Second National Mathematics Seminar 2021

Wednesday June 2, 2021

Bloc 500 Places "Tidijani Haddam"

Central Camps - **Freres Mentouri University**- Constantine, Algeria.

الجمهوريـــة الجزائريـــة الديمقراطيـــــة الشعبيـــة
Pople's Democratic Republic of Algeria
وزارة التعليم العالي و البحث العلمي
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جامعة الاخوة منتوري – قسنطينة
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كلية العلوم الدقيقة – قسم الرياضيات
Department of Mathematics, Faculty of Exact Sciences
مخبر الرياضيات التطبيقية والنمذجة
Applied Mathematics and Modeling Laboratory

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Program

08h00-08h30	Registrations
08h30-08h45	Official opening by the Rector of The Freres Mentouri Constantine 1 University, Professor Toufik BOUFENDI.
08h45-09h15	Conference Plenary: "*Introduction to the notion of Distributions*" presented by Professor Abdelhamid AYADI. (Page 1)
09h15-09h45	Poster session 1 & Coffee-Break.
10h00-12h00	Starting of the different Workshops. (Page 2, 15, 28, 41 and 54)
13h00-15h00	Afternoon sessions for the programmed workshops.
15h00-15h30	Poster session 2 & Coffee-Break.
16h00	Closure and distribution of the participation attestation.

Conference Plenary
Introduction to the notion of Distributions

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Abstract. Distributions are a ubiquitous tool of all the disciplines where one can use a mathematical formalism. We cite for example, fluidmecanics, quantummecanics, biology, signalprocessing, ...
In this talk we will give the motivation to build the theory of distributions.This notion is based on the generalization of the notion of functions.

Workshop 1

Tempered generalised functions type

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Abstract: *the aim of this communication is to present a general method of construction of generalized function algebras of coloumbeau type in order to define a generalized function algebra which contains tempered ultradistributions*

Key Words: *colombeau generalized functions,tempered distribution,tempered ultradistribution*

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A study of existence to positive solutions for p-Laplacian boundary value problems of fractional differential equations

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Abstract: *In this manuscript, we deal with a study of the existence and the multiplicity of ρ_1-concave positive solutions for a boundary value of two-sided fractional differential equations involving generalized-Caputo fractional derivatives. An application of a functional analysis tools, more specifically, we using some fixed point theorems and under some additional assumptions, some of important results have been proven and we obtain the existence of at least one solution.*

Key Words: *Fractional differential equations; Caputo-Katugampola (CK) fractional type; boundary value problem; fixed point theorems; Positive solutions.*

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An existence theorem of a nonlinear filtration problem through a porous medium

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Abstract: Let Ω be a bounded domain in $\mathbb{R}^n (n \geq 2)$, which represents a porous medium with locally Lipschitz boundary $\partial\Omega$, $T \in (0, +\infty)$, $Q = \Omega \times (0, T)$, $(x, t) = (x_1, ..., x_n, t)$ be a generic point of Q and $\varphi \in C_x^{0,1} \cap C_t^1$ be a nonnegative function defined in $\overline{Q}$. The boundary $\partial\Omega$ is divided into a nonempty relatively open subset Γ_2 which represents the pervious part in contact with the fluid or air and an impervious part Γ_1. We consider the following filtration problem related to a compressible flow governed by a nonlinear Darcy's law (see [1]):

$$\begin{cases} \text{Find } (u, g) \in (L^q(0, T; W^{1,q}(\Omega)) \cap L^{q'}(Q)) \times L^\infty(Q) \text{ such that :} \\ \quad u \geq x_n,\ 0 \leq g \leq 1,\ g(u - x_n) = 0 \quad \text{a.e. in } Q \\ \quad u = \psi \quad \text{on } \Sigma_2 \\ \quad \displaystyle\int_Q \left[\big(\mathcal{A}(x, \nabla u) - g\mathcal{A}(x, e)\big) \cdot \nabla\xi + (g - u)\xi_t \right] dxdt \leq \int_\Omega (u_0(x) - g_0(x))\xi(x, 0)\, dx \\ \quad \forall \xi \in W^{1,q}(Q),\ \xi = 0 \text{ on } \Sigma_3,\ \xi \geq 0 \text{ on } \Sigma_4,\ \xi(x, T) = 0 \text{ for a.e. } x \in \Omega, \end{cases}$$

where $\psi = \varphi + x_n$, q' is the conjugate exponent of q, $\Sigma_2 = \Gamma_2 \times (0, T)$, $\Sigma_3 = \Sigma_2 \cap \{\varphi > 0\}$, $\Sigma_4 = \Sigma_2 \cap \{\varphi = 0\}$, $e = (0, ..., 0, 1) \in \mathbb{R}^n$, $\mathcal{A} : \Omega \times \mathbb{R}^n \to \mathbb{R}^n$ is a vector function and u_0, g_0 are functions of the variable x. We prove the existence of a solution for this problem using convenient regularized problem and Schauder fixed point theorem.

Key Words: Filtration problem; compressible fluid; nonlinear Darcy's law; regularized problem; Schauder fixed point; existence.

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A trace result for Sobolev extension domains

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Abstract: *This presentation concerns a work, cf. [1], whose object is the study of the validity of the trace theorem in domains with less boundary regularity than what is usually considered in most of the mathematical analysis literature. Precisely, we establish the existence and continuity of a trace operator, for functions of the Sobolev space $W^{1,p}(\Omega)$ with $1 < p < \infty$, on the boundary of a domain Ω which only possesses the Sobolev $W^{1,p}-$extension property. First, we prove the result for functions of the subspace of the up to boundary smooth functions by using a uniform estimate. The essential ingredients used in the proof of this estimate are Green's representation of a function on a disk as well as Banach's isomorphism theorem. Finally, we conclude the trace result using the density of smooth functions in the space $W^{1,p}(\Omega)$. The presented proof fully exploits the extensibility hypothesis of the domain Ω. The relevance of the herein established result lies in the existence of extension domains which are not Lipschitz regular and under this point of view it constitutes a generalization of the usual trace theorem. It should be emphasized that trace-like results are, without contest, of fundamental importance, namely, for studying the well-posedness character of boundary value problems arising from mathematical modeling.*

Key Words: *Sobolev spaces; $W^{1,p}-$extension domains; Green representation; Trace inequality; Density of smooth functions.*

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Behavior of the solutions of some systems of non-integer differential equations

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Absrtact

This work is devoted to the generalization of certain theorems of comparisons known in the theory of ordinary differential equations,to systems of differential equations of fractional order.

Keywords : Fractional integral, Riemann-Liouville derivative, Caputo derivative, fractional differential system, differential inequality, integral inequality, comparison theorems.

