermentation conditions.

Keywords: CFD, population balance equation, Fermentation, IA, Artificial Neural Network.

ABSTRACTS

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Existence and characterization of a bilinear spatial control of the wave equation

Abderrahman Ait Aadi

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Abstract: This paper studies a bilinear optimal control of the wave equation with Dirichlet boundary condition. Such an equation is excited by distributed bounded controls that act on the velocity term. The question is meant to obtain a bilinear spatial control that minimizes a functional cost constituted of the deviation between a desired state and the reached one, and the energy term. Hence, we prove that a minimizing control exists, and we give a characterization of optimal control.

Keywords: Wave equation, controllability of distributed systems, optimal control of PDE's, semigroups.

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Numerical modeling of thermodynamic properties of some complex fluids using artificiel neural networks

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Abstract: Biodiesel can easily become the crucial solution for environmental problems. To date, many vegetable oils have been used to produce biodiesel. In this regard, the knowledge of the thermodynamic properties of biodiesels and their derived properties becomes crucial not only for developing optimal biodiesel production and purification processes, but also for enhancing biodiesels performance in engines. In this work, we report the new experimental density data for Waste Cooking Oil Biodiesel (WCOB) and Butanol binary mixtures at several temperatures between (298.15 and 393.15) K and pressures up to 140 MPa .The PC SAFT was used to optimizethe density of mixture over wide pressure and temperature ranges. PC-SAFT parameters of waste cooking oil biodiesel were optimized using density data at the same range of pressure and temperature. From PC-SAFT, density of sample was reasonably well modeledwith a global absolute average deviation (AAD) of 0.086%. Furthermore, VE values were fitted to the Redlich-Kister equation and showed satisfactory correlation with very small standard deviation values with a global of 4.23 10-5 cm3 mol-1. The derived thermodynamic properties, i.e. isobaric thermal expansion coefficient and the isothermal compressibility coefficient, were then calculated from the experimental density data using thermodynamic equations and artificiel neural networks.

Keywords: biodiesels, waste cooking oil biodiesel, thermophysical properties, butanol, neural networks.

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Optimisation du problème de tournées de véhicules pour la valorisation des déchets solides au Maroc

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Abstract: La thématique de l'optimisation de la collecte et du transport des déchets solides présente un véritable enjeu économique et écologique de la société. En effet, le problème de tournées de véhicules (VRP) est l'un des problèmes combinatoires d'optimisation les plus connus, il consiste en la recherche des meilleurs itinéraires pour une flotte de véhicules partant d'un dépôt afin de visiter un ensemble de clients en répondant à un ensemble de contraintes telles que le coût total du transport, la capacité des véhicules et les délais de livraison.

Ce problème est une extension classique du problème de voyageur de commerce, il appartient à la classe des problèmes d'optimisation NP- difficile. Depuis l'introduction du problème VRP formulé par [Dantzig et al. 1959], de nombreuses méthodes ont été proposées pour résoudre ce type de problème. Les différents types d'algorithmes et de méthodes qui existent pour résoudre ce problème distinguent principalement trois types de méthodes: les approches classiques basées sur la programmation mathématique, les approches heuristiques et les approches basées sur l'apprentissage automatique.

Le VRP est un problème d'optimisation combinatoire important avec de nombreuses applications dans le domaine de la logistique et du transport. Bien que le VRP soit un problème NP-difficile, de nombreuses approches ont été développées pour résoudre ce problème de manière efficace et précise. Les développements récents dans les domaines de l'intelligence artificielle et de l'optimisation combinatoire offrent de nouvelles perspectives pour améliorer la résolution du VRP de manière plus efficace et plus précise. Dès lors, ce travail présentera un état de l'art de quelques méthodes de résolution du problème de routage des véhicules, nous préciserons leurs principes et leur performance dans le cadre des études publiées afin de déterminer et comparer leurs avantages et leurs limites.

Keywords: Routage, Optimisation, Itinéraire, Véhicule ...

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New optical solitons for the Wu-Zhang system with time-fractional conformable derivative

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Abstract: In this paper, the Sine-Gordon expansion method is implemented to obtain new explicit solutions for nonlinear Wu-Zhang system with time-fractional conformable derivative. The solutions constructed are expressed by three types of functions : hyperbolic function solution, exponential function solution and trigonometric function solution. The nonlinear fractional partial differential equation is converted into an ordinary differential equation with integer order so as to solve a fractional Wu-Zhang system. These solutions might be important and highly useful in various scientific fields. It is shown that this method is very efficient for constructing exact solutions of nonlinear fractional partial differential equations.

Keywords: Sinh-Gordon expansion method, Fractional Wu-Zhang system, Fractional conformable derivative.

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Dynamic response of High-speed railway bridges: A study on effects Stiffness of coupling connection and elastic bearing

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Abstract: Coupling connections and bearing supports have been widely used in various engineering structures such as robotic structures, aircraft, vehicles, buildings, and bridges. Because can offer a reasonable and realistic representation of many boundary conditions. In this paper, a parametric analysis was conducted to study the effect of the vertical stiffness of the bearings and the rotational stiffness of the coupling connection on the dynamic response mechanism of the bridge subjected to a constant moving load model HSLM-A is utilized to simulate the moving real train, and the relationships between these parameters of stiffness and the displacement, acceleration of the bridge and resonance speed of moving load are investigated, the results indicate that the stiffness has an important influence on the dynamic response and considering them in the beam system can improve the prediction accuracy.

The numerical solution of nonlinear integral equations with Green's kernels

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Abstract: In this paper, polynomially based projection and modified projection methods for approximating the solution of *Uryshon* integral equations with a kernel of *Green's* function type are proposed. The projection is either an orthogonal projection or an interpolatory projection using *Legendre* polynomial basis. The orders of convergence of these methods and those of superconvergence of their iterated versions are analysed. A numerical example is given to illustrate the theoretical results.

Keywords: Uryshon integral equation, Orthogonal projection, Interpolatory projection, Legendre Polynomial, Superconvergence

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Improving transportation for a smart and ecofriendly environement in smart cities

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Abstract: The Internet of Things (IoT) describes the network of physical objects— "things"—that are embedded with sensors, software, and other technologies for the purpose of connecting and exchanging data with other devices and systems over the internet. IoT plays an important role in facilitating human's life in more domains such as healthcare, economy, transportation and so on. Nowadays, smart transportation plays a vital role in reducing carbone emissions on public transport, control pollution and improve citizens's quality of life especially in urban areas with high vehicle traffic density and this is done by developing some systems that can reduce travel time, traffic congestion. This paper will cover what exactly smart transportation is, how it works and an overview about the articles that work on some systems to reduce carbone missions in smart cities.

Keywords: IoT, Smart Cities, Smart Transportation

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Finite Volume Method For The Linearized Navier-Stokes Equation

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Abstract: he Navier-Stokes equations are fundamental equations in fluid dynamics used to describe the motion of fluids. One way to solve these equations is through the finite volume method (FVM), which discretizes the domain into a grid of cells and approximates the solution at each cell by integrating the equations over the cell. This paper presents a numerical study of solving the Navier-Stokes equations using FVM in one dimension. the results show that the method is accurate and stable, and the numerical solution converges to the analytical solution as the grid size is refined. Overall, this study demonstrates the effectiveness of FVM in solving the Navier-Stokes equations in both steady and unsteady states. Let Ω be a bounded Lipschitz domain in $\mathbb{R}^N$, $N = 1, 2, 3$, with the boundary Γ, and set $J = (0, \infty)$. We consider the following linearized Navier-Stokes equations:

$$\begin{aligned} \frac{\partial u}{\partial t} - \mu\Delta u + (\mathscr{U} \cdot \nabla)u + \nabla p = f \quad &\text{on} \quad \Omega \times J, \\ \nabla \cdot u = 0 \quad &\text{on} \quad \Omega \times J, \\ u = 0 \quad &\text{on} \quad \Gamma \times J, \\ u(x, 0) = 0 \quad &\text{on} \quad \Omega, \end{aligned}$$

where $\mathscr{U} = \mathscr{U}(x)$ is independent of t and the positive constant μ denotes the dynamic viscosity.
A motivation for our problem comes from the governing equations of Oseen's flow at low Reynolds numbers in which $\mathscr{U}$ is regarded as a constant vector.

Keywords: Navier-Stokes, Finite Volume Method.

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Spectral Methods for nonlinear integral equations with superconvergent degenerate kernel and Nyström methods

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Abstract: In this paper, polynomially based superconvergent collocation methods for approximating the solution of nonlinear integral equations are studied. The superconvergent degenerate kernel method is chosen for approximating the solution of Hammerstein equations, while a superconvergent Nyström method has been used for solving Urysohn equations. By applying an interpolatory projection based on Legendre polynomials of degree $\leq n$, we analyze the superconvergence of these methods and their iterated versions. Numerical results are presented to validate the theoretical results.

Keywords: Hammerstein equation, Urysohn equation, Degenerate kernel method, Nyström method, Interpolatory projection, Legendre polynomial, Superconvergence.

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Impact of support size in CSRBF function interpolation for BEMD decomposition

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Abstract: Several time-frequency analysis method have been developed, including the Fourier transform and the wavelet transform. In the case of non-stationary and non-linear signals, the previous techniques of time-frequency analysis remain unsuitable for this type of signal, despite their further developments. The bidimensional empirical mode decomposition (BEMD) [3], is a new time-frequency analysis method invented to overcome this problem. This decomposition enables the extraction of structures at different scales and frequencies, including amplitude and frequency modulations. The major obstacle to this decomposition is the computational complexity, most of this calculation is done in the extremum interpolation phase. Several versions of the BEMD developed with different interpolation functions to minimize the cost and maintain the quality of this decomposition. One of the methods that show good results in terms of computational complexity and maintaining the quality of the decoposition is the BEMD with Compactly Supported Radial Basis Functions (BEMD- CSRBF) [1]. Despite the effectiveness of CSRBF functions, especially in terms of computational complexity, the choice of support size for these functions plays an important role in the quality of the BEMD, in particular that this decomposition is iterative, at each iteration we get a different number of extrema and a different distribution in space. In this context, we will present in this article a study on the influence of the support size of the compactly supported radial Basis functions (Wendland functions [2]) on the BEMD, either in terms of computational complexity or decomposition quality. Finally, we propose a method to adjust the size of the support during the algorithm

Keywords: Time-frequency analysis, Decomposition BEMD, CSRBF functions, Wend- land functions.

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Fractional Kirchhoff-type equations driven by an anisotropic operator

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Abstract: The purpose of this article is to investigate the existence and multiplicity of solutions for the following class of fractional Kirchhoff type equations

$$\left(a + b\|u\|_{X_s}^{2(\gamma-1)}\right)\left((-\Delta_x)^s u - \Delta_y u + \Phi(x,y)u\right) = \lambda f(x,y)u + g(x,y,u),\ (x,y) \in \mathbb{R}^N = \mathbb{R}^n \times \mathbb{R}^m,$$

where

$$\|u\|_{X_s} = \left(\iint_{\mathbb{R}} \left(|(-\Delta_x)^{\frac{s}{2}} u|^2 + |\nabla_y u|^2 + \Phi(x,y)u^2\right) dxdy\right)^{\frac{1}{2}}.$$

Under appropriate assumptions on Φ, f and g. We use the fountain theorem to prove that the above equation has infinitely many small-energy solutions for $g \equiv 0$. We also show that our equation has an in- finite energy solution sequence by applying the mountain pass theorem with and without the well-known Ambrosetti-Rabinowitz (AR) condition on the nonlinearity g for $\lambda = 0$.

Keywords: Potential BO-ZK operator, Fractional Kirchhoff equations, variational method, Infinitely many solutions.

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La consolidation unidimensionnelle des différents types des sols

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Abstract: Vu l'importance de l'effet du tassement provoqué par l'expulsion de l'eau interstitielle sous l'effet à long terme du chargement appliqué par la construction sur la stabilité de cette dernière; l'étude de la consolidation de sol a eu une importance dans les recherches scientifiques. La théorie de la consolidation unidimensionnelle primaire de Terzaghi étude la variation de pression interstitielle à l'intérieur d'un système compressible chargé, et comme a été définit par Karl Von Terzaghi la consolidation de sol est « Tout processus par lequel la teneur en eau d'un sol saturé diminue, sans remplacement de l'eau par l'air ». La variation de la pression interstitielle se traduit par une variation de contrainte effective, elle-même commandant à son tour le tassement du système chargé. En 1965 Davis et Raymond [1] ont proposé pour la première fois la théorie de la consolidation non linéaire basée sur les deux hypothèses suivantes:

- La diminution de la perméabilité est proportionnelle à la diminution de la compressibilité au cours du processus de consolidation.
- La contrainte effective initiale est constante avec la profondeur.