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On the stability of a viscoelastic equation

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Abstract: *In this talk, we consider a viscoelastic equation with a nonlinear frictional damping and a relaxation function satisfying $g'(t) \leq -\xi(t)G(g(t))$. we establish an explicit and general decay rate results, using the multiplier method and some properties of the convex functions.*

Key Words: *Viscoelasticity; Optimal decay; Relaxation functions*

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On Solutions of a Nonlocal Boundary Value Problem with Integral Condition for Second Order Parabolic Equation

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Abstract: *The aim of this work is to prove the well posedness (i.e: existence, uniquenessand the continuous dependence on the initial conditions) of some posed linear andnonlinear mixed problems with integral conditions. First, an a priori estimate isestablished for the associated linear problem and the density of the operator rangegenerated by the considered problem is proved by using the functional analysismethod. Subsequently, by applying an iterative process based on the obtainedresults for the linear problem, the existence, uniqueness of the weak solution of thenonlinear problems is established.*

Key Words: *Energy inequality, Integral boundary conditions, Strong solution, weaksolution, Second order parabolic equation.*

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A nonlinear elasticity system in Sobolev spaces with variable exponents

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Abstract: *Several authors studied the system of elasticity with laws of particular behavior and using various techniques in constant exponents Sobolev spaces. In this work we consider a Dirichlet problem for nonlinear elasticity system with laws of general behavior. The coefficients of elasticity depends on x and the density of the volumetric forces depends on the displacement. We consider this problem as a Leray-Lions operator we treat this problem by the techniques of lions and the main aim of this paper is to apply Galerkin techniques and monotone operator theory to prove a theorem of existence and uniqueness.*

Key Words: *Existence and uniqueness, spaces of Lebesgue and Sobolev with variable exponents, Dirichlet problem, nonlinear elasticity system, operator of Leray-Lions..*

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On a nonlinear mixed problem for a parabolic equation with a nonlocal constraint

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Abstract: *The aim of this work is to prove the well posedness of some posed linear and nonlinear mixed problems with integral conditions defined only on parts of the considered boundary are combiened. First, we establish for the associated linear problem a priori estimate and prove that the range of the operator generated by the considered problem is dense by using the functional analysis method.Then by applying an iterative process based on the obtained results for the linear problem, we establish the existence, uniqueness and continuous dependence of the weak solution of the nonlinear*

Key Words: *Energy inequality, Integral boundary conditions, Strong solution,weak solution, Second order parabolic equation .*

References

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Existence and uniqueness for a nonlinear fractional differential equation With Nonlocal Condition

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Abstract: *In the literature, many researchers used the functional analysis method to investigate the well of initial boundary value problems for classical partial differential equations with nonlocal conditions[3]. For the case of the fractional equation with boundary conditions, only a few results are dealing with the existence and uniqueness of solutions such we cite, for example, the references [1, 2]. In this work, a nonlinear initial boundary value problem with nonlocal constraints of integral type for a Caputo time-fractional order equation is studied by applying the energy inequality method; we prove the existence, uniqueness and continuous dependence of a strong solution. We establish for the associated linear problem a priori estimate and prove that the range of the operator generated by the considered problem is dense. The technique of deriving the a priori estimate is based on constructing a suitable multiplicator. From the resulted energy estimate,it is possible to establish the solvability of the linear problem. Then, by applying an iterative process based on the obtained results for the linear problem, we establish the existence, uniqueness and continuous dependence of the weak solution of the nonlinear problem. The obtained results show the efficiency of this method to study the existence and uniqueness of solution for the time-fractional order differential equations with nonlocal conditions.*

Key Words: *Existence and uniqueness, a priori estimate, fractional derivatives and integrals, integral condition.*

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Reduced and Modified Differential Transform Methods for two – Dimensional Lane – Emden Type Equations

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Abstract

In this work, I study the linear and the nonlinear forms of two–dimensional Lane–Emden type equations. I use the reduced and modified differential transform methods to solvet hese equations with specified initial conditions. These differential transform methods are efficient toolsfor obtaining exact analytic solutions of two–dimensional singular nonlinear equations.

Keywords: *Two–dimensional Lane–Emden Equation; reduced Differential Transform Method; modified Differential Transform Method; Initial Value Problems.*

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Continuity of some pseudo-differential operators on Lizorkin-Triebel spaces

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Abstract: *We will establish the continuity of O.P.D of* $op^m_{1,0}(\omega,[s])$ *on Lisokin-Triebel-type spaces, where* ω *is a continuity module such that*

$$\Big(\sum_{m\geq 1}\Big(2^{sm}2^{-(1-\delta)mN}\omega(2^{-(1-\delta)m})\Big)^q\Big)^{1/q}<\infty. \tag{1}$$

Theorem *Let* $s\in\mathbb{R}^+\setminus\mathbb{N}, 1\leq p<\infty, 1\leq q\leq\infty, 0\leq\tau\leq 1/p$ *and* $m\geq 0$. *Let* ω *be a continuity module satisfing* (1). *Then, any O.P.D.* $op_\sigma\in op^m_{1,\delta}(\omega,[s])$ *is bounded from* $F^{s+m,\tau}_{p,q}$ *on* $F^{s,\tau}_{p,q}$.

Key Words: *Lizorkin-Triebel spaces, peusdo-differential operators*

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Workshop 2

Combination of the strong stability method and semi-parametric approach for the evaluation of ruin probability of a classical risk model

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Abstract: *This work focuses on the application of estimation and approximation methods for the analysis of risk models. Indeed, companies in the banking and insurance sector manage today significant risks of various kinds. It is therefore important to be able to decide on the choice of a measure for these risks. Furthermore, in the actuarial literature, the aim of ruin theory is to model the wealth of an insurance company by a stochastic process and to assess its probability of ruin. However, there is no explicit formula for its evaluation. In addition, the parameters governing these risk models are often unknown and can only be estimated with uncertainty. Consequently, one can only give a few bounds for their values. Hence, the interest of using approximation methods to assess the probability of ruin. In addition, we are often faced, in finance and insurance, with claims of unknow distribution. This type of distribution has the particularity of being defined on a bounded positive support on the one hand, and presents large claims (heavy tailed distribution) on the other hand. To remedy these problems, non-parametric and semi-parametric estimation methods are used. The technique which will be described in our work consists in estimating a distribution of loss in two stages. First we use a starting parametric distribution (the generalized Champernowne distribution) to estimate the initial data. The second step consists in applying to the sample resulting from the first step the estimator with asymmetric Beta kernel.*

Key Words: *Approximation, risk model, ruin probability, kernel method, Champernowne transformation.*

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Kernel regression estimator in the single functional index modelling

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Abstract:
In nonparametric regression framework with the high dimensional problem, this abstract is devoted to study the asymptotic behaviour of regression estimator of a scalar response Y on functional variable X. When the high dimensional causes many problems in nonparametric regression, we attempt to project the explanation of Y given X on one functional direction. In what follow, we present our model then we study the almost complete convergence and uniform almost complete convergence of the regression estimator in the single functional index modelling (denoted by : $\hat{m}_\theta$) under mild conditions.
We observe n pairs (X_i, Y_i) for $i = 1, ..., n$ identically distributed as (X, Y), this last is valude in $\mathcal{F} \times \mathbb{R}$, where $\mathcal{F}$ is a Hilbertian space and there exists a $\theta \in \Theta_{\mathcal{F}} \subset \mathcal{F}$ such that : $\mathbb{E}[Y|X] = \mathbb{E}[Y| < \theta, X >]$

$$\hat{m}_\theta(x) = \frac{\sum_{i=1}^{n} K(h^{-1}| < x - X_i, \theta > |)Y_i}{\sum_{i=1}^{n} K(h^{-1}| < x - X_i, \theta > |)}, with\ h : bandwidth, K : kernel function$$

Theorem 0.1 *under some assumption we get*

$$\hat{m}_\theta(x) - m_\theta(x) = O(h^b) + O_{a.co.}\left(\sqrt{\frac{\log n}{n\varphi_{\theta,x}(h)}}\right), b > 0, \mathbb{P}(| < X - x, \theta > | < h) := \varphi_{\theta,x}(h)$$

in order to establish the uniform almost complete convergence we have to take the following notions $S_{\mathcal{F}} \subset \cup_{k=1}^{d_n^{S_{\mathcal{F}}}} B(x_k, r_n)$, $\Theta_{\mathcal{F}} \subset \cup_{j=1}^{d_n^{\Theta_{\mathcal{F}}}} B(t_j, r_n)$ with, $k(x) = \arg \min_{k \in \{1,...,q_n^{S_{\mathcal{F}}}\}} ||x - x_k||$,
$k'(\theta) = \arg \min_{k' \in \{1,...,q_n^{\Theta_{\mathcal{F}}}\}} ||\theta - t_{k'}||$, with $(x_k, t_{k'}) \in \mathcal{F}^2$ and $r_n, q_n^{S_{\mathcal{F}}}, q_n^{\Theta_{\mathcal{F}}}$ are a sequences of positive real numbers and $B(x_k, r_n)$ (res, $B(t_j, r_n)$) the ball centered at x_k (res, t_j) with radius r_n.

Theorem 0.2 *under some assumption we have that*

$$\sup_{\theta \in \Theta_{\mathcal{F}}} \sup_{x \in S_{\mathcal{F}}} |\hat{m}_\theta(x) - m_\theta(x)| = O(h^b) + O_{a.co}\left(\sqrt{\frac{\log q_n^{S_{\mathcal{F}}} + \log q_n^{\Theta_{\mathcal{F}}}}{n\phi(h_K)}}\right)$$

Key Words: *Conditional single-index, Nonparametric estimation, regression function*

Estimation of the rate of recalls in the M /G/1 system with linear retrials.

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Abstract: *The objective of this work is the analysis of the M/G/1 retrial queue from a statistical point of view. More precisely, we are interested in estimating of the retrial rate by generalizing the works of Rodrigo (1998 and 2006) for ergodic case. Suppose that retrials are exponentially distributed, with linear policy. The estimator and its variance were obtained.*

Key Words: *Retrial queues, Statistical analysis, Orbit*

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HEAVY TAILED DISTRIBUTION FOR EXPONENTIALLY GROWING PROCESSES

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Abstract: *In this paper, we study the asymptotic distribution of exponentially growing processes in a random stopping time. Under hypothesis of the exponential growth of a positive random process, we prove that its asymtotic distribution in a random stopping time is a heavy tailed distribution. In particular, under some conditions the continuous time branching process in the supercritical case, is exponentially growing process, we prove also that its asymptotic ditribution in a random stopping time is a heavy tailed distribution.*

Key Words: *exponential growth, heavy tailed distribution, branching process.*

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Approximation and Stability Results in The G- Stochastic Control Problems

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Abstract: In the G-framework, we establish existence of an optimal stochastic relaxed control for stochastic differential equations driven by a G-Brownian motion (G-SDEs). We consider a control problem where the state variable is a solution of a G- SDE, we study the relaxed problem for which admissible controls are measure-valued processes. Using compactification techniques, we derive the first existence result of an optimal relaxed control for G- SDEs with uncontrolled diffusion coefficient. We prove that every diffusion process associated to a relaxed control is a strong limit of a sequence of diffusion processes associated to strict controls. As a consequence, we show that the strict and the relaxed control problems have the same value function and that an optimal relaxed control exists.

Key Words: Relaxed optimal control, G-chattering lemma, G-Brownian motion.
2010 Mathematics Subject Classification. 60H10, 60H07, 49N90.

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Bayesian modeling of patient recruitment in a clinical trial

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Abstract: We deal with the enrolment of patients in multi-centre clinical trial. The goal is to recruit N_f patients in a time T_c; C centres are open. Doing an on-going study at time $\widetilde{T}$,one wishes to predict the recruitment Time.
To this end, it is classical to model the recruitment processes of the centres by C independent Poisson processes $\left(N_t^i\right)_{t\geq 0}$,with respective rates λ_i.
Following Anismov (2008),we present a bayesian approach where the rates $(\lambda_{1,...,}\lambda_c)$ are seen as i.i.d.r.v of Gamma distibution with parameters α and β.
At some interim time $\widetilde{T}$, the parameters are estimated via the maximum likelihood technique, then used to predict the recruitment time.We give the distributions of both the number of enrolled patients at some time $t \geq \widetilde{T}$, and of the time $\widetilde{T}$ needed to recruit N_f patients. We also give a method for adaptative adjustment of the recruitment process.
An asymptotic confidence region is given for the estimated parameters $(\widetilde{\alpha},\widetilde{\beta}$) and the impact on the predictions of the error made on parameters.
Finally, an extension of this model is proposed when the opening dates of entres are unknown; they are then supposed uniformly distributed in some interval depending on the first inclusion time of each centre. The model is tested on real data.

Key Words: Clinical trials,Recruitment time,Bayesian statistics,Poisson process,Maximum Likelihood Estimation,Sensitivity analysis.

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Model Selection and Complexity: From Likelihood to Information-Type Criteria

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Abstract: Model selection is a crucial step in statistics. Statistical inference makes predictions on data by fitting parametric or nonparametric models. Nevertheless, we do not identify a unique model that is suitable for any given data, but a class of models. In this paper, we show how the likelihood (or the log-likelihood) considered as a choice criterion, is used in selecting a parameterized statistical model among a class of identified candidate models. We study the cases where the models are nested or not, and show to what extent the likelihood approach remains valid. The inadequacy of the likelihood when measuring the model fitting is then corrected by a penalization term depending on the sample size and the free parameters of the model, giving the penalized-likelihood where the number of parameters (complexity) of the model appears explicitly. Statistical models in competition are given a valeu, say an information criterion. We choose the model with the best criterion. According to the penalization terms, we compare and discuss the performance of the widely used information-type criteria.