De nombreuses recherches ont été effectuées dans le but de généraliser l'équation de Terzaghi sur un sol non-linéaire multicouche saturé sous l'effet d'un chargement qui dépend du temps et de dériver des solutions analytiques de l'équation de la consolidation de Terzaghi afin d'étudier la variation de la pression interstitielle et de de degré de consolidation en fonction de plusieurs paramètres : le coefficient da la consolidation, le temps de la consolidation, le facteur de temps de la consolidation, la profondeur et le chargement. Parmi ces tentatives de recherche on peut citer P. K K. LEE[2], K.-H. Xie et al. [3] et P. Kim [4] toute en se basant sur les mêmes hypothèses de Davis et Raymond ci-dessus. Le comportement de la consolidation unidimensionnelle et non-linéaire de différents types des sols monocouche saturé d'un mètre d'épaisseur est étudié en se basant sur ces solutions proposées par P. Kim [4] dans le but d'évaluer la variation du temps de consolidation en fonction de degré moyen de la consolidation des Kaolinites, Illites, Montmorillonites, Argiles sableuses et Limons en variant le paramètre de chargement Nq qui présente le rapport entre la contrainte effective final et initiale. L'étude confirme que l'augmentation de coefficient de la consolidation est proportionnelle avec la diminution de temps de consolidation, et plus le paramètre de chargement Nq croit plus la consolidation devient rapide, ainsi que le gradient de la variation de degré moyen de consolidation en fonction de temps de consolidation se diffère selon le type de sol ; tel que plus le coefficient de consolidation du sol est grand plus le temps de consolidation est rapide.

Keywords: Consolidation, Terzaghi, Tassement, Coefficient de consolidation.

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An entropy solutions for some nonlinear elliptic problem in Musielak-Orlicz spaces

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Abstract: In this paper we investigate the existence result of entropy solution for some nonlinear elliptic problems of Leray-Lions type associated to the equation $-\text{div } a(x,u,\nabla u) = f(x) - \text{div } F(u)$ in Ω, with large mo-notonicity condition in the setting of Musielak-Orlicz-Sobolev spaces and where the right hand side f belongs to $L^1(\Omega)$ and $F = (F_1, \ldots, F_N)$ satisfies $F \in (C_0(\mathbb{R}))^N$.

Keywords: Elliptic problem, Entropy solutions, Musielak-Orlicz-Sobolev spaces, Compact imbedding, Δ_2-condition.

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Vibration and stability analysis of composite conical nano-shells based on nonlocal elasticity theory and Haar wavelet method

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Abstract: The dynamic analysis and stability of rotating composite conical nano-shells is modeled and numerically simulated based on the Haar wavelet method. The partial differential equation of motion based on the nonlocal elasticity and the Love thin shell theories is given. The Galerkin and harmonic balance methods are used for the linear and parametric vibration analysis. The influences of nonlocal parameter, the fibers orientation, circumferential wave number, and geometrical parameters effects on the dynamic behaviors of the composite conical nano-shells as well as the instabilities induced by the rotation speed and its excitation frequency are investigated.

Keywords: Vibration; Dynamic; instability; nonlocal theory; Haar wavelet.

Une étude comparative des algorithmes de classification pour guider les élèves marocains du collège

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Abstract: L'orientation scolaire des élèves et des étudiants est un processus important mais difficile. Prendre une décision pour l'avenir d'un être humain est complexe et dépend principalement de ses aptitudes et de ses intérêts. Si un étudiant est attiré par une spécialité mais n'a pas les compétences nécessaires pour réussir dans cette filière, il peut être confronté à des difficultés pour suivre le rythme du programme d'études. Cela peut provoquer un sentiment d'injustice et mener à l'abandon des études. C'est pourquoi l'orientation scolaire est une étape cru- ciale dans le cursus de chaque élève. Malheureusement, les élèves du secondaire doivent souvent faire face à ce dilemme, car ils ne sont pas encore en mesure de décider de leur orientation lorsqu'ils sont au collège. De nombreux facteurs influencent l'orientation des lycéens, notamment la pres- sion exercée par leur famille. Les familles savent que la spécialité du baccalauréat peut avoir une incidence sur les perspectives d'études supérieures et l'insertion professionnelle, surtout lorsque le marché de l'emploi est compétitif. L'objectif principal de notre recherche est de créer un système intelligent basé sur les résultats scolaires des élèves pour les aider dans leur orientation en util- isant les technologies de l'Intelligence Artificielle. L'Intelligence Artificielle est un ensemble de technologies qui permettent de simuler l'intelligence et d'accomplir automatiquement des tâches de perception, de compréhension et de prise de décision[1]. L'Apprentissage Automatique (Machine Learning) est un champ d'étude de l'intelligence artificielle qui utilise des approches mathématiques et statistiques pour donner aux ordinateurs la capacité d'apprendre à partir de données[2]. Les algorithmes d'Apprentissage Automatique peuvent être catégorisés selon le mode d'apprentissage qu'ils utilisent[3] : Apprentissage supervisé, Ap- prentissage non-supervisé et Apprentissage par renforcement[4]. Nous avons collecté des données réelles de 7720 étudiants de troisième année de collège qui ont choisi leur orientation pour l'année suivante et nous les avons entraînées sur des algorithmes d'apprentissage automatique. Pour prendre une décision, nous avons comparé quatre algorithmes de classification (Arbre de Décision, Forêt d'arbres de décision, Naïf-Bayes et KNN) en termes de précision, de rappel et de score f1. Nos résultats ont montré que la forêt d'arbres de décision était la plus adaptée pour cette procédure.

Keywords: Artificial Intelligence; machine learning; Student's Orientation; Supervised learning.

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Data Lakehouse: a new data management approach

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Abstract: A data lakehouse is a modern data management architecture that combines the best features of data lakes and data warehouses. It is a hybrid architecture that looks to overcome some of the limitations and challenges posed by traditional data warehouses and data lakes.

As a data lake, a data lakehouse can store big volumes of data in its native format, without modifying schema design or transformation. This permits flexibility and agility when dealing with data. However, unlike a data lake, a data lakehouse also provides the functionalities of a traditional data warehouse, such as data quality, governance, and security, making it easier for consumers to access and manipulate the data.

Thanks to their solutions to system deficiencies of data lakes, the concept of a data lakehouse is gaining popularity due to the increasing need for companies to manage and analyze large volumes of data from various sources. It offers a scalable, cost-effective, and efficient way to manage data while ensuring its quality, security, and governance.

Keywords: Big Data, Data warehouses, Data Lake, Machine Learning, Data Lakehouse.

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Fast Convergence rates of Smooth Convex Functions using Inertial Dynamics with Tikhonov Regularization, Time Scaling, and Hessian-Driven Damping.

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Abstract: In a real Hilbert space H, let $f\ H \to \mathbb{R}$ be a convex twice differentiable function whose solution set $argmin_H f$ is nonempty. Our goal is to study the long-term behavior of the trajectories of the vanishing damped dynamical system with Tikhonov regularization and Hessian-driven damping. This system is represented by the following equation:

$$\ddot{x}(t) + \alpha\dot{x}(t) + \delta\nabla^2 f\left(x(t)\right)\dot{x}(t) + \beta(t)\nabla f\left(x(t)\right) + cx(t) = 0$$

where $\alpha, c, \delta > 0$, and the time scale parameter β is a positive nondecreasing function such that $\lim_{t\to+\infty}\beta(t) = +\infty$. The Hessian driven damping significantly reduces the oscillatory aspects. We simultaneously show rapid convergence of values, strong convergence towards the minimum norm element of $argmin_H f$ and fast convergence of the gradients towards zero by making appropriate assumptions about the first and second-order derivatives of β. To illustrate our results, we present two choices of β: the first is $\beta(t) = t^r \ln^q(t)$, where $(r, q) \in \mathbb{R}^2_+$ and the second is $\beta(t) = e^{\gamma t}$, where $p \in]0; 1[$ and $\gamma > 0$. Finally, numerical experiments are given for a simple convex (not strictly convex) function.

Keywords: Convex optimization; Tikhonov approximation; Heavy-ball method; Hessian-Driven damping.

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Smoothing splines Galerkin approximation for solving Black-Scholes PDE

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Abstract: In this work, we solve the Black-Scholes equation, considered a successful model in the financing area. We use the Fourier transform method to solve the considered problem as a partial differential equation with initial and final conditions and non-homogeneous boundary conditions. The method employs the -spline kernel and consists of two stages. In the first stage, we use a classical characteristic function as a solution of an ordinary differential equation to find the theoretical solution of an intermediate transport equation. Using the finite difference technique with respect to the time variable, the governing advection-diffusion-reaction problem is transformed into a discrete scheme. In the second stage, the numerical solutions of the Black and Scholes problem are obtained using a Galerkin projection based on the -spline finite element method. Finally, several test examples are presented to verify high accuracy, effectiveness, and good resolution properties for smooth and discontinuous solutions.

Keywords: Black and Scholes model, Galerkin approximation, Smoothing γ-spline, Data analysis.

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A numerical method for thin plate deformation problem using Tensorial Spline Galerkin Approximation

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Abstract: The dynamic deflection of a beam deformation model in 2D subjected to an arbitrary moving force is solved using the Fourier Transform Discretization (FTD) method. The considered dynamic problem is a partial differential equation given by

$$\rho(x)\frac{\partial^s \phi}{\partial t^s}(x,t) + (a(x)\cdot\Delta)\frac{\partial^p \phi}{\partial t^p}(x,t) + \Delta\left(\frac{\partial^q \phi}{\partial t^q}(x,t)\right) + \Delta(q(x)\Delta\phi(x,t)) - \nabla\cdot(\mathcal{N}(x)\nabla\phi(x,t)) + (\mathcal{P}(x)\cdot\nabla)\phi(x,t) + \mu(x)\phi(x,t) = f(x,t) \text{ in } \Omega\times[0,T], \quad (1)$$

with the following non-homogeneous boundary conditions

$$q(\xi)\Delta\phi(\xi,t) = \mathcal{M}_0(\xi,t),\ \forall(\xi,t)\in\partial\Omega\times[0,T], \quad (2)$$

$$d(\xi)\phi(\xi,t) + \frac{\partial}{\vec{n}}(q(\xi)\Delta\phi)(\xi,t) = \mathcal{M}(\xi,t),\ \forall(\xi,t)\in\partial\Omega\times[0,T], \quad (3)$$

$$\kappa(\xi)\phi(\xi,t) + \mathcal{N}(\xi)\frac{\partial\phi}{\partial\vec{n}}(\xi,t) = g(\xi,t),\ \forall(\xi,t)\in\partial\Omega\times[0,T], \quad (4)$$

The FTD method is carried out in two steps. First, the equations are transformed into another problem for the frequency variables. The numerical solutions of this problem are approximated using a Tensorial Spline Galerkin variational approximation based on the higher-order Normalized Uniform Polynomial Splines (NUPS) solver. In the second step, several quadrature procedures are proposed for the computa- tion of the solution of the inverse Fourier transform. A comparison report between the various numerical computations of this integral is provided. The proposed method provides an efficient and accurate way of solving the dynamic deflection of beam deformation models, which has implications for the design and analysis of various structures.

Keywords: Beam deformation model, Frequency-domain approach ; Spline finite element analysis ; Gauss-Hermite quadrature method, Robin boundary conditions ;Tensorial spline functions ; Interpolation ; Numerical analysis.

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Time-Schwarz DDM applied to a parabolic partial differential equation

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Abstract: In this work, we developed an algorithm based on time domain decomposition method (TDDM) to solve a parabolic partial differential equations. Firstly, we transform our partial differential equations to a system of ordinary differential equations by finite difference scheme space discretization, in order to facilitate the application of our TDDM algorithm. After this, we give a description of TDDM algorithm based on Schwarz domain decomposition method and we verify some proprieties which are necessary in our situation.