Keywords: *Model selection, Likelihood, Penalization term, Penalized-likelihood, Complexity, Information criterion.*

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BAYESIAN ESTIMATION OF A COMPETING RISK MODEL BASED ON WEIBULL AND EXPONENTIAL DISTRIBUTIONS UNDER RIGHT CENSORED DATA

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Abstract: *In this paper we investigate the estimation of the unknown parameters of a competing risk model based on a Weibull distributed decreasing failure rate and an exponentially distributed constant failure rate, under right censored data. The Bayes estimators and the corresponding risks are derived using various loss functions. Since the posterior analysis involves analytically intractable integrals, we propose a Monte-Carlo method to compute these estimators. Given initial values of the model parameters, the Maximum Likelihood estimators are computed using the Expectation-Maximization algorithm. Finally, we use Pitman's closeness criterion and integrated mean-square error to compare the performance of the Bayesian and the maximum likelihood estimators.*

Key Words: *Weibull model, Exponential model, right censored sample, Bayesian estimations, Expectation Maximisation algorithm, Markov chain Monte Carlo.*

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CLASSICAL M/G/1 QUEUE with PREEMPTIVE RESUME PRIORITY

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Abstract: *In this work, we consider a classical M/G/1 queue system with preemptive resume priority and two types of customers.In this System, any customer finding the server free immediately occupies the server and leaves the system after service completion. Any high priority customer finding the server occupied by the service of another high priority customer, take place in an infinite waiting line. A low priority customer finding the server occupied by the service of any type of customer lives the system. high priority customers have a preemptive priority over low priority customers. low priority customer whose service was interrupted by the arriving of high priority customers persists in the service station until the completion of high priority customers service to resume immediately his service again. For model under consideration, we give the generating function of steady-state distribution of the number of customers, by using the embedded Markov chain technique.*

Key Words: *Queue, Preemptive priority, Embedded markov chain, Ergodicity condition, Steady-state distribution.*

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PARAMETER ESTIMATION IN SEMIPARAMETRIC MODELS VIA DIVERGENCES WITH CENSORED DATA

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Abstract: *Let X be a nonnegative random variable. We consider semiparametric models defined by moment condition equations, of the form $\mathbb{E}(g(X,\theta))=0$, where $\theta\in\Theta\subset\mathbb{R}^d$ is the parameter of interest and $g(\cdot,\cdot):=(g_1(\cdot,\cdot),\ldots,g_\ell(\cdot,\cdot))^\top\in\mathbb{R}^\ell$ is some known $\mathbb{R}^\ell$-valued function defined on $\mathbb{R}\times\Theta$. Denote by θ_T the true value of θ. We suppose that X is right censored by a nonnegative random variable R, independent of X. The observed variables are $Z:=\min(X,R)$ and $\Delta:=1_{\{X\leq R\}}$ ($1_{\{.\}}$ denotes the indicator function). Let $\varphi:\mathbb{R}\mapsto[0,+\infty]$ be a convex function such that its domain $dom_\varphi:=\{x\in\mathbb{R}/\varphi(x)<\infty\}$ is an interval with endpoints $a_\varphi<1<b_\varphi$. Denote by $\varphi^*(t):=\sup_{x\in\mathbb{R}}\{tx-\varphi(x)\}$ the Fenchel-Legendre transform of φ and let $\overline{g}:=(1_{\mathbb{R}\times\Theta},g_1,\ldots,g_\ell)^\top$. Following [1], we estimate θ_T by*

$$\widehat{\theta}_\varphi:=\arg\inf_{\theta\in\Theta}\sup_{t\in\Lambda_\theta^{(n)}}\left\{t_0-\sum_{i=1}^n\frac{\Delta_i}{n\,S_R^{(n)}(Z_i^-)}\,m(Z_i,\theta,t)\right\},$$

where $m(x,\theta,t):=\varphi^*(t^\top\overline{g}(x,\theta))$, for all $x\in\mathbb{R}$, $\theta\in\Theta\subset\mathbb{R}^d$, $t\in\mathbb{R}^{1+\ell}$, $\Lambda_\theta^{(n)}:=\{t\in\mathbb{R}^{1+\ell}/a_\varphi^*<t^\top\overline{g}(Z_i,\theta)<b_\varphi^*,\ \text{for all } i=1,\ldots,n \text{ with } \Delta_i=1\}$ and $S_R^{(n)}$ is the Kaplan-Meier estimate of the survival function of R (see [2]).
In this work, we prove the existence, the weak consistency and the asymptotic normality of the estimator $\widehat{\theta}_\varphi$.

Key Words: *Moment condition models, Divergences, Fenchel-Legendre transform, Censored data, Asymptotic normality*

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Spectral analysis for harmonizable random fields: structure and estimation

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Abstract: *In this paper, we attempt to shed light on the harmonizable random fields. So, in the first part, we present different representation for general harmonizable random fields. In the second part, we propose a general class of such estimators relying on an arbitrary weighting function and discuss their asymptotic properties in an unifying way. This estimators which is based on the taperd spatial periodogram and the spatial smoothed pseudo Wigner-Ville estimator, are shown to be special cases of the general class.*

Key Words: *Harmonizable random field, Wigner-Ville spectrum, Locally stationary*

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Existence and uniqueness of solution of coupled forward -backward stochastic differential equations driven by Teugels martingales

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Abstract: *We deal with a class of fully coupled forward-backward stochastic differential equations (FBSDEs), driven by Teugels martingales associated with a general Levy process. Under some assumptions on the derivatives of the coefficients, we prove the existence and uniqueness of a global solution on an arbitrarily large time interval.*

Key Words: *forward-backward stochastic differential equations, Teugels martingale, Levy process.*

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Workshop 3

Analytical solution for free vibration of piezoelectric nano-saft

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Abstract:

In recent years, smart materials have been widely used in industries. Smart materials are materials whose material properties are affected by external electric, thermal or magnetic fields. One of the most important types of smart materials is the piezoelectric material [1].
In our project we will take the case of a voltage generates a mechanical deformation. We will therefore take a piezoelectric nano-shaft guiding in rotation at both its ends and we apply a voltage to the upper and lower surface and we measure it in rotation.
We will deal with our problem with the theory of non-local elasticity which takes into account the scale effect because our problem is a nano-shaft that means a shaft at the nanometric scale and we take the model of the Bernoulli Euler beam before extracting the equations of motion using Hamilton's principle.
After extracting the equations of motion as well as the boundary conditions we will use the state space [2] method to solve our differential equations.
This method consists in transforming a differential equation of order raising to one of several first order differential equations before generating a matrix of size costs of the order of the differential equation and to find the solution we will introduce the exponential at the matrix and to compute exponential of the matrix one passes by the diagonalization of the latter and one works just with its eigenvalue and eigenvector

Key Words: piezoelectric nano-saft, free vibration, state space.

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Effective algorithms in global optimization and Numerical simulations.

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Abstract: Currently the global optimization is the only option capable of giving with precision and exactly the optimum for any real problem and more with the multiplicity and what constitutes an additional and major asset. Global optimization concerns, for example, mono-objective and multi-objective problems and bi-level (multi - level) problems with deterministic, stochastic and stochastic fuzzy parameters. So Global Optimization addresses any programming problem mathematical. the real problems in global optimization evolve in the space of dimension $n = 1$ or $n > 1$, but the gateways of passage from dimension $n = 1$ to dimension $n > 1$ or from dimension $n > 1$ to dimension $n = 1$ exist. The techniques of resolution have evolved enormously, so much so that the technique of Branch and Bound is found to compete by original modern techniques which gain much in the field of the algorithmic complexity. Our presentation is mainly focused on these original modern techniques.

Key Words: *Global optimization, αBB method, convexification, reformulation, separation, quadratic lower bound function, Branch and Bound, pruning method.*

1 Introduction

We consider the following problem

$$(P)\begin{cases} \min f(x) \\ x \in D \subset R^n \end{cases}$$

* / The functions to be treated are of any types.
* / We use any function (plolynomial, signomial ... etc.), with any combination of functions (sin, cos, exp, log, power.....).