Keywords: Time-Schwarz domain decomposition method, Parabolic partial differential equations, Ordinary differential equations.

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New inequalities for (p,h)-convex functions for τ-measurable operators

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Abstract: The main goal of this article is to present new inequalities for (p,h)-convex and (p,h) log-convex functions for a non-negative super-multiplicative and super-additive function h. Our first main result will be

$$h^{\lambda}\left(\frac{v}{\mu}\right) \leq \frac{(h(1-v)f(a)+h(v)f(b))^{\lambda}-f^{\lambda}\left[((1-v)a^{p}+vb^{p})^{\frac{1}{p}}\right]}{(h(1-\mu)f(a)+h(\mu)f(b))^{\lambda}-f^{\lambda}\left[((1-\mu)a^{p}+\mu b^{p})^{\frac{1}{p}}\right]} \leq h^{\lambda}\left(\frac{1-v}{1-\mu}\right),$$

for the positive (p,h)-convex function f, when $\lambda \geq 1$, $p \in \mathbb{R}\backslash\{0\}$ and $0 < v \leq \mu < 1$. Which gives a generalization of an important result due to M. Sababheh [Linear Algebra Appl. **506** (2016), 588–602]. As applications of our results, we present many inequalities for the trace, and the unitarily norms for τ-measurable operators.

Keywords: (p, h)-convex function; Operator (p, h)-convex function; τ-measurable operators; Super-additive functions; Multiplicative functions.

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A meshfree approach based on TSDT theory for the analysis of carbon nanotube reinforced ceramic skew plates

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Abstract: Have the new frontiers feature Nanocarbon technology for improving construction materials, and the importance of ceramic substance used for construction. We study in this paper the bending analysis of Carbon Nanotube (CNT) reinforced ceramic skew plates using the Third order Shear Deformation Theory and the rule of mixture. The rule of mixture theory is used to estimate the effective material properties for CNT reinforced ceramic skew plates. The local equations obtained are solved by a meshfree method based on the Radial Point Interpolation Method. The effects of different parameters on the bending response of CNT-RTWSBOCS are discussed such as CNT volume fraction and various types of CNT distributions

Keywords: ceramic skew plate, carbon nanotube reinforcement, third order shear deformation theory, meshfree method.

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Discrete Legendre modified projection-type methods for Hammerstein integral equations

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Abstract: In this paper, discrete modified projection-type methods are studied for solving Hammerstein integral equations with a smooth kernel using Legendre polynomial basis. Using sufficiently accurate numerical quadrature rule, we give superconvergence results for approximate and iterated approximate solutions of discrete Legendre modified Galerkin-type and discrete Legendre modified collocation-type methods. Numerical results are presented to validate the theoretical results.

Keywords: Hammerstein equations, discrete projection-type methods, Legendre polyno- mial, numerical quadrature, superconvergence

Catalogue de données : l'impact du machine Learning

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Abstract: L'approche machine learning offre de nombreux avantages pour la gestion d'un catalogue de données. Elle peut aider à améliorer la qualité des données, à faciliter la recherche des données pour les utilisateurs finaux, à effectuer des analyses prédictives et à personnaliser les recommandations des produits ou des services. Les données contenues dans le catalogue peuvent être utilisées pour diverses tâches de machine learning, telles que la classification, la prédiction, la détection d'anomalies, l'analyse de sentiment, etc. Le catalogue de données peut également être utilisé pour stocker des informations sur les modèles de machine learning, telles que les performances, les paramètres de configuration, les métadonnées, les scripts de pré-traitement et les résultats d'évaluation. En utilisant l'approche machine learning, les entreprises peuvent mieux comprendre les besoins de leurs clients et proposer des produits ou des services plus adaptés à leurs besoins. Cela peut aider à augmenter les ventes et à fidéliser les clients, ce qui est essentiel pour la croissance et le succès à long terme de l'entreprise. Dans ce travail, nous avons explore les différentes manières dont l'approche machine learning peut aider à améliorer la gestion d'un catalogue de données.

Keywords: Catalogue De Données; ML; Métadonnées.

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ARTIFICIAL INTELLIGENCE IN STOCK MARKETS

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Abstract: Stocks are widely considered to be one of the most popular financial instruments available for building wealth, and they typically serve as the centerpiece of many investment portfolios. Thanks to the latest advancements in trading technology, stocks are now accessible to nearly anyone. As a result, there has been a significant surge in the average person's interest in the stock market over the past few decades. In a highly volatile market like the stock market, it is crucial to make precise predictions about future trends. Given the financial crisis and the need to achieve profits, it has become increasingly essential to have secure predictions of stock values.
In this research paper, we use artificial intelligence algorithms, specifically machine learning with a particular focus on Linear Regression (LR), Three-month Moving Average (3MMA), Exponential Smoothing (ES), and Time Series Forecasting methods to make predictions of stock values.

Keywords: Artificial intelligence, financial markets, prediction, Machine learning.

Analyzing accidents using a hybrid approach between metaheuristics and Deep learning: An overview

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Abstract: The growth of smart cities, urbanization, and overpopulation has led to an increase in the number of vehicles on the road, resulting in traffic congestion and a higher likelihood of accidents. Road injuries not only impact an individual's health but also have negative economic and social consequences for families and governments. Analyzing traffic accident data is crucial in preventing and reducing accident costs, as it allows us to identify the factors that influence accident severity and frequency. This involves analy- zing a vast amount of data, including driver characteristics, environmental factors, vehicle features, road geometry, and time of day. To create efficient prediction or decision-making models, clustering, classifica- tion, and feature selection techniques are essential. In this communication, We will present an overview of the various metaheuristics and deep learning methods utilized to solve this task and explore how their hybridization can be leveraged to create a robust model.
The remaining of this communication will be as follow : 1- K-means clustering for analyzing accident [3],[2],[4],[5],[6] 2- Metaheuristics for feature selection [8],[9],[10] 3- Pedestrians to vehicle accident [1],[12] 4- Deep learning for predicting accident probability[11] ,[7],

Keywords: Deep Learning, Metaheuristics, Road accident

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Quantum Fisher information matrix and quantum Cramér-Rao bound

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Abstract: Multiparameter quantum estimation theory aims to determine simoultaneously the ultimate precision of all parameters within a quantum system's state[1]. The quantum Fisher information matrix is crucial in establishing this ultimate precision and obtaining the quantum Cramér-Rao bound whose saturation has so far remained elusive due to the incompatibility of observables [2]. In this work, we drive the analytical expressions of quantum Fisher information matrices and the corresponding quantum Cramér-Rao bound. Then we investigate the simultaneous and individual estimation of the phase and interaction damping parameters encoded in the master equation describing the time evolution of a two-qubit system coupled to independent reservoirs.

Keywords: Multiparameter quantum estimation theory, quantum Fisher information ma- trix, quantum Cramér-Rao bound

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Machine learning-based Ransomware detection: Review and challenges

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Abstract: In recent years, the world has seen an exponential increase in cyberattacks, as well as the emergence of new sophisticated and hard-to-detect cyberattacks such as malware, internal attacks, advanced persistent threats (APT), spear-phishing and DDOS attacks. One of all these destructive attacks, ransomware attack which is a widespread type of malware that silently encrypts victim's data and makes it inaccessible to users, and it is considered one of the most dangerous and harmful cyber-attacks. Especially as ransomware gangs are turning to a ransomware-as-a-service (RAAS) model, using stolen or compromised identities from the dark web to perform the attack. The attackers then demand a ransom in digital currency from victims to regain access to the data. There are two types of ransomware attacks: crypto ransomware, which encrypts files on the system and makes them inaccessible, and locker ransomware, which does not tamper with data but prevents users from using their computer system. Ransomware can be mitigated in three ways, namely prediction, detection and prevention. Detection is more important, and numerous studies have been carried out on it.
Furthermore, the staggering growth in cyberattacks has prompted security experts to focus on developing an efficient Network Intrusion Detection System that can detect not only known, but also unseen attacks. The primary purpose of Intrusion Detection System (IDS) is to monitor network activity in order to inform administrators if any suspicious activity is identified. In addition, IDS aims to detect malicious behavior that typical firewall or antivirus cannot detect, making it the security system's last line of defense.
Moreover, Machine Learning techniques have already demonstrated their effectiveness against sophisticated and unseen hard to detect attacks. For that, companies consider using Machine Learning techniques to develop intelligent Intrusion Detection Systems with high efficiency, low false alarm, and reduced processing time.
In this work, we will conduct a detailed study on the most relevant and recent articles about Machine Learning-based Ransomware detection techniques, in which we will discuss each work strengths and shortcoming. Finally, we will use the drawbacks of proposed methods to list the difficulties that researchers can face when developing Machine learning based Ransomware detection.

Keywords: Intrusion Detection System, Machine Learning, Anomaly Detection, Ransomware.

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Artificial Intelligence for education Sustainability in higher education

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Abstract: Education for Sustainable Development (ESD) is an educational approach that aims to increase students' knowledge of sustainability issues, foster critical thinking and reflection, and foster innovation and solutions for a more sustainable way of life. ESD is focused on our future, with a focus on preserving the environment and creating eco-friendly solutions using our expertise, knowledge, science, and cutting-edge technologies, W. Steele et al [1]. We can reimagine a better future where education and learning can influence the destiny of people and the earth by taking advantage of technology like AI, UNESCO [2]. In order to produce graduates who are concerned about sustainability, higher education must respond to these requirements and changes, C. Marouli et al [3], this means that educational standards should equip graduates with the necessary skills and values to function in an AI-rounded society, M. Tanveer et al [4]. interdisciplinary works are likely to increase since the deployment of AI in educational settings cannot be carried out without the assistance of experts in education and social science and because Artificial Intelligence in Education (AIEd) applications must be designed with cumulative knowledge of theory and practice in education, A. Bozkurt et al [5]. For the purpose of preparing the next generation of professionals, the element of sustainability needs to be incorporated into conventional theory, knowledge, projects, and final theses, A. Paulauskaite et al [6] with a range of abilities and skills, including the capacity to create group solutions based on ecological and socioeconomic sustainability, analytical and critical thinking, comprehension of the Sustainable Development Goals SDGs' implementation pathways, global awareness, and bolstered leadership and communication abilities, A. Paulauskaite et al [6]. It is crucial to provide as much multidisciplinary knowledge on sustainability as possible because cutting-edge sustainable solutions demand the skills of experts from several sectors, A. Paulauskaite et al [6]. However, the emergence of AI and its growing impact on education necessitates an assessment of its effect on the attainment of sustainable development. This study describes and proposes a novel methodology that can be used to evaluate the sustainability level when integrating AI into the education process. Our model takes place at three inter-dependent levels:

• Institution-wide level: identify and assess Sustainable Management of the institution, Academic Policy, and so on.

• Program level: identify and assess sustainability integration in a field of study, study program, or module.

• Individual level: identify and assess how teachers make pedagogically informed decisions on how to teach specific content with the help of the most suitable technology.

Keywords: Artificial Intelligence, Sustainability, Education for Sustainable Development (ESD), Artificial Intelligence in Education (AIEd)

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Étude bibliographique comparative des approches classiques et de l'apprentissage profond en reconnaissance vocale

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Abstract: Ce travail présente un état de l'art des méthodes classiques et des méthodes d'intelligence artificielle en reconnaissance vocale. Les méthodes classiques sont basées sur des modèles statistiques tels que les modèles de Hidden Markov (HMM) [1] et les modèles de Gaussian Mixture (GMM)[2] , qui utilisent des caractéristiques extraites du signal audio pour reconnaître les mots. Ces méthodes ont été largement utilisées pendant des décennies et ont atteint des niveaux de précision élevés dans des contextes bien définis et contrôlés, comme la reconnaissance de chiffres ou de commandes vocales simples. En revanche, les méthodes d'intelligence artificielle, telles que les réseaux de neurones profonds (DNN) [3] et les réseaux de neurones convolutifs (CNN) [4], ont révolutionné la reconnaissance vocale en permettant des performances supérieures dans des environnements plus complexes et variés, avec des bruits de fond et des accents différents. Les DNN et CNN utilisent des caractéristiques automatiquement apprises à partir des données audios elles-mêmes, ce qui leur permet de généraliser mieux et de s'adapter à des situations imprévues. En outre, les méthodes d'intelligence artificielle peuvent être combinées avec des techniques de traitement du langage naturel (NLP) pour améliorer la compréhension du langage parlé et la traduction automatique. Par exemple, les modèles de langage neuronaux (NLM) [5] utilisent des réseaux de neurones pour modéliser la probabilité d'une séquence de mots, ce qui peut aider à comprendre le sens d'une phrase entière plutôt que simplement des mots individuels.

Keywords: Reconnaissance vocale, Apprentissage profond, Intelligence artificielle , DNN, CNN.

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Analyse de réduction dimensionnelle d'une plaque mince élastique tridimensionnelle renforcée de rubans fractals

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Abstract: L'homogénéisation des structures et des matériaux élastiques renforcés par des fibres, ou par des inclu- sions minces développant une géométrie fractale et ou par des rubans composés de matériaux élastiques très contrastés a attiré l'attention ces dernières années en raison des caractéristiques géométriques et physiques des inclusions et était l'objectif de plusieurs travaux, voir par exemple [1, 2, 3, 5, 6, 10, 12], et leurs références. Les problèmes homogénéisés obtenus à la limite sont généralement constitués de formes singulières contenant des termes fractals. Dans cet travail, on considère la déformation d'une plaque élastique tridimensionnelle de faible épaisseur variable renforcée par des rubans minces verticales très contrastés suivant des trajectoires fractales, en supposant que les rubans sont des bandes minces élastiques verticales de hauteur $2r_h$ qui sont construites sur une courbe pré-fractale obtenue après $h-$itérations des similitudes contractives du tapis de Sierpinski. En utilisant les méthodes de $\Gamma-$convergence, on prouve que la suite des énergies fonctionnelles associées au problème $\Gamma-$converge vers la fonctionnelle qui décrit l'énergie effective bidimensionnelle du composite comprenant des termes singuliers pris en charge dans le tapis de Sierpinski.

Keywords: Plaques élastiques minces, rubans fractals, analyse de réduction dimensionnelle, interactions microscopiques, matériau efficace.

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Étude d'une nouvelle propriété de type Drazin-Ruston dans la théorie de Fredholm relativement à un homomorphisme entre deux algèbres de Banach

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Abstract: We introduce the class of essentially Ruston and Drazin-Ruston elements with respect to a homomor- phism between two Banach algebras. In this work, we extend some well-known results of Ruston theory by among other things, developing the Ruston, almost Ruston elements, and spectra relative to an arbitrary homomorphism. In addition, we provide a number of application.

Keywords: Banach algebra, Drazin-Ruston, Fredholm theor ...

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Impact of Machine Learning on Diabetes Management

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Abstract: n artificial intelligence, in many fields of applications, statistical learning methods have demonstrated their high level of performance. One of the tasks often performed by this type of method consists in studying the statistical dependence between variables for improved classification or prediction. A consi- derable amount of research is also being carried out, in order to evaluate the performance of machine learning methods through the angle of causality, and their use in particular in epidemiology.
The current focus on strengthening progress in measures to prevention diabetes and control the progression of its complications is mainly due to : (i) the increase in the prevalence of diabetes and, (ii) the significant improvements in clinical studies, in particular observational studies, with the increasing availability and the quality of clinical databases and the progress made in methods combining Machine Learning algorithms with causal inference.
This paper presents the results of many selected research articles that focuses on the usage of machine learning and causal inference in general healthcare and particulary in diabetology, namely : (i) predictive systems for estimation and early detection of diabetes and its complications, and, (ii) causal systems able to predict patient response to targeted therapies.
In light of the complexity of the human body structure, of its physical constraints as well as its big va- riability, models combining Machine Learning and causal inference thus lead to optimal decision-making, to identify new morbidity factors associated with diabetes, to customize treatment for an individual's specific needs and to anticipate and reduce the risks of diabetes complications.

Keywords: Machine Learning, Causal Inference, Precision medicine, Statistics, Epidemio- logy.

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Survey of dynamic analysis of Multi Degree of Freedom systems.

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Abstract: Dynamic analysis of structures is a critical aspect in the field of civil engineering as it helps to better understand the movements and vibrations of structures, especially under dynamic loads such as earthquakes, strong winds, or loads. This enables better prediction of the behavior of the structure in extreme situations, reducing the risk of collapse and ensuring the safety of people and property. Furthermore, dynamic analysis of structures also helps to optimize the design and performance of buildings, minimizing costs while maximizing their efficiency and reliability [1,2,3,4]. There are various methods for conducting dynamic analysis of structures such as analytical approach which are based on simplified mathematical models, but for complexes structures this method can become more challenging to apply because it may not take into account all the details and nuances of the actual structure. For this, researchers have resorted to proposing numerical methods such as Newmark-β and Wilson-θ which can be very precise but they have limitations in that they cannot take into account the different properties of the structure.Today, the scientific community is mainly interested in AI (artificial intelligence) such as neural networks [5], these methods is becoming an extremely powerful approach for predicting the response of a structure to seismic loads based on acceleration data from the seismic environment and the properties of the structure [6]. These methods have become trend through their use to optimize structural design by identifying areas of weakness and improving seismic resilience.

Keywords: Dynamic analysis, artificial intelligence, neural networks.

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LE DÉVELOPPEMENT DES COURBES DE FRAGILITÉ A LA ZONE D'AL HOCEIMA EN CONSIDÉRANT L'INTERACTION SOL-STRUCTURE

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Abstract: L'objectif de cette contribution est d'étudier l'effet de l'intersection sol structure (ISS) sur la réponse sismique d'une structure en béton armé en considérant quatre vitesses des ondes de sol à la zone d'ALHOCEIMA.
En effet cette prise en compte de l'interaction (sol-fondation) est traduite à partir des fonctions d'impédance associées à un système ressort-amortisseur, intégrant ainsi la flexibilité du sol.
En analysant l'effet de l'intersection sol et structure (ISS) sur l'état de dommage des structures qui ce traduit par le développement des courbes de fragilité de ces structures.

Keywords: ISS, la réponse sismique, courbe de fragilité, sol.

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Aa hybrid Finite Element-Meshfree method for numerical simulation of FGM structures

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Abstract: In this work, we are interested in the study of functionally graded composite materials, as these materials can play a major role in different industries (e.g. automotive, aerospace, civil engineering, etc.). We present a hybrid numerical development, by combining weak and strong formulations, to simulate functionally graded composite materials. The hybrid approximation is based on the meshless strong form method and the Finite Element Method (FEM). The proposed approach allows us to exploit the advantages of both formulations. Numerical tests are performed to demonstrate the reliability and performance of the proposed approach by setting up a comparative study with the results obtained by the analytical solution and the FEM.

Keywords: functionally graded material, hybrid algorithm, meshless methods, finite element method.

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Modeling and analysis of the effects of government programs on the prevention of unemployment

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Abstract: In this work, a nonlinear mathematical model of the effects of government programs on the control and reduction of unemployment has been proposed and analyzed. In the modeling process, it is assumed that the control and reduction of unemployment results from the change between the unemployed and employed classes. It is assumed that the growth rate of programs to address unemployment that impact the population is proportional to the number of unemployed. It is also assumed that due to the classification effect, the unemployed form a distinct class from the employed class. The model is analyzed using the stability theory of differential equations. Analysis of the model shows that unemployment growth can be controlled by government programs, but unemployment remains endemic due to university graduates and immigration. The Simulation analysis of the model confirms the analytical results.

Keywords: Mathematical model, Unemployment, Equilibrium, stability, Numerical simulation.

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Bioinspired Intelligent Optimization Algorithms and Its Applications for Mobile Robot Control and Energy

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Abstract: Electronics and software advancements have boosted mobile robot applications in different domains. Although mobile robots must constantly evolve to meet emerging challenges regarding operating time, robustness, and energy consumption. Tasks like moving, exploring, transportation, and completing complex tasks using an onboard system like robotic arms are a considerable power consumption. To respond to this problem, several works have proposed bioinspired intelligent algorithms [1]–[3].
In this work, we propose an overview of the algorithms and methods used for mobile robot control and energy optimization. We expose our methodology and results aimed to optimize the energy consumption of a differential mobile robot and discuss the perspectives [4], [5].

Keywords: Bioinspired Algorithm, Mobile robot control, Energy optimization, Fuzzy logic.

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Multi-domaines Dataset pour l'analyse des sentiments Marocains dans les réseaux sociaux

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Abstract: Ces dernières années, l'avènement du phénomène des médias sociaux et l'omniprésence de l'accès à Internet a créé un déluge d'informations des données textuelles sur le World Wide Web. Les données partagées sont importantes en volume, en vélocité et en variété. Elles apportent de nouvelles opportunités et pose de nombreux défis pour le Machine Learning et le traitement automatique du langage naturel (TALN) en particulier. Dans ce travail, une nouvelle contribution aux ressources arabes est présentée comme un grand ensemble de données marocaines extraites de différents réseaux sociaux et soigneusement annotées. À notre connaissance, cet ensemble de données est le plus grand ensemble de données marocain pour l'analyse des sentiments. Les données collectés et annotées couvrent tous les types de réseaux sociaux (Facebook, Twitter, YouTube, Instagram, site web), elle est liée aux différents domaines (action, art, comédie, commerce, Covid, Cuisine, éducation, fêtes, Guerre, islamique, politique, social et sport).

Keywords: darija marocaine, réseaux sociaux, analyse de sentiments.

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Dynamic hypermedia adapted to Serious Games for effective e-learning strategies.

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Abstract: Nowadays, e-learning systems play an essential role in providing learners with the knowledge and skills needed to cope with their learning process. The Dynamic Adaptive Hypermedia (DAH) system is one of the systems that allow the opportunity for the learners to acquire and adopt their learning according to their needs and skills. It is widely agreed, therefore, that the most effective way of learning is by doing, in this regard, integrating playing (SG: serious games) through learning was and still is a vital method to opt for to achieve effective, productive, and successful outcomes.

The present paper sheds light on the employment and the use of DAHs (SGs) as a method that assists and aids learners in their learning process according to the standards that meet their needs. In the first part, the paper will provide an insightful analysis concerning the platforms used to employ these games and the challenges that designers and developers might encounter while working on such systems. The second part will be dedicated to displaying some of the research and investigations that have been made concerning implementing serious games into learning. Last but not least, the paper will focus on the restrictions and limitations that DAH may suggest while opting for such new systems of learning.

Taking everything into consideration, it is of paramount importance to know that this research study offers at first account all the information and arguments needed to improve new e-learning systems by using DAHs and SGs.

Keywords: Dynamic adaptive hypermedia, Serious Games, E-learning, learning.

Méthode des Volumes Finies et Éléments Finis pour la Résolution d'Équation de Stokes

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Abstract: Le but de cette étude est de résoudre l'équation de Stokes en une dimension en utilisant la méthode des éléments finis. Cette méthode permet de discrétiser l'équation en un ensemble de nœuds et d'éléments finis, ce qui facilite sa résolution numérique. Dans cette étude, nous avons utilisé le schéma de Galerkin pour discrétiser l'équation de Stokes, ce qui nous a permis de trouver une solution approchée pour la vitesse et la pression dans le système. Nous avons également comparé notre solution avec la solution analytique pour valider notre méthode. Les résultats montrent que la méthode des éléments finis est une méthode efficace pour résoudre l'équation de Stokes . On considère un domaine $\Omega \subset \mathbb{R}^2$ polygonal. On cherche la vitesse $u : \Omega \to \mathbb{R}^2$ et la pression $p : \Omega \to \mathbb{R}$ telles que:

$$\begin{cases} \eta \mathbf{u} - \nu \Delta \mathbf{u} + \nabla p = \mathbf{f} & \text{dans } \Omega, \\ \text{div } \mathbf{u} = 0 & \text{dans } \Omega, \\ \mathbf{u} = g & \text{sur } \partial\Omega. \end{cases}$$

Où $\eta > 0, \nu > 0$ ainsi que $f, g : \Omega \to \mathbb{R}^2$ sont données.

Keywords: Stokes, Éléments Finis.