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ADAPTIVE SYNCHRONIZATION OF BAM NEURAL NETWORKS WITH MIXED DELAYS

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Abstract: *In this work, we aim to study delayed bidirectional neural networks which include some known neural networks such as Hopfield neural networks, Cellular networks and many others [1]. Delays are detrimental to neurodynamic systems by causing oscillations, divergences and instabilities. Discrete delays are induced from the finite switching speed of amplifiers, while due to the existence of a multitude of parallel paths with axons of different sizes and lengths, neural networks usually have a spatial extent, and thus a distribution of propagation delays over a time interval occurs [2]. Therefore, the incorporation of mixed delays to systems is crucial in applications as well as in theory. On the othe hand, the synchronization criteria refers the conherency beween systems over time. This is perfectly applicable to secure communication, associative memory, and so forth [3]. Through the direct Lyapunov method, some analytical techniques, bounded and Lipschitz continuous activation functions, and adaptive feedback controllers, some sufficient conditions depending on the system parameters for deriving the asymptotic and exponential synchronization are obtained. Instead of the LMI approach used in the most existing literature and by using adaptive feedback controllers that are capable of improving conventional controllers, our sufficient conditions are simpler and succinct compared to the existing ones.*

Key Words: *Synchronization, bidirectional associative memory, discrete delay, distributed delay, adaptive controller*

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A fractional $p(x,\cdot)$-Laplacian problem involving a singular term

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Abstract: *We are going to study a class of singular problems involving the fractional $p(x,\cdot)$-Laplace operator of the form*

$$\begin{cases} (-\Delta)^s_{p(x,\cdot)}u(x) = \frac{\lambda}{u^{\gamma(x)}} + u^{q(x)-1} & \text{in } \Omega, \\ u > 0, \ \text{ in } \ \Omega \\ u = 0 \ \text{ on } \ \mathbb{R}^N \setminus \Omega, \end{cases}$$

where Ω is a smooth bounded domain in $\mathbb{R}^N$ ($N \geq 3$), $0 < s < 1$, λ is a positive parameter and $\gamma : \mathbb{R}^N \longrightarrow (0,1)$ is a continuous function, $p : \mathbb{R}^{2N} \longrightarrow (1,\infty)$ is a bounded, continuous and symmetric function, $q : \mathbb{R}^N \longrightarrow (1,\infty)$ is a continuous function. Using the direct method of minimization combined with the theory of fractional Sobolev spaces with variable exponents, we prove that the problem has one positive solution for $\lambda > 0$ small enough. To our best knowledge, this paper is one of the first attempts in the study of singular problems involving fractional $p(x,\cdot)$-Laplace operators.

Key Words: *Fractional $p(x,\cdot)$-Laplace operators; Singular equations; Minimization methods; Fractional Sobolev spaces.*

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Compactly supported radial basis functions for solving nonlinear functional Volterra-Fredholm integral equations

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Abstract: *The traditional basis functions, such as polynomials and trigonometric functions, are computationally expensive due to their dependency on geometric complexity. Instead radial basis functions are constructed in terms of one dimension distance variable and appear to have a clear edge over the traditional ones. RBFs method contains a free shape parameter that has a big effect on the accuracy of the method. However the optimal choice of the shape parameter is still until now an open topic for researchers, this can be considered as a drawback on the implementation of RBFs method. In this paper, a new approach based on the compactly supported radial basis functions (CSRBFs) interpolation method has employed to approximate the solution of functional nonlinear Volterra-Fredholm integral equations. The proposed method reduces the integral equation into algebraic equations via the Chebychev-Gauss-Lobatto points, and the shifted Gauss-Legendre quadrature formula. The convergence accuracy is guaranted by theorem 11.22 [7]. At the end Several numerical examples are presented to show the efficiency and the applicability of the proposed technique.*

Key Words: *Compactly supported radial basis functions (CSRBFs); Collocation method; Nonlinear ; Volterra-Fredholm integral equation; Legendre-Gauss-Lobatto nodes and weights; Chebychev-Gauss-Lobatto points.*

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FREQUENTIST OPERATING CHARACTERISTICS OF THE PREDICTION OF SATISFACTION DESIGN IN PHASE II CINICAL TRIALS

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Abstract: *Phase II clinical trials investigate whether a new drug or treatment has sufficient evidence of effectiveness against the disease under study. Multi-stage designs are popular for phase II since they can be stopped in the earlier stages, if the drug is ineffective. The implementation of the predictive stopping rules must allow flexible determination of the schedule of interim analyses. Since the use of such stopping rules materially affects the frequentist operating characteristics of the hypothesis test, it is necessary to choose an appropriate stopping rule during the planning of the study. In this paper, we study the use of the prediction of satisfaction as stopping rule in the implementation of phase II multi-stage clinical trials, which guarantees the type I error rate and plays a critical role in the sample size determination with respect to a prespecified power [2].*

Key Words: *Bayesian prediction, p-value, Index of satisfaction, Stopping rule, sequential analysis.*

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New fixed point results for F-contractions of Hardy-Rogers type in b-metric spaces with applications

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Abstract: *The purpose of this communication is to expose our project, when we introduced the notions of extended F-contraction of Hardy-Rogers type, extended F-contraction of Suzuki-Hardy-Rogers type and generalized F-weak contraction of Hardy-Rogers type and we established some new fixed point results for such kind of mappings in the setting of complete b-metric spaces. These fixed point results improve (and/or) extend those obtained in Vetro (Nonlinear Anal Model Control 21(4):531â546, 2016) and Lukacs and Kajanto (Fixed Point Theory 19(1):321â334, 2018) since some conditions made therein are removed or weakened.As an application of our results, we give the existence and uniqueness of solutions for certain functional, integral and differential equations.*

Key Words: *b-Metric space, contraction of Hardy-Rogers type, dynamic programming,F-contraction, fixed point, functional equations, integral equations, differential equations.*

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Parameter identification in elliptic boundary value problem

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Abstract: *We consider a nonlinear inverse problem which consists of identifying the parameter $a(x)$ in $1D$ elliptic problem:*

$$\begin{cases} -(a(x)u'(x))' + c(x)u(x) = f(x), \quad \text{for a.e } x \in]0,1[, \\ u(0) = u(1) = 0, \end{cases}$$

from distributed observation $Hu = u$.
We assume that $U_{ad} = \{a \in H^1(0,1),\ a(x) \geq a_0 > 0\}$, $c \in L^\infty(0,1)$ and $f \in L^2(0,1)$.
The algorithm of the reconstruction is based on the least squares method [1, 3]. We consider some numerical examples to show the effectiveness of the method. Finally, we consider the case of noisy observations $Hu = u + \eta$ where η is a the noise.

Key Words: *Inverse problem, Least squares method, Newton algorithm, Tikhonov regularization.*

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A dynamic piezoelectric contact problem with friction and damage

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Abstract: We consider a bilateral contact problem between an electro-elastic viscoplastic body with damage and an electrically conductive foundation. The process is dynamic and the contact is modelled with Tresca's friction law. We derive a variational formulation of the problem and, under a smallness assumption, we establish an existence and uniqueness theorem of a weak solution including a regularity result.