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Smart Farming in Morocco: Advantages and Challenges

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Abstract: In Morocco, as in many other countries around the world, agriculture is one of the pillars of the national economy; it ensures food security by producing cereals, citrus fruits, olives, tomatoes, potatoes, vegetables and other food and livestock products for a growing population [1], [2]. It provides also employment and income to almost 40population[2]. However, the agricultural sector is facing several challenges and issues including water scarcity, climate change, soil erosion, and pests and diseases, which can affect significantly the productivity and the quality of crops yields [3], [4]. To address these issues, Moroccan government, over the years, has implemented several strategies and policies to develop and promote sustainable agriculture practices and techniques such as Irrigation Development Program, Green Morocco Plan, Organic Farming, Agricultural Research, and recently Smart Farming also known as Agriculture 4.0 or Precision Agriculture [5]. Smart farming is an approach that refers to the use of advanced technologies such as Artificial Intelligence, Internet of things, cloud computing and edge computing to improve crop quantity and quality and optimize resources. The focus of this study is to highlight the first steps of Morocco into the field of smart agriculture, and the potential benefits of using edge- cutting technologies like Machine Learning and Deep Learning to address some of the challenges faced by the agricultural sector. Finally, problems facing smart agriculture adoption in Morocco will be listed.

Keywords: Smart agriculture, IoT, UAV, machine learning, deep learning.

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Integration of Lean Six Sigma and industry 4.0 to improve production performance: Case of automotive industry.

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Abstract: Several factors are impacting automotive industry. Some issues are considered as internal factors, and others are coming from outside and considered as external. In this paper we will focus on internal matters and related preventive actions to improve the production performance by using lean six sigma tools and implementing industry 4.0 technologies to get a combined flexibility with productivity, efficiency, and better profitability.

Keywords: Industry 4.0; Lean Six sigma; Operational excellence; Sustainability.

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Survey on Breast Cancer Tumor Segmentation Using Deep Learning Schemes

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Abstract: Breast cancer is the most commonly diagnosed cancer among women and the second leading cause of cancer death in them. Approximately 2.5dying from breast cancer. In the United States, around 13develop invasive breast cancer at some point in their lifetime [1]. The American Cancer Society reports that women with breast cancer detected at an early stage (localized) have a five-year relative survival rate of 99improves survival rates but also decreases the cost of treatment. It is fortunate that with the help of advancements in radiographic imaging, this fatal disease can now be diagnosed at an early stage. Nevertheless, Radiographic images are analyzed by experienced radiologists and pathologists, and the process is costly and fallible.In the recent years, deep learning techniques have revolutionized medical imaging analysis, particularly in the field of breast cancer diagnosis and treatment because of its ability to handle large amounts of data. Deep learning models automatically extract the features by analyzing the high dimensional and correlated data efficiently. We have seen a rapid advancement of deep learning in computer vision disciplines such as categorization, detection, and semantic segmentation. As segmentation of breast tumors provides image features such as shape, morphologic structure, texture, and enhancement dynamics that can improve diagnosis and prognosis in patients with breast cancer [2-4]. Furthermore, there is no reliable automated tumor segmentation yet, and manual segmentation requires a significant amount of labor and a large number of workers, making it is a time-consuming process [5]. In this communication we will present the critical analysis of the research and findings already done to segment and classify breast cancer tumor using various imaging modalities including "Mammography","Ultrasound", "Computed Tomography(CT)" and "Magnetic Resonance Imaging (MRI)".First, we will provide an overview of the different deep learning techniques and specific architectures for the segmentation and classification of breast cancer. We also provide a brief overview of the different image modalities to give a complete overview of the area with strengths and weaknesses of each modality. In the same context, this review was performed using a broad variety of research databases for access to various field publications.Finally, a critical discussion about research difficulties and prospects for future study in this emerging area.

Keywords: Breast Cancer; Deep Learning; Image medical; neural network; segmentation.

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Meshless method for the numerical solution of fractional stochastic integro-differential equations based on the moving least squares technique

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Abstract: The main purpose of this work is to extend the meshless method based on moving least square approxima- tion (MLS) to solve stochastic fractional integro-differential equations (SFIDEs). To establish the scheme; we apply the composite Gauss-Legendre integration rule to compute the fractional integral appearing in the scheme and the Riemann sum for estimating Itˆo integral. We have also compared different basis in terms of CPU time. The error bound of the numerical method is given. The major advantage of this approach is that the results converge more quickly to the exact solution by using a small number of points and basis functions, and it is more flexible because it allows an easy adaptation of the nodal density, then the computational cost of the moment matrix is reduced. This method is very convenient for solving fractional stochastic integro-differential since it does not require any need for mesh connectivity. Several numerical tests are reported and compared with the results obtained by other methods which verified the theoretical findings.

Keywords: Meshless methods, Stochastic Integro-diferential equations, Fractional calculus, MLS approximation.

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Conformal Perfectly Matched Layers For Bernstein–Bezier Finite Element Modelling Of Berkhoff Equation

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Abstract: This work presents a high-order Bernstein-Bézier finite element (FE) discretization to accurately evaluate the wave agitation for island models in real-time based on the linear elliptic mild-slope equation. Unbounded or partially unbounded domains should be dealt with by truncation of the (partially) infinite domain and prescription of an appropriate boundary condition allowing outgoing waves to leave the computational domain without spurious reflection. Due to bathymetric effects, the wave in the far field is generally unknown a priori, and a standard radiation condition can not be applied, unless the bathymetry outside the computational domain is approximated by a constant water depth. Here, the perfectly matched layer (PML), combined with high-order Bernstein-Bézier finite elements [1], will be adapted to include exterior bathymetry effects.
Although high-order FEs possess many advantages over standard FEs, the computational cost of matrix assembly is a major issue in high-order computations. A key ingredient to address this drawback is to perform an element-level static condensation of the interior degrees of freedom to reduce the memory requirements[2].
In this work, we consider just the case of constant bathymetry outside the island. the performance of Bernstein-Bézier FEs combined with the PML approach, in terms of accuracy is investigated through the benchmark of the refraction-diffraction of long waves over a circular island with a parabolic shoal [3], a circular island consisting of two surmounted cylinders and a single scattering.

Keywords: High order finite elements; Bernstein-Bézier; mild-slope equation; absorbing boundary condition; perfectly matched layer; static condensation; refraction-diffraction; long waves.

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The use of artificial intelligence to boost tourism in the region of Beni Mellal : an analysis of data from social networks

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Abstract: Our work presents a study on the use of AI to encourage tourism in the Beni Mellal - Khénifra region by analyzing data from social networks. The goal is to understand the trends and interests of potential tourists in order to better target and encourage them to visit the region. The collected data includes information on preferred destinations, modes of transportation, tourist activities, and lodging services. The results show that using this data allows for optimization of marketing and promotion efforts to attract tourists to the Beni Mellal - Khénifra region. Tourism can bring many economic benefits to the region, which will be possible through the use of AI to collect and analyze data from social networks.

A numerical method for the Schrödinger equation using finite element method.

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Abstract: In this work, we solve the Schrödinger partial differential equation

$$i\hbar\frac{\partial\phi}{\partial t}(t,X)+\frac{\hbar^2}{2m}\Delta\phi(t,X)-V_0(X)\phi(t,X)-V_{1*t}\phi(t,X)=f(t,X)$$

for all $(t,X)\in[0,+\infty[\times\Omega$, with the initial conditions $\phi(0,X)=\phi_0(X)$ and the following boundary conditions

$$\phi(t,\xi)+\frac{\hbar^2}{2m}\frac{\partial\phi}{\partial\vec{n_\xi}}(t,\xi)=g(t,\xi),\ (t,\xi)\in[0,+\infty[\times\partial\Omega.$$

We use the frequency-domain method to solve the considered problem, as a partial differential equation with non-homogeneous boundary conditions. The method employs the Fourier transform Discrestization (FTD) and consists of two stages. In the first stage the equations are transformed into an equivalent problem for the frequency variables. The numerical solutions of this problem are approximated using a Galerkin projection based on the higher-order Spline finite element method. In the second stage a several quadrature procedure are used for the calculation of the solution of the inverse Fourier transform, and then we gives a comparison report between the various numerical computations of this integral. The frequency domain method avoids the discretization of the time variable in the considered problem. Finally, several test examples are presented to verify high accuracy, effectiveness, good resolution properties for smooth and discontinuous solutions and plots of field of displacements of the waves.

Keywords: Quantum information, Schrödinger partial differential equation, frequency- domain approach, pline finite element analysis, Quadrature method and numerical analysis.

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Quantum Codes from Cyclic Codes over Non Local Rings

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Abstract: The construction of quantum error-correcting codes from cyclic codes has been introduced over various finite rings, more precisely, over finite non local rings. Bechoc [1] and Gao [2] have studied some special cases of this rings. In this paper, linear and cyclic codes over a finite non local ring $\mathcal{R}$ are introduced. We give Gray images of linear and cyclic codes over this ring. There is a necessary and sufficient condition for cyclic codes over $\mathcal{R}$ that contains its dual is presented. Finally, we obtain the construction of quantum error-correcting codes from cyclic codes over the ring we are studying.

Keywords: Gray map, cyclic codes, non local finite rings, self-dual codes, Quantum codes.

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New approach to solve the Job Shop Scheduling Problem

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Abstract: Job shop scheduling problem is a combinatorial optimization problem whose main goal is to find a schedule with the minimum makespan for processing n jobs on a set of m machines. This problem has been confirmed as one of the NP-hard problems. Several solutions have been proposed before, including the disjunctive graph representation proposed by Roy and Sussmann[1] and an enumerative approach based on the disjunctive graph proposed by Balas[2]. Since then, researchers have tried various strategies to solve this problem, and recently they have adapted different meta-heuristic approaches to obtain a near-optimal solution for JSP, yielding good results. In this work, we propose a hybridization of the genetic algorithm (GA) and the dragonfly algorithm (DA) using operation-based representation to solve the JSP problem. We use the different operators of GA and DA to generate new solutions and find the best solutions of this problem. Both the GA and DA are widely used algorithms to solve optimization problems and have given excellent results. With the use of their operators, we were able to generate several good solutions and find a better makespan in an optimal time for both small and large problems of JSP.

Keywords: Job shop scheduling problem, Genetic Algorithm, DragonFly Algorithm.

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Approximate solution for an acoustic wave problem based Galerkin finite element method

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Abstract: In this talk, we interest to study the Transverse Electromagnetic Wave equation

$$\frac{1}{c^2}\frac{\partial^2\phi}{\partial t^2}(x,t) - \nabla^2\phi(x,t) = f(x,t) \text{ in } \Omega \times [0,T], (5)$$

with the initial conditions

$$\phi(,0) = \phi_0(x) \text{ and } \frac{\partial\phi}{\partial t}(x,0) = \phi_1(x) \text{ for all } x \in \Omega, (6)$$

where ϕ_0 and ϕ_1 are given initial functions. As usual, c denotes the constant speed of sound and $f(x,t)$ prescribe the internal source term. The boundary conditions for the transverse electromagnetic equation (1) are

$$\kappa(\xi)\phi(\xi,t) + \frac{\partial\phi}{\partial\vec{n}}(\xi,t) = g(\xi,t),\ \forall(\xi,t) \in \partial\Omega \times [0,T]. (7)$$

We propose a numerical method based on the frequency-domain approach and the tensorial spline to solve the electromagnetic wave equation in the time domain. The discretization procedure of the time variable is based on the Fourier transform and the inverse Fourier transform to avoid the finite difference schemes. For the spatial variable, we also use a partitioned mesh grid with a mother tensorial spline functions to form the bases of solution. Using the Fourier transform, the electromagnetic wave equation in the time domain is also transformed to an equivalent wave equation in frequency-domain (FD). So, an approximation of the electromagnetic wave equation in frequency domain is proposed by using a tenso- rial spline finite element method. The calculation of the solution of the electromagnetic wave equation in the time domain require the Rectangle, Trapeze, Simpson and Gauss quadrature methods to implement numerically the inverse Fourier transform. Several numerical experiment are presented to confirm the robustness and the performance of the proposed method.

Keywords: Transverse electromagnetic wave equation, Fourier transform discritization, Tensorial spline finite element method (TSFEM) and Quadrature method.

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Modeling of Tumor Growth and Drug Resistance in Gastrointestinal Stromal Tumor Metastases to the Liver

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Abstract: In this study, we examine mathematically and through numerical analysis a partial differential equation model for tumor growth that takes into account drug resistance. Specifically, we focus on modeling the growth and resistance to therapies of gastrointestinal stromal tumor metastases in the liver, and speci- fically the resistance to two tyrosine kinase inhibitor therapies (Imatinib and Sunitinib). Using medical images, we develop a spatial model of non-linear partial differential equations. This model accurately depicts the spatial progression of one particular patient's tumor. The first part of the paper proves the well-posedness of the model given certain conditions on the initial tumor. The second part presents nu- merical results from simulations and compares them to the clinical data of one specific patient for which we have complete treatment information, thus validating the model.

Keywords: Cancer Modeling, Tumor Growth, Drug Resistance, Numerical Simulations, PDEs.

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Numerical simulation of pavement-tire interaction: investigating the effects of multiple parameters on pavement performance

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Abstract: Pavement-tire interaction is a complex phenomenon that affects the performance and durability of roadways. Numerical simulation is a powerful tool for investigating the effects of various parameters on pavement-tire interaction. In this work, a parametric study of pavement-tire interaction using numerical simulation was performed. The study investigates the effects of friction coefficient, inflation pressure, rolling speed, pavement layer thickness, and material properties on the behavior of the pavement. The finite element method is used to simulate the pavement and the tire interaction. A range of pavement types and loading conditions are considered to capture the variability of real-world conditions. The results show that the friction coefficient, inflation pressure, and rolling speed significantly affect the tire-pavement interaction, with higher values of these parameters leading to greater contact pressure and deformation. Additionally, the thickness and material properties of the pavement layers have a significant impact on the pavement response, with thicker and stiffer pavements exhibiting lower levels of deformation and stress. The study provides insights into the complex behavior of pavement-tire interaction and highlights the importance of considering a range of parameters in pavement design and maintenance. The results can inform the development of new design standards and performance evaluation methods that better reflect the real-world conditions of pavement- tire interaction.

Finite element modeling of FRP-confined concrete under cyclic loading

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Abstract: This article presents a finite element modeling study on the behavior of fiber-reinforced polymer (FRP)-confined concrete under cyclic loading. The objective of the study is to investigate the effectiveness of FRP confinement in improving the ductility and energy dissipation capacity of concrete structures subjected to cyclic loading, which is a common loading condition in earthquake-prone regions. The study uses a three-dimensional finite element model to simulate the behavior of FRP-confined concrete under cyclic loading and analyzes the stress-strain response, hysteresis loops, and energy dissipation capacity. The results show that FRP confinement significantly enhances the ductility and energy dissipation capacity of concrete structures under cyclic loading, making them more resistant to seismic events. The study also highlights the importance of using accurate and reliable material models in finite element simulations to obtain realistic predictions of the behavior of concrete structures under cyclic loading.

Keywords: Concrete, Columns, Confinement, Fiber reinforced polymer, Finite element method, Plasticity.

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Etude multi-échelle de l'érosion de contact solide/fluide au sein des ouvrages hydrauliques

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Abstract: L'érosion interne est définie comme une migration de particules engendrée par un écoulement hydraulique souterrain dans un sol ou dans un ouvrage en terre. Cette migration engendre une modification des caractéristiques hydrauliques et mécaniques du matériau constituant l'ouvrage, et notamment de la perméabilité. La rupture d'un ouvrage hydraulique est définie généralement comme la perte de sa fonction principale : retenir l'eau. La rupture peut être générée soit par une rupture mécanique du sol le long d'une surface de glissement, soit par l'effet des forces hydrodynamiques qui entraînent progressivement les particules de sol.

Cette étude concerne l'étude multi-échelle de l'érosion interne de sol à l'interface Solide /fluide au sein des ouvrages hydrauliques pour but de caractériser l'écoulement à L'interface entre deux milieux poreux, afin d'analyser l'influence de la taille de particules de sol sur le processus d'érosion, et étudier les mécanismes en jeu depuis l'initiation du phénomène à la rupture d'un ouvrage. Une modélisation numérique par le logiciel ArcGIS a été réalisé pour comparer les résultats trouves avec d'autres résultats trouvés par plusieurs auteurs dans ce domaine.

Keywords: Erosion interne, Hydraulique, ArcGIS, rupture, loi d'é rosion

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A novel approach based on genetic algorithms and parallel optimization for large industrial problems

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Abstract: The purpose of this work is to introduce a novel approach based on genetic algorithms and parallel optimization for large industrial problems to improve the convergence and efficiency. These techniques are related to interface variables for the simulation of mechanical, electrical and thermal problems in presence of cross points. More precisely, we are interested not only in domain decomposition with two equal parts having the same physical properties but rather in more general splitting components. It is known that the convergence of the problem is obtained unconditionally and the problem is still challenging in the 2D case. The primary goal then is to fill part of the gap in such problem domain decomposition techniques and to contribute to solve extremely difficult industrial problems of large scale by using parallel sparse direct solver of the multi-core environment of the whole system and handling each part of the system independently of the change of the mesh or the shifting of the mathematical method of resolution and subsequently, we treat the interface as boundary conditions. The numerical experiments of our algorithm are performed on few models arising from discretizations of partial differential equations using finite elements and meshless methods.

Keywords: Domain decomposition method, Schur complement, Meshless method, Finite Element Method, parallel computing.

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Transferts couplés d'humidité, de chaleur et de soluté dans la pierre calcarénite

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Abstract: Le problème des transferts couplés de masse et de chaleur dans un milieu poreux est gouverné par des équations de convection-diffusion. L'approche numérique pour résoudre ce système s'impose; d'une part, à cause de la complexité de ces problèmes (équations non- linéaires et couplées; impossibilité d'une solution analytique sauf pour des cas très simples) et d'autre part, pour compléter les études expérimentales.

L'objectif principal de ce travail est d'établir un modèle mathématique des transferts couplés d'humidité, de chaleur et de soluté dans la pierre calcarénite. Le système d'équation obtenu est discrétisé par la méthode des différences finis. A cette fin, le schéma centré d'ordre deux (CDS) a été utilisé pour l'approximation des termes advectifs et diffusifs, et le schéma implicite pour les termes d'instationnarité. Les équations algébriques ainsi obtenues sont résolues à l'aide de l'algorithme de Thomas (TDMA).

Keywords: Pierre calcarénite, loi de Darcy, chlorure de sodium, porosité, imbibition capillaire, perméabilité.

Tripled system of nonlinear fractional Langevin equations with nonseparated integral boundary conditions

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Abstract: In this research, we study a tripled system of fractional Langevin equations with non-separated integral boundary conditions. Existence and Uniqueness results are proved by using the Banach's and Krasno- selskii's fixed point theorems. Two examples are provided to identify the main results.

Keywords: Tripled system, Fractional Langevin equations.

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An optimization methodology using TSDT theory and artificial neural networks for the analysis of FGM plates

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Abstract: The design and optimization of mechanical structures often requires the simulation of the mechanical behavior of structures in a repetitive manner and can thus take a high CPU usage time. The process of the stiffness matrix inversion can be expensive if the system dimensions are large. However, the cal- culation of the mechanical behavior of a plate by an artificial neural networks would allow to repeat the simulations at low CPU usage time and thus, the time needed for the design process of functionally graded materials (candidate materials for material selection) and geometric optimization of the FGM structure would remain reasonable. In the present work we studied the nonlinear dynamic behavior of FGM plates using the third order shear deformation theory, finite element method, hight order implicit algorithm and neural networks of the multilayer perceptrons type, to evaluate the properties of candidate materials for material selection of FGM plate and to demonstrate its influence on dynamic behavior. The combination of these tools can be interesting to improve FGM plates and help industries produce FGM plates with good mechanical properties of the selected materials for FGM plate. Being a parametric model, several architectures and optimization algorithms have been tested resulting in improvement of 66% in CPU usage time compared to the proposed model in [1]. This improvement will be exploited in the scientific research for the combination of materials for FGM plates contributing to the improvement of the dynamic behavior of these types of plates.

Keywords: nonlinear dynamic, third order shear deformation theory, finite element method, hight order, implicit algorithm, artificial neural networks.

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Quasi Efficient Solutions in a Nonsmooth Multiobjective Bilevel Programming Problem

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Abstract: In combining the value function approach and convexificators, We formulate both necessary and sufficient optimality conditions for (local) quasi efficient solutions of a nonsmooth multiobjective bilevel programming problem under a suitable constraint qualification.

Keywords: Bilevel programming, optimality conditions, quasi efficient solutions, convexificators, optimal value function, constraint qualifications.

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Textured Images Segmentation Using Bi-dimensional Pairwise Markov Chain

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Abstract: The classical hidden Markov chain model has many applications in different image processing problems, such as segmentation or edge detection. The process X of the classes in this model is assumed to be a Markov chain and we observe its noisy version Y. The Markovianity of X is not necessarily confirmed, in this work we use a more general model called pairwise Markov chain, considering that the couple (X, Y) is a Markov chain and taking into account the object boundaries between the classes, which can be of great interest for the segmentation of textured images.
The originality in this modeling is to consider Y two-dimensional and use a Bayesian algorithm based on $MCMC$ methods to estimate the parameters in the model used. We apply the MPM algorithm to segment the image in question. The model is illustrated and evaluated by comparative unsupervised segmentation results obtained on textured images.

Keywords: Classical Hidden Markov Chain, Pairwise Markov Chain, $MCMC$ methods, Unsupervised Segmentation, Textured Image.

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An continuous SIR mathematical model of the spread of infectious illnesses that takes human immunity into account

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Abstract: In this study, we propose a mathematical model of infectious disease contagion that accounts for population stratification based on immunity criteria. Our goal is to demonstrate the effectiveness of this idea in preventing different epidemics and to lessen the significant financial and human costs these diseases cause. We determined the fundamental reproduction rate, and with the help of this rate, we were able to examine the stability of the free equilibrium point and then propose two control measures. The Pontryagin's maximum principle is used to describe the optimal controls, and an iterative approach is used to solve the optimality system. Finally, numerical simulations are carried out in MATLAB to verify the theoretical analysis.

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Domain decomposition preconditioner for a higher order compact difference discretization of a plate vibrations problem

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Abstract: In this work, we present an additive Schwarz domain decomposition method used for solving a fourth order parabolic partial differential equation in two dimension, governing the transverse vibrations of a thin plate.
A non-symmetric system of linear equations results from the discretization of the differential equation by a higher order compact finite difference scheme. Stability analysis of the scheme is discussed, using energy estimation for differential equation with variable coefficients.
The linear system is solved with GMRES krylov algorithm preconditioned by additive Schwarz domain decomposition. Numerical test cases have been carried out to show the effectiveness and the good accu- racy of the proposed approach.

Keywords: Thin Plate Equation, Domain Decomposition Method, Higher Order Compact Difference Scheme, Stability analysis, Krylov Methods, Schwartz Method, Preconditioning.

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Homotopy Sumudu transform method for solving fractional-order epidemic model

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Abstract: In this talk, we present a fractional-order SEIS epidemic model with general non-linearity for susceptibles to incorporate the effect of behavioral changes in susceptible individuals. The existence of solutions, steady states, and sufficient conditions to ensure global asymptotic stability are investigated. Meanwhile, by using the homotopy Perturbation Sumudu Transform Method (HPSTM), numerical results were obtained to verify the presented analysis.

Keywords: Non-linear epidemic model, Fractional system, Stability of equilibria, Homotopy perturbation Sumudu transform method.

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Genetic Algorithm with immigration strategy for Fixed Charge Transportation Problem

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Abstract: In this work, we are interested in improving the performance of genetic algorithm (GA) to solve the Fixed Charge Transportation Problem (FCTP). Several approaches have been developed with genetic algorithms based on the adaptation and improvement of different standard genetic operators. We proposes a new Genetic Algorithm adopting immigration strategy to maintain diversity and to perform more the genetic algorithm. Experimental results on series of standard instances of FCTP show that the proposed structured memory immigration scheme in GA effectively improves the performance of GAs.

Keywords: Combinatorial Optimization, Genetic Algorithm, Fixed Charge Transportation Problem, Immigration strategy.