Key Words: Electro-elastic viscoplastic material, damage, dynamic process, Tresca's friction law, bilateral contact.

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Deriving the dynamical of a system from the corresponding results on the Lorenz system

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Abstract: *In this letter, we show that there is a coordinate transform that can convert some system to the Lorenz system, Therefore, the two systems are topologically equivalent, accordingly, all the dynamical behavior exhibited by this system is also present in the Lorenz system. Consequently, all the results obtained in the papers devoted to the study of this system can be trivially derived from the corresponding results on the Lorenz system.*

Key Words: *Lorenz system, coordinate transform, topological equivalence.*

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ITERATIVE CONTINUOUS COLLOCATION METHOD FOR SOLVING NONLINEAR VOLTERRA INTEGRAL AND INTEGRO-DIFFERENTIAL EQUATIONS .

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Abstract
This paper is concerned with the numerical solution of nonlinear Volterra integral (VIES) and integro-differential equations (VIDES). The main purpose of this work is to provide a new numerical approach based on the use
of iterative continuous collocation Lagrange polynomials for the numerical so- lution of nonlinear Volterra integral and integro-differential equations. It is
shown that this method is convergent. The results are compared with the
results obtained by other well-known numerical methods to prove the effec- tiveness of the presented algorithm

Key Words: *Iterative Continuous Collocation Method,nonlinear Volterra integral , integro-differential equations, Lagrange polynomials*

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An approximate solution by using an iterative collocation method for a class of nonlinearvolterra integral equation with weakly singular kernel.

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Abstract: *In this work, an iterative collocation method based on the use of Lagrange polynomials is developed for the numerical solution of a class of nonlinear weakly singular Volterra integral equations. The error analysis of the proposed numerical method is studied theoretically. Numerical illustrations confirm our theoretical analysis.*

Key Words: *Nonlinear weakly singular Volterra integral equation, Collocation method, Iterative Method, Lagrange polynomials.*

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Workshop 4

Injective edge coloring of hypercube and cubic Halin graphs

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Abstract: *Three edges e_1, e_2, and e_3 in a graph G are consecutive if they form a path (in this order) or a cycle of length three. An injective edge-coloring of a graph $G = (V, E)$ is a coloring c of the edges of G such that if e_1, e_2, and e_3 are consecutive edges in G, then $c(e_1) \neq c(e_3)$. In other words, every two edges at distance exactly 2 or belonging to a triangle do not use the same color. The injective chromatic index of G, denoted by $\chi'_i(G)$, is the minimum number of colors needed for an injective edge-coloring of G. This notion was introduced by Cardoso et al. [3] motivated by a packet radio network problem. They proved in [3] that computing $\chi'_i(G)$ of a graph G is NP-hard. In this talk, we show that every cubic Halin graph G has $\chi'_i(G) \leq 5$ and this bound is tight. We also present bounds for the injective chromatic index of cartesian product of graphs in terms of injective chromatic index of each factor. In particular, an upper bound of the injective chromatic index of the hypercube is given.*

Key Words: *Graph coloring, injective edge coloring, Halin graphs, hypercube.*

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Exploitation symmetries in circle packing

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Abstract: *The circle packing problem is one of the well studied problems in optimization. As a result, most solution methods contain an interesting symmetry which leads to the exploration of several symmetric states and sometimes even symmetric search sub-trees. However, it is not useful to find solutions that give the same results, as this takes up computing time and sometimes memory space. Thus, there are different methods to deal with symmetry among them the addition of constraints that eliminates some symmetric solutions. So-called symmetry breaking constraints. In this paper, we show an approach to breaking symmetries for the problem of packing equal circles in a given region.Which consists in the reformulation of the mathematical program so that certain symmetrical optima are infeasible.*

Key Words: *symmetry, circle packing, symmetry in circle packing*

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ON THE COEXISTENCE OF FSHFPS AND IFSHFPS BETWEEN WIDE CLASSES OF DYNAMICAL SYSTEMS

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Abstract: This paper presents new synchronization schemes, which assure the co-existence of the full-state hybrid function projective synchronization (FSHFPS) and the inverse full-state hybrid function projective synchronization (IFSHFPS) between wide classes of three-dimensional master systems and four-dimensional slave systems. In order to show the capability of co-existence approaches, numerical examples are reported, which illustrates the co-existence of FSHFPS and IFSHFPS between 3D chaotic system and 4D hyperchaotic system in different dimensions

Key Words:*chaos; full-state hybrid function projective synchronization; co-existence; Lyapunov stability.*

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On the 2-independence subdivision number ofgraphs

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Abstract : A subset S of vertices in a graph $G = (V, E)$ is 2-independent if every vertex of S has at most one neighbor in S. The 2-independence number is the maximum cardinality of a 2-independent set of G. In this paper, we initiate the study of the 2-independence subdivision number $\mathrm{sd}_{\beta_2}(G)$ defined as the minimum number of edges that must be subdivided (each edge in G can be subdivided at most once) in order to increase the 2-independence number. We first show that for every connected graph G of order at least three, $1 \leq \mathrm{sd}_{\beta_2}(G) \leq 2$, and we give a necessary and sufficient condition for graphs G attaining each bound. Moreover, restricted to the class of trees, we provide a constructive characterization of all trees T with $\mathrm{sd}_{\beta_2}(T) = 2$, and we show that such a characterization suggests an algorithm that determines whether a tree T has $\mathrm{sd}_{\beta_2}(T) = 2$ or $\mathrm{sd}_{\beta_2}(T) = 1$ in polynomial time.

Keywords: Trees, 2-independence, subdivision numbers.

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Stabilization of a vertical flexible pipe conveying fluid with end-mass

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Abstract: *In this work, we consider the pipes conveying fluid with harmonic velocity. Using Lyapunov's direct method, we establish the exponential decay result under a linear boundary control.*

Key Words: *pipes conveying fluid, exponential stability, Lyapunov's direct method, boundary control*

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ON THE MAXIMUM NUMBER OF PERIODIC SOLUTIONS OF A PLANAR DIFFERENTIAL SYSTEM

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Abstract: In this work, we study the maximum number of limit cycles bifurcating from the periodic solutions of $\ddot{x} + x = 0$, when we perturb this system as follows:

$$\begin{cases} \dot{x} = y, \\ \dot{y} = -x - \varepsilon(1 + R^m(\theta))\psi(x, y), \end{cases} \tag{1}$$

where $\varepsilon > 0$ is a small parameter, m is an arbitrary non-negative integer, $\psi(x, y)$ is a polynomial of degree $n \geq 1$ and $\theta = \arctan(\frac{y}{x})$ and R is a trigonometric function. We determine an upper bound for the maximum number of limit cycles in system (1) in the four cases where m and n are even and odd. The main tool used for proving this result is the averaging theory of first order.

Key Words: Periodic solution, averaging method, differential system.