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On a class of Steklov problems involving $(p(x), q(x))$-Laplacian

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Abstract: This work discusses the elliptic equation with Steklov boundary conditions

$$\begin{cases} -\Delta_{p(x)}u - \Delta_{q(x)}u = \lambda(x)f(x,u) & \text{in } \Omega, \\ \left(|\nabla u|^{p(x)-2} + |\nabla u|^{q(x)-2}\right)\frac{\partial u}{\partial \nu} = \mu(x)g(x,u) - |u|^{p(x)-2}u - |u|^{q(x)-2}u & \text{on } \partial\Omega, \end{cases}$$

where $\Omega \subset \mathbb{R}^N$ $(N \geq 3)$ is a bounded domain with smooth boundary $\partial\Omega$ and ν is the unit outward normal vector on $\partial\Omega$. $p, q : \Omega \mapsto (1, +\infty)$ are continuous functions such that $q(x) \leq p(x)$ for all $x \in \Omega$. $\lambda \not\equiv 0$, $\mu \not\equiv 0$, $f : \Omega \times R \mapsto \mathbb{R}$ and $g : \partial \times \mathbb{R} \mapsto \mathbb{R}$ are Carathéodory functions satisfying appropriate conditions. We show the existence of at least two nontrivial weak solutions by using the mountain pass theorem (AR) and Ekeland's variational principle.

Keywords: $(p(x), q(x))$-Laplacian operator, Steklov eigenvalue problem, Ekeland's variational principle, Mountain Pass Theorem.

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The thermistor problem : existence and numerical approximation.

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Abstract: We analyse the existence and the numerical simulation of a capacity solution to a coupled nonlinear ellip- tic system with a quadratic growth in the gradient and a non-uniformly elliptic problem in the context of anisotropic Sobolev spaces. The system may be regarded as a generalization of the so-called thermistor problem.

Keywords: Capacity solution, anisotropic Sobolev spaces, nonlinear elliptic equation, ther- mistor problem.

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A Survey Of Blockchain Security : Challenges And Solution

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Abstract: Blockchain technology is known for its secure and decentralized nature, making it an ideal platform for various applications. However, the security of blockchain is not immune to attacks and vulnerabilities. This article reviews the current state of security in blockchain and highlights some of the key challenges and solutions to address these issues. We first discuss the attacks on consensus mechanisms, including the Byzantine Generals Problem and the recent Colluding Faulty Nodes (CFN) attack. We then discuss the attacks on the blockchain network, including Sybil attacks and Distributed Denial of Service (DDoS) attacks. We also discuss the attacks on smart contracts. Finally, we discuss the challenges and solutions related to privacy and regulatory compliance in blockchain technology. We conclude that although blockchain technology has many advantages, it still faces many challenges related to security, privacy, and regulatory compliance. Further research and development are needed to address these challenges and ensure the widespread adoption of blockchain technology in various applications.

Keywords: Blockchain, PoW, PoS, SBFT, CFN, ECDSA, DeFi...

Blockchain pour l'éducation

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Abstract: La technologie blockchain [1] permet de créer un enregistrement distribué et dé- centralisé d'un événement numérique, libre de tout contrôle par des tiers sur les données et les transactions associées. Initialement utilisée pour la transmission de la valeur, cette technologie offre aujourd'hui un large éventail d'applications dans des secteurs tels que la santé, la banque, l'internet des objets, et bien d'autres en- core. Elle offre également une grande variété d'alternatives pour la gestion décen- tralisée et interopérable des documents dans les établissements d'enseignement. La demande pour la technologie blockchain a augmenté en raison de ses avantages distincts dans le domaine de l'éducation. Plusieurs applications sont actuellement actives sur la blockchain, et d'autres sont en cours de développement. Echolink est un réseau blockchain mondial qui enregistre les titres de compétences, les talents et l'expérience professionnelle vérifiés dans un hash immuable. Comme toutes les informations sont saisies par des organisations réputées, on peut les considérer comme fiables. Echolink et Microsoft ont coopéré pour fournir des services de cloud computing d'applications blockchain sur Azure [2]. Un autre exemple est Disciplina, une plateforme blockchain polyvalente dévelop- pée par Teach Me Please, qui produit et stocke des profils personnels vérifiés pertinents pour les carrières universitaires et professionnelles. En proposant des CV numériques d'étudiants créés au cours de leur parcours universitaire, ainsi que des preuves d'authenticité, elle aide les services de recrutement [3]. À l'aide de smart contracts Ethereum, une application appelée Open Certificates attribue une preuve de bloc aux certificats d'études. Elle a officiellement annoncé sa relation avec les instituts universitaires de Singapour [4].

Keywords: Blockchain; smart contract; Internet des objets.

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Strongly Nonlinear Coupled System in Anisotropic Orlicz Sobolev Spaces.

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Abstract: In this work, we study the existence of a capacity solution for a nonlinear elliptic coupled system in aniso- tropic Orlicz-Sobolev spaces. The unknowns are the temperature inside a semiconductor material, u, and the electric potential, ϕ. This system may be considered as a generalization of the steady-state thermistor problem.

Keywords: Nonlinear equations; monotone operators; weak solution; capacity solution; anisotropic Orlicz-Sobolev spaces; thermistor problem.

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Superconvergent Nyström and Degenerate Kernel Methods for Integro-Differential Equations

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Abstract: The aim of this paper is to carry out an improved analysis of the convergence of the Nyström and degenerate kernel methods and their superconvergent versions for the numerical solution of a class of linear Fredholm integro-differential equations of the second kind. By using an interpolatory projection at Gauss points onto the space of (discontinuous) piecewise polynomial functions of degree $\leq r-1$, we obtain convergence order $2r$ for degenerate kernel and Nyström methods, while, for the superconvergent and the iterated versions of theses methods, the obtained convergence orders are $3r+1$ and $4r$ respectively. Moreover, we show that the optimal convergence order $4r$ is restored at the partition knots for the approximate solutions. The obtained theoretical results are illustrated by some numerical examples. Many authors have used spline functions for the numerical solution of integro-differential equations; in particular, a semi-orthogonal spline wavelets approximation method for Fredholm integro-differential equations was proposed in [5]. In [2], the authors used a fast multiscale Galerkin method for solving second order linear Fredholm integro-differential equation with Dirichlet boundary conditions. In [6], the authors applied B-spline collocation method for solving numerically linear and nonlinear Fredholm and Volterra integro-differential equations, and in [3] an exponential spline method for approximating the solution of Fredholm integro-differential equation was studied. More recently, in [4] Kulkarni introduced an efficient method called modified projection method or multi-projection method to solve Fredholm integral equations of the second kind. Inspired in Kulkarni's method, authors in [1] have introduced superconvergent Nyström and degenerate kernel methods to solve the same type of equations. This work is concerned with numerical methods to solve a class of linear Fredholm integro-differential equations of the form

$$\begin{cases} y'(x) + a(x)y(x) = \int_0^1 k(x,t)y(t)dt + f(x) \quad , \ x \in [0,1], \\ y(0) = y_0, \end{cases} \tag{8}$$

where $y_0 \in \mathbb{R}$, a, f, k are continous functions, and y is the function to be determined.

Keywords:degenerate kernel method, Nyström method, Fredholm integro-differential equation.

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Investigation of Transient Nonlinear Heat Transfer Using FEM in Metal Plate with Variable Thickness

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Abstract: The heat exchange that occurs by conduction and radiation is a dynamic problem of longstanding interest with several application areas as diverse as aerospace engineering and design, power generation, industrial and civil security [1-2]. To better understand the performance of the different parameters during the nonlinear heat transfer analysis. Several examples of solutions are studied numerically using the finite element method [3-5]. To study this performance, we will try to solve numerically the nonlinear conduction problem with a non-source term through a rectangular metal plate domain coupled with radiation using FEM method by changing the temperature values for the other three edges with varying the of thickness parameter [3]. The results of the temperature distribution obtained are compared, for Copper and one for Aluminum, when the state of equilibrium is reached over the whole plate, for the different values of the thickness in a chosen time interval.

Keywords: Heat Transfer; Conduction-Radiation; Thermal Plate; Thickness parameter.

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Construction du diagramme de Voronoï 2D à l'aide de cercles croissants

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Abstract: Le diagramme de Voronoï est une structure de géométrie discrète qui divise l'espace en différentes régions pour chaque site dans un ensemble de sites dans un plan. Bien que de nombreux algorithmes aient été publiés pour le calcul des diagrammes de Voronoï ces dernières années, leur implémentation est souvent difficile et le succès n'est pas garanti. Cet article présente un algorithme simple et efficace pour le calcul des diagrammes de Voronoï dans l'espace R^2. L'algorithme utilise une transformation géométrique qui permet de calculer les diagrammes de Voronoï à l'aide de cercles croissants à partir de sites, les intersections entre les cercles servant de base pour la construction du diagramme de Voronoï selon certains critères. L'efficacité de cette approche permet de l'appliquer à de grands ensembles de données avec une grande précision et qualité, et nous fournissons une discussion détaillée des considérations temporelles.

Keywords: Cercles croissants, Simple, Efficace, Diagrammes de Voronoï.

Cement Dispatch Efficiency through License Plate Recognition for trucks identification and assignments

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Abstract: Digital innovations and intelligent networks offer tremendous opportunity to supercharge efficiencies in the cement industry. New technologies have the strength to create powerful connections between physical and digital systems. Many cement players know the benefits of implementing digital solutions, but few have seen its full power or taken advantage of its full potential. In the context of industrial processes digitalization, the logistics sector is also concerned with image recognition techniques for several applications such as the recognition of the vehicle's license plate to insure traceability, road safety, autonomous vehicles [1].
The purpose of this document is to set up an on-board platform for the detection, recognition, and the extraction of the shipping truck's number plate in the heavy industry to constitute a database of vehicles transiting on their sites in order to optimize the flow (minimize waiting times). Several cameras placed in a local network detect the passage of trucks throughout multiple checkpoints and capture their license plates which will then be transmitted to a processing center [2].
The center already embeds a model of recognition and extraction of the registration number which will then be archived for optimization purposes.

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Quasi interpolation methods for linear Volterra integral equations

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Abstract: In this work, we present a numerical method for solving linear Volterra integral equations of the second kind based on approximating the solution by spline quasi-interpolant operators. Such a method is stable in the whole interval, preserves the smoothness of the exact solution and gives convergence in the uniform norm. Global convergence errors are given for approximate solution, its derivatives and the iterated solu- tion. Moreover, a local superconvergence at some particular points is shown for the approximate solution. We also analyzed the discrete version of the method obtained by suitable numerical quadrature. Finally, numerical tests supporting theoretical results and comparison with several methods on the literature are given.

Keywords: Volterra integral equation, Quasi-nterpolation, Numerical solution.

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Image classification and segmentation for Brain Tumor Prognosis using DCNN

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Abstract: The categorization of brain images by MR has been an active area of research over the last decade since the MR technique has become more popular due to its non-invasive principle [1]. Several techniques have been designed in the past for the categorization of MR images, ranging from classical methods to deep learning methods such as convolutional neural networks (CNNs). Widely used for the segmentation of biomedical images, convolutional neural networks have significantly improved the state-of-the-art accu- racy of the brain tumor segmentation task. The CNNs also can perform the classification by extracting the characteristics of the image directly from raw images via the adjustment of the parameters of the convolution and grouping layer [2]. CNNs carry out the classification by extracting the characteristics of the image directly from raw images via the adjustment of the parameters of the convolution and grouping layer. The characteristics extracted by CNN are highly dependent on the size of the training dataset. If the training dataset is small, CNN tends to overfit after several epochs. Thus, deep CNNs (DCNNs) with transfer learning has evolved. This work aims to accurately diagnose brain tumors by exploring the capa- city of different pre-trained DCNN models with transfer learning for the classification and segmentation of pathological brain images.

Keywords: DCNN Segmentation, DCNN Classification, Brain images by MR...