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Global stability for a second-order quadratic rational difference equation

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Abstract: *We investigate the boundedness of solutions and the global stability of the positive fixed point for the quadratic rational difference equation*

$$x_{n+1} = ax_n + bx_{n-1} + \frac{\alpha x_n + \beta x_{n-1} + \gamma}{Ax_n + Bx_{n-1} + C}$$

with non-negative parameters and initial values. We obtain sufficient conditions that imply the global asymptotic stability of fixed point.

Key Words: *Difference equations, quadratic rational difference equations, global stability.*

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Some Properties of Bilinear Extremals

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Abstract: *In this paper, we study some properties of bilinear extremals in infinite dimensional case, these properties have a direct application in sub-Riemannian geometry, especially in the case of a sub-Riemanniann structure generated by a bilinear distribution. We prove also that, under some conditions a sub-Riemannian distance can be approximated by a normal geodesics. .*

Key Words: *sub-Riemnnain geometry, geodesics, Optimal control*

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Some existence results for a class of nonlinear fractional Langevin integro-differential equations

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Abstract: *This work is devoted to the study of nonlinear fractional Langevin integro-differential equations involving two fractional orders with boundary conditions. Some effective results about the existence and uniqueness are obtained by applying the Banach contraction mapping principle and the Schauder fixed point theorem. An example is presented which illustrates the effectiveness of the theoretical results.*

Key Words: *Fractional Langevin equation, Riemann-Liouville fractional derivative, Caputo fractional derivative, existence, uniqueness, fixed point.*

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INTEGRABILITY OF CUBIC KOLMOGOROV SYSTEMS

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Abstract: *In this work we charaterize the integrability of cubic kolmogolov systems of the form*

$$\begin{cases} x' = (p+x)\left(-2qy - x^2 - 3y^2 + aqx + axy\right), \\ y' = (q+y)\left(2px + 3x^2 + y^2 + apy + axy\right). \end{cases}$$

Where a,p,q are reals. Concret example exhibiting the applicability of our result is introduced.

Key Words: *Cubic kolmogorov systems, first integral.*

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Global Optimization Based on Bi-Linear Chaotic Search and Its Application to Nonlinear Problems

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Abstract: *A chaotic optimization method based on Bi-linear search is proposed. The properties of ergodicity, randomness and "regularity" of chaotic variables are used to escape from the local minima. Bi-Linear chaotic search can improve the local search and speed up the rate of convergence. The improved chaos optimization algorithm is used to a Nonlinear Problems, the numerical simulation results indicate that the convergence speed and accuracy of global optimization is significantly improved.*

Key Words: *chaos, global optimization, chaotic map.*

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A qualitative study of a class of cubic differential system

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Abstract: *In this work, we deal with a class of cubic differential system*

$$\begin{cases} \dot{x} = \beta x^3 + \frac{2}{h}(\alpha - \beta) x^2 y + \alpha x y^2 - hx - 2(\alpha - 1) y, \\ \dot{y} = \beta x^2 y + \frac{2}{h}(\alpha - \beta) x y^2 + \alpha y^3 + 2(\beta - 1) x - hy, \end{cases}$$

where the parameters α, β and h are nonzero real constants.
We determine the conditions on the parameters of this class to be integrable, then we give the exact expression of its first integral. The main tool used in this work is to transform the differential system into Bernoulli differential equation.

Key Words: *Integrable system, First integral, Bernoulli differential equation.*

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Workshop 5

Some para-Norden structures on the tangent bundle with deformed-Sasaki metric

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Abstract: In the present paper, we study some almost para Norden structures on the tangent bundle with the deformed-Sasaki metric and search conditions for these structures to be Para-Kähler and quasi-Para-Kähler.

Key Words: *Horizontal lift and vertical lift, tangent bundles, deformed-Sasaki Metric, almost para-complex structure, pure metric.*

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On the Legendre Curves on Lorentzian Heisenberg Space

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Abstract: *In this paper, we show that the Legendre curves on three-dimensional Lorentzian Heisenberg space (H_3, g) is locally ϕ-symmetric if and only if is a geodesic. Moreover we prove that the Legendre curves on three-dimensional Lorentzian Heisenberg space is biharmonic if and only if is a pseudo-helix.* In this communication we give definition of Locally ϕ-symmetric Legendre curves on Lorentzian Heisenberg space, and a theorem which proves that a Legendre curves on Lorentzian Heisenberg space is a locally ϕ-symmetric if and only if is a geodesic. Finaly we give definition of biharmonic Legendre curves on Lorentzian Heisenberg space and a theorem which proves that a Legendre curves on Lorentzian Heisenberg space is biharmonic if and only if is a pseudo-helix.

Key Words: *Legendre curves, Lorentzian Heisenberg space, biharmonic curves, locally ϕ-symmetric.*

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Characterization of $\mathcal{T}$-intuitionistic fuzzy ring

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Abstract

In this paper, we extend the notion of intuitionistic fuzzy ring of crisp ring to $\mathcal{T}$-intuitionistic fuzzy subrings of a crisp ring ($\mathcal{T}$-$IFSR$) where $\mathcal{T}$ is triangular intuitionistic fuzzy norm and we studied some of the characteristics resulting from this concept.

Mathematics Subject Classification: 03E72, 47A30, 13A99.
Keywords: Intuitionistic fuzzy ring, Intuitionistic fuzzy ideal, Intuitionistic fuzzy prime ideal, Intuitionistic fuzzy point.

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On the p-biharmonic submanifolds and stress p-bienergy tensors

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Abstract: In this paper, we consider p-biharmonic submanifolds of a space form. We give the necessary and sufficient conditions for a submanifold to be p-biharmonic in a space form. We present some new properties for the stress p-bienergy tensor.

Consider a smooth map $\varphi : (M, g) \longrightarrow (N, h)$ between Riemannian manifolds, and let $p \geq 2$, for any compact domain D of M the p-bienergy functional of φ is defined by

$$E_{2,p}(\varphi; D) = \frac{1}{2}\int_D |\tau_p(\varphi)|^2 v^g. \tag{1}$$

where $\tau_p(\varphi)$ is the p-tension field of φ (see [1, 3, 5]) and v^g is the volume element on (M, g). We say that φ is a p-biharmonic map if it is a critical point of the p-bienergy functional, that is to say, if it satisfies the Euler-Lagrange equation of the functional (1), that is (see [5])

$$\begin{aligned}\tau_{2,p}(\varphi) &= -|d\varphi|^{p-2}\,\mathrm{trace}_g\, R^N(\tau_p(\varphi), d\varphi)d\varphi - \mathrm{trace}_g\,\nabla^\varphi|d\varphi|^{p-2}\nabla^\varphi\tau_p(\varphi)\\ &\quad -(p-2)\,\mathrm{trace}_g\,\nabla < \nabla^\varphi\tau_p(\varphi), d\varphi > |d\varphi|^{p-4}d\varphi = 0.\end{aligned} \tag{2}$$

A submanifold in a Riemannian manifold is called a p-biharmonic submanifold if the isometric immersion defining the submanifold is a p-biharmonic map.

Key Words: *p-biharmonic submanifolds, stress p-bienergy tensors.*

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Existence of solutions belonging to a tube for non-convex sweeping processes

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Abstract: *We establish existence results of solutions belonging to a tube for non-convex sweeping processes. Our approach mainly combines features belonging to the class of prox-regular sets, sweeping processes associated with this type of sets and fixed point theorems techniques.*

Key Words: *differential inclusion; sweeping processes; solution-tube; prox-regular sets; fixed point theorems.*

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Cyclic Linear Codes over $\mathfrak{R} = \sum_{j=0}^{j=3} v_4^j \mathcal{A}_3$, where $v_4^4 = v_4$

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Abstract: *The purpose of this work is to investigate cyclic linear codes over the ring* $\mathfrak{R} = \sum_{j=0}^{j=3} v_4^j \mathcal{A}_3$ *such that* $\mathcal{A}_3 = \mathbb{Z}_{16}[v_1, v_2, v_3] / \langle v_1^2 = v_1, v_2^2 = v_2, v_3^2 = v_3 \rangle$ *with condition,* $v_i v_j = v_j v_i$ *for* $1 \leq i \leq 3$ *and* $v_4^4 = v_4$. *Cyclic Codes over rings have become an active research area in classical coding theory over the recent decades. The cyclic codes over finite rings remain a special topic of interest in the field of algebraic coding theory because of their relation to lattices, designs, cryptography, quantum codes and many applications [1] and [2]. Many articles [3] and [4] derived some properties corresponding to the cyclic linear codes over* $R = \mathbb{F}_p + u\mathbb{F}_p + v\mathbb{F}_p + uv\mathbb{F}_p$ *with* $u^2 = u, v^2 = v$ *and similar ones. Hence we are interested to examine the new structure of cyclic codes over* $\mathfrak{R} = \sum_{j=0}^{j=3} v_4^j \mathcal{A}_3$ *using main properties of this ring, we define cyclic linear codes over the ring* $\mathfrak{R} = \sum_{j=0}^{j=3} v_4^j \mathcal{A}_3$ *and the Gray map from* $\mathfrak{R}^n$ *to* $\mathbb{Z}_{16}^{24n}$ *of these codes.*

Key Words: *Cyclic codes over the ring, Idempotents, Commutative ring, Gray map.*

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A new efficient sampling method based on the Latin hypercubemethod.

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Abstract: *Many problems based on numerical simulation require a high precision of the output parameters, that requires the application of a more efficient simulation method. Different sampling techniques and alternative sampling methods to the MC method sometimes require a large sample size to obtain an adequate representation of the interest variable and the desired precision, sometimes going to thousands of observations to obtain such precision, that makes the procedure extremely expensive when the numerical model studied is more complex and of large dimension. Hence the need to find a method that give a more satisfactory results in a shorter time for a better representation of the studied model and a faster convergence of the estimates. This work proposes an alternative sampling method to Monte Carlo methods, based on LHS. This approach allows to accelerate the convergence, to reduce the risk of bias and gives a notable reduction in the variance of the estimator.*

Key Words: *Simulation; Monte Carlo Methods; Latin Hypercube ; bias ; Variance reduction; Estimation.*

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A ROLLING BEARING DATA ANALYSESBASED ON MINIMUM ENTROPY DECONVOLUTION

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Abstract:
In this work, we are concerned with the numerical analysis of the operation of asynchronous machine, which is one of the most widely used machines in the industry due to its robustness, reliability and low cost. Rolling element bearings are considered one of the most important components of such machine. Their monitoring is therefore essential for the correct operation of the machine. For this purpose, we apply a data analysis method, commonly used for bearing fault identification, based on Minimum Entropy Deconvolution (MED). The MED is designed to optimize the Finite Impulse Response (FIR) filter that eliminates the effect of the transmission path by minimizing the entropy of the filtered signal, to get a signal closer to the original impulse. It typically operates in combination with other signal processing techniques in order to improve its performance. The MED is tested and evaluated using real vibration measurements acquired from accelerometer sensors mounted on rolling bearings in operation.

Key Words: Monitoring, Minimum Entropy Deconvolution, Rolling Bearing, Vibration.

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Asymptotic properties of the estimators for periodic ARFIMA models

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Abstract: *We consider a fractionally differenced process driven by a periodically time varying long memory parameter, we assume under a sufficient condition that this process is invertible and causal when the periodic long memory parameter d(t) lie in (0,1/2). Our main focus is on estimation of the long memory parameter which varies over time, using the minimum Hellinger distance method. In fact, we have proved that this estimator is consistent and asymptotically normally distributed. To illustrate our theoretical asymptotic results, a simulation study is conducted.*

Key Words: *Periodic ARFIMA, Minimum Hellinger distance, Fractionally process, Estimation,Time-varying long memory parameter.*

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Mean-field G−Stochastic differential equations and their applications

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Abstract: In the space of sublinear expectation, we consider a mean-field stochastic differential equation driven by $G-$Brownian motion (MF $G-$SDEs in short) under model uncertainty, which is represented by ambiguity about the law. We prove the existence and uniqueness of solution of mean-field $G-$SDEs under some regularity conditions. Moreover, we give an application to the stochastic differential utility of mean-field type driven by $G-$Brownian motion and an example to illustrate the impact of volatility ambiguity.

Key Words: sublinear expectation, mean-field stochastic differential equations, model uncertainty, $G-$brownian motion.

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On the integrability of a class of quartic polynomial differential system

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Abstract: *One of the main problems in the theory of ordinary differential equation is the study of the existence of first integral of polynomial differential system.*
In this work, we are interested in the qualitative study of a class of quartic polynomial differential system

$$\begin{cases} \dot{x} = (4m+2p)x^4 + (4m+4n)x^3y + 2amx^3 + 2acx^2y^2 + 2anx^2y \\ \quad -(4n+8p-2ca)xy^3 - (2na+2pa-ca^2)xy^2 - 2py^4 - 2apy^3, \\ \dot{y} = 2px^4 + (4m+4p)x^3y + 2apx^3 + 4(m+n+p)x^2y^2 + 2amx^2y \\ \quad +(4p+2ca)xy^3 + (2na+4pa)xy^2 - (4n+6p-2ca)y^4 \\ \quad -(2na+2pa-ca^2)y^3, \end{cases} \tag{1}$$

where a, c, p, n and m are real constant with $p \neq 0$.
More precisely, we will show for certain conditions of parameters, this class is integrable, moreover, we give the exact expression of the first integral. We present an example of application and the phase portrait on the poincaré disc.

Key Words: *Quartic polynomial differential system, Integrability, First integral, Poincaré disc.*

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Feasible full-Newton step interior-point method for monotone LCP

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Abstract: *The paper presents a path-following full-Newton step interior-point algorithm for solving monotone linear complementarity problems (LCP). Under new choices of the defaults of the updating barrier parameter θ and the threshold τ which defines the size of the neighborhood of the central-path, we show that the short-step algorithm has the best-known polynomial complexity, namely, $\mathcal{O}(\sqrt{n}\log\frac{n}{\epsilon})$. Finally, some numerical results are reported to show the efficiency of our algorithm.*

Key Words: *Linear complementarity problem; Interior-point methods; Short-step algorithm; Polynomial complexity*

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