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Applications de l'Intelligence Artificielle pour la prédiction des nouvelles molécules en chimie organique

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Abstract: L'intelligence artificielle (IA) est une technologie émergente qui promet de transformer les industries du monde entier. L'une des industries qui pourraient bénéficier le plus de l'IA est la chimie organique, qui est la branche de la chimie qui étudie les composés organiques, leurs propriétés et leur réactivité. L'IA a déjà commencé à faire des progrès significatifs dans le domaine de la chimie organique. L'une des applications les plus importantes de l'IA dans ce domaine est la conception de médicaments. L'IA peut être utilisée pour identifier des cibles thérapeutiques potentielles et pour concevoir des molécules qui se lient à ces cibles de manière efficace et spécifique. Cela peut aider à accélérer le processus de découverte de médicaments et à réduire le coût de développement. Dans cette contribution, on va faire une vue transversale sur l'impact de L'IA qui peut également être utilisée pour prédire la réactivité des composés organiques. Les chimistes organiques utilisent souvent des méthodes expérimentales pour mesurer la réactivité des composés organiques, mais ces méthodes peuvent être coûteuses et chronophages. L'IA peut aider à prédire la réactivité des composés organiques avec une grande précision, ce qui peut permettre aux chimistes organiques de concevoir de nouveaux composés plus rapidement et plus efficacement. L'IA peut être utile est la synthèse de composés organiques. La synthèse de composés organiques est un processus complexe qui nécessite souvent l'utilisation de plusieurs réactifs et conditions de réaction différentes. L'IA peut être utilisée pour prédire les conditions de réaction optimales pour synthétiser un composé organique particulier, ce qui peut aider à réduire le temps et les coûts associés à la synthèse de nouveaux composés.

Keywords: chimie organique, L'intelligence artificielle, prédiction, molécule médicale.

POSTERS

Mathematical modeling of a fractal contact law in granular materials

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Abstract: In this paper, we study a dense elastic network generated by an Apollonian loading of granular material in R ! [1]. We suppose the discs are compressed together to generate tiny straight contact regions with perfect attachment on thinner sections [2]. The goal is to use Γ-convergence methods to investigate the structure's asymptotic behavior in respect to a parameter characterizing the thickness of the perfect contact lines between the materials [3, 4]. On the resultant residual fractal interface, we get an effective limit condition that represents the potential elastic energy of this balancing network under external stresses.

Keywords: Elastic material, boundary layers, Γ-convergence, fractal interface

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Discrete superconvergent degenerate kernel method for Fredholm integral equations

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Abstract: Approximate solutions of integral equations using methods related to an interpolatory projection involve many integrals which need to be evaluated using a numerical quadrature formula. In this paper, we pro- pose the discrete version of the superconvergent degenerate kernel method for solving Fredholm integral equation of the second kind with a smooth kernel. Using sufficiently accurate numerical quadrature rule, we obtain optimal convergence rates for both approximated solution and iterated discrete solution. Nu- merical results are presented to illustrate the theoretical estimates for the error of this method.

Keywords: Degenerate kernel method, Interpolatory projection, Gauss points, Nyström approximation.

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Identification And Equalization Of Transmission Channel Using RKHS

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Abstract: The subject matter of the article is to identify and equalize the parameters of telecommunication channels. The goal is to develop a new mathematical approach based on positive definite kernels on a Hilbert space. The tasks to be solved are: to formulate a mathematical procedure based on kernels. A kernel is a function that maps pairs of data points to a scalar value, and positive definite kernels are widely used in machine learning and signal processing applications. The next task is to identify the channel parameters using the proposed method. The final task is to apply the Zero Forcing and MMSE equalizer to measure the performance of the proposed system. This article introduces a new method to address the problem of supervised identification of transmission channel parameters based on the positive definite kernel on Hilbert space, which implements Gaussian kernels. The input sequence, used as input for a system or process, is assumed to be independent, have a zero mean, a non-Gaussian distribution, and be identically distributed. These assumptions are made to simplify analysis and modeling. The proposed method for estimating the parameters of the channel impulse response yields promising results, indicating that the estimated parameters are close to the measured parameters of the model for various channels. The convergence of the estimated parameters towards the measured parameters of the model is particularly noticeable for BRAN A (indoor) and BRAN E (outdoor) channels. The method has been tested with different channel models, and the results remain consistent. Overall, the proposed method appears to be a reliable and effective approach for estimating channel impulse response parameters. The accuracy of the estimated parameters is particularly noteworthy in light of the challenges inherent in modeling wireless channels, which can be influenced by a variety of factors such as obstacles and interference. These findings have important implications for the design and optimization of wireless communication systems. Accurate estimates of channel impulse response parameters are essential for predicting and mitigating the effects of channel distortion and interference, and the proposed method represents a promising tool for achieving this goal. Further research and testing are needed to validate and refine the method and to explore its potential applications in different settings and scenarios. We evaluated the performance of the system using the estimated parameters obtained from the proposed method. Two equalizers, MMSE and ZF, were used, and the results show that MMSE outperforms ZF. Both equalizers produced highly satisfactory outcomes.

Keywords: telecommunication channel, BRAN, Zero Forcing, MMSE, identification, equalizers.

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Sentiment Analysis And Prediction Of Polarity Covid'19 Vaccines Based On Twitter Data Using Deep NLP Techniques

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Abstract: The global impact of COVID-19 has been significant and several vaccines have been developed to combat this virus. However, these vaccines have varying levels of efficacy and effectiveness in preventing illness and providing immunity. As the world continues to grapple with the ongoing pandemic, the development and distribution of effective vaccines remains a top priority, making monitoring prevention strategies mandatory and necessary to mitigate the spread of the disease. These vaccines have raised a huge debate on social networks and in the media about their effectiveness and secondary effects. This has generated big data, requiring intelligent tools capable of analyzing these data in depth and extracting the underlying knowledge and feelings. There is a scarcity of works that analyze feelings and the prediction of these feelings based on their estimated polarities at the same time. In this work, first, we use big data and Natural Language Processing (NLP) tools to extract the entities expressed in tweets about AstraZeneca and Pfizer and estimate their polarities; second, we use a Long Short-Term Memory (LSTM) neural network to predict the polarities of these two vaccines in the future. To ensure parallel data treatment for largescale processing via clustered systems, we use the Apache Spark Framework (ASF) which enables the treatment of massive amounts of data in a distributed way. Results showed that the Pfizer vaccine is more popular and trustworthy than AstraZeneca. Additionally, according to the predictions generated by Long Short-Term Memory (LSTM) model, it is likely that Pfizer will continue to maintain its strong market position in the foreseeable future. These predictive analytics, which uses advanced machine learning techniques, have proven to be accurate in forecasting trends and identifying patterns in data. As such, we have confidence in the LSTM's prediction of Pfizer's ongoing dominance in the industry.

Keywords: Natural Language Processing (NLP); Machine learning; Big Data; COVID-19; Sentiment analysis; Prediction; Vaccines; Long short-term memory (LSTM); Apache Spark Framework (ASF).

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Based 3D shape retrieval using deep leanring & GPU

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Abstract: TThis work presents a comprehensive system for content-based 3D shape retrieval that leverages deep learning and GPU resources to improve relevance and speed. The system employs a Convolutional Neural Network (CNN) to index shapes and generate descriptors for each 3D object, which are then used to predict a list of matching models, avoiding the need for a sequential comparison with all models in the database. Moreover, we explore the potential of GPU computing resources to accelerate shape matching process. The proposed system is evaluated against state-of-the-art techniques using the Shape Retrieval Contest 2017 (SHREC'17) event specifications and ShapeNetCore subset data. Experimental results demonstrate that the proposed approach significantly enhances relevance and retrieval time compared to existing methods.

Keywords: CBR, 3D shape, IA, deep learning, GPU.

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Numerical study of a fluid bubble bifurcation by analytic continuation

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Abstract: AThe main purpose in this paper is the investigation of axisymmetric shapes of a deformable bubble in a uniform fluid flow. We use a domain perturbation method which consists in taking as principal unknown a transformation field from the initial known position of the bub- ble to the unknown position depending on a positive parameter corresponding here to the Weber number. Velocity and pressure solution for the flow, and the shape of the bubble are determined in terms of series expansion in power of the Weber number. Bifurcation and turning points are located by applying a special type of Hermite Padé approximation.

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Amélioration des Générateurs des Nombres Pseudo-aléatoires

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Abstract: La technologie RFID (Radio Frequency Identification) utilise une communication basée sur des nombres aléatoires, généralement générés à l'aide de générateurs de nombres pseudo- aléatoires (PRNG)[1, 6, 7]. Les PRNG génèrent une séquence de nombres qui semblent être aléatoires mais qui sont en fait déterministes, basés sur une valeur de départ initiale. En cryptographie, les clés de chiffrement et de déchiffrement sont également généralement générées à l'aide de PRNG. Cependant, au lieu d'utiliser GA (Genetic Algorithm) pour trouver les clés, les algorithmes cryptographiques utilisent d'autres techniques telles que les protocoles d'échange de clés[2,3], les fonctions de dérivation de clés ou les générateurs de nombres aléatoires avec des sources à haute entropie. Il est important de noter que la sécurité des systèmes cryptographiques dépend fortement de la qualité des nombres aléatoires utilisés pour générer des clés et d'autres paramètres[4,5]. Par conséquent, des tests statistiques rigoureux sont nécessaires pour s'assurer que les nombres aléatoires utilisés sont vraiment aléatoires et non biaisés de quelque manière que ce soit. Cinq tests statistiques peuvent ne pas être suffisants pour garantir la qualité des clés aléatoires générées par GA, et des tests plus complets peuvent être nécessaires pour garantir la sécurité du système cryptographique.

Keywords: Tests Statistiques, établissement des clés, PRNG, RFID Technologies.

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Genetic Algorithm with immigration strategy for Fixed Charge Transportation Problem (FCTP)

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Abstract: The Fixed Cost Transport Problem (FCTP) is a combinatorial optimization problem that belongs to the class of NP-hard problems. It involves deciding how to transport goods from a set of suppliers to a set of customers while minimizing the total transportation cost subject to capacity constraints and other operational constraints. In this paper, we present the Dragonfly Algorithm DA as a new approach to optimization that takes inspiration from nature and can be tailored to suit different optimization problems. To evaluate its effectiveness, we conducted a comparative study with other metaheuristic methods using the FCTP problem instances. The numerical results indicate that the DA-based approach outperforms the other methods in terms of efficiency, while producing results that are similar to those obtained using the existing methods employed for the FCTP problem.

Keywords: Keyword1; Combinatorial Optimization; Genetic Algorithm; Fixed Charge Transportation Problem; Immigration strategy.

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On a class of p-fractional Kirchhoff-type equations

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Abstract: This work deals with a p-fractional Kirchhoff-type equation with critical exponent, By transforming the equation into an equivalent system, we establish the existence of at least one nontrivial solution or two nontrivial solutions without the well-known Ambrosetti- Rabinowitz (AR) condition. Furthermore, the nonexistence case is also treated. Our result extends and completes the recent works in the literature.

Keywords: Degenerate kernel method, Interpolatory projection, Gauss points, Nyström approximation.

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Revolution-bump and extrusion-bump mapping

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Abstract: Generating 3D computer-rendered surfaces has always been a daunting task in the field of computer graphics, especially when it comes to representing vast landscapes with intricate surfaces in real-time. Revolution-bump mapping and extrusion-bump mapping, which are an image-based modeling and rendering techniques that generates convincing revolved and extruded surfaces without polygonization effects. Although this tow techniques produce satisfactory results in terms of interactivity and visual quality. The main issue with these two techniques is that the revolved or extruded models are only rendered with an illusion of micro-reliefs. Additionally, these techniques do not take into account the treatment of the silhouette at the edges of the 3D object.

Keywords: revolution-bump mapping; extrusion-bump mapping; image-based modeling and rendering technique; computer graphic.

Modélisation de la conduction thermique non linéaire avec effet de rayonnement

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Abstract: Le couplage thermique conduction-rayonnement lors du transfert de la chaleur dans les plaques joue un rôle essentiel dans diverses applications tels que technologiques dans la construction du bâtiment, les moteurs thermiques et la production de l'énergie solaire, etc. Notre objectif est de résoudre numériquement le problème de conduction non linéaire avec un terme source sur une plaque métallique rectangulaire couplé avec le rayonnement utilisant la méthode des éléments finis (MEF) pour différentes valeurs du paramètre de conductivité non linéaire avec des valeurs de température bien définies pour les bords et au centre de la plaque.

Keywords: Elastic material, boundary layers, Γ-convergence, fractal interface

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