A class of fractional ψ-Hilfer hybrid differential equation: existence and attractivity of solution

Ayoub LOUAKAR
Laboratory of Applied Mathematics and Scientific Competing, Sultan Moulay Slimane University, Beni Mellal, Morocco

Ahmed KAJOUNI
Laboratory of Applied Mathematics and Scientific Competing, Sultan Moulay Slimane University, Beni Mellal, Morocco

Khalid HILAL
Laboratory of Applied Mathematics and Scientific Competing, Sultan Moulay Slimane University, Beni Mellal, Morocco

Hamid LMOU
Laboratory of Applied Mathematics and Scientific Competing, Sultan Moulay Slimane University, Beni Mellal, Morocco

Abstract
In this work, we present some results regarding the uniform locally attractivity and existence of solutions to some fractional ψ-Hilfer hybrid differential equation in Banach algebras. The results on the existence of solutions are predicated on hybrid fixed-point theory. We then establish the uniform local attractivity of all solutions.

Keywords: ψ-Hilfer fractional derivative; uniformly locally attractive; hybrid fixed-point theory.

A generalized fixed point of a contraction multi-valued maps in b-metric space and application Fredholm-type integral inclusion.

Ben.hssain Hamid
Moulay Ismail University – Morocco

Elbour Aziz
Moulay Ismail University – Morocco

El Haddouchi Abdelhak
Moulay Ismail University – Morocco

Abstract
In this work we are interested to prove a general fixed point theorem for a contraction multi-valued mappings in b-metric spaces. The results in this paper generalize the results obtained in an article and to obtain other particular results.

Keywords: metric space, fixed point, continuous, multi, valued maps, contraction multi, valued maps.

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A NEW VERSION FOR SOME PROPERTIES OF THE CONFORMABLE FRACTIONAL DERIVATIVE

SOPHIA BENTAHAR
Department of Mathematics, Ibn Tofaïl University, Kénitra

AZENNAR RADOUANE
Department of Mathematics, Ibn Tofaïl University, Kénitra

DRISS MENTAGUI
Department of Mathematics, Ibn Tofaïl University, Kénitra

Abstract
In this paper, some interesting results of real analysis are extended to the context of the fractional derivative using the definition of fractional derivative given by [6].

Keywords: Conformable Fractional Differentiable Function,mean value theorem, fractional differentiable functions.

A numerical 3D fluid-structure interaction model for blood flow in an atherosclerotic carotid artery

Oualid Kaf
Al Akhawayn Univesity Ifrane, School of Science and Engineering – Morocco

Abstract
Compelling evidence shows the association of inflammation with atherosclerosis diseases, one of the leading cause of mortality and morbidity worldwide. Recent research indicated that the inflammatory process of atherosclerotic lesions is involved in the progression of atherosclerotic plaques in specific regions, such as the carotid bifurcation, which represent a risk for ischemic stroke as a result of the interaction between the blood and the plaque. We start modeling using 3D idealized geometry in order to capture the most important features of such interactions. Then, we proceed to a partly patient-specific computational domain representing an atherosclerotic artery. Understanding such interactions is of paramount importance preventing the risk of the plaque rupture. The numerical results comparisons have shown that, qualitatively, there is an agreement between idealized atherosclerotic artery and patient-specific atherosclerotic carotid artery. The idealized carotid geometry will be useful in future FSI studies of hemodynamic indicators based on medical images.

Keywords: Atherosclerosis, blood flow, carotid bifurcation, fluid, structure interaction.

Accelerated Hager-Zhang Projection Method for Convex Constrained Monotone Nonlinear Equations with Application in Image Deblurring Problems

Abubakar Sani Halilu
Depatment of Mathematics, Sule Lamido University Kafin Hausa, Jigawa state, Nigeria. – Nigeria

Yunusa Aliyu Hadejia
Department of Mathematics, Sule Lamido University, Kafin Hausa, Nigeria – Nigeria

Yau Balarabe Musa
Department of Mathematics, Sule Lamido University, Kafin Hausa, Nigeria – Nigeria

Habibu Abdullahi
Department of Mathematics, Sule Lamido University, Kafin Hausa, Nigeria – Nigeria

Abstract
This paper presents a conjugate gradient method for solving constrained monotone nonlinear equations using the projection technique of Solodov and Svaiter (Kluwer Academic Publishers, (1998), pp. 355-369). The proposed approach is based on presenting a new value of the Hager-Zhang nonnegative parameter. This is accomplished by combining the conjugate gradient direction with the Newton technique. Furthermore, the Barzilai and Borwein (BB) update is employed as an acceleration parameter to approximate the Jacobian matrix. The proposed method is proven to be globally convergent under some mild conditions.

Keywords: BB parameters, CG method, Global Convergence, Image Restoration.

Analytical approach and Stability Results for a coupled system of ψ-Caputo fractional semilinear differential equations involving integral operator

Baihi Asmaa
Laboratory of Applied Mathematics and Scientific Computing, Sultan Moulay Slimane University, Beni Mellal, Morocco

Ahmed Kajouni
Laboratory of Applied Mathematics and Scientific Computing, Sultan Moulay Slimane University, Beni Mellal, Morocco

Khalid Hilal
Laboratory of Applied Mathematics and Scientific Computing, Sultan Moulay Slimane University, Beni Mellal, Morocco

Hamid Lmou
Laboratory of Applied Mathematics and Scientific Computing, Sultan Moulay Slimane University, Beni Mellal, Morocco

Abstract
In the present paper, we investigate the existence of solutions for coupled systems of ψ-Caputo semilinear fractional differential equations in Banach Spaces with starting conditions. The stability of the relevant solutions of the Ulam-Hyers (UH) type is discussed. To demonstrate the theoretical outcomes, an example is provided.

Keywords: Coupled Semilinear differential equations; ψ-Caputo differential derivatives; Mittag-Leffler-Ulam-Hyers stability.

Discrete energy behavior of a thermoelastic-Bresse system with second sound

Atika RADID
Département de Mathematiques et Informatique, FSAC-LMFA, University Hassan II, Casablanca, Morocco

Ali SMOUK
Département de Mathematiques et Informatique, FSAC-LMFA, University Hassan II, Casablanca, Morocco

Karim RHOFIR
LASTI-ENSA, Sultan Moulay Slimane University, Khouribga, Morocco

Abstract
Our contribution will consist in studying numerical method based on finite element discretization in the spacial variable x and finite difference schema in time of the linear one-dimensional thermoelastic Bresse system with second sound. We get some a priori error estimates and we present some numerical results which demostrate for the discrete energy under the different decay rate profiles. We study the behaviors of the discrete energy with respect to the system parameters and the initial data. Some numerical simulations will be given in order to validate the theoritical results.

Keywords: Bresse system, numerical approximation, Finite element method, numerical stability

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Existence of solutions and stability analysis of an epidemic model for COVID-19 with Hattaf fractal-fractional derivative

Hamza Elmamouni
Hassan II University of Casablanca. – Morocco

Khalid Hattaf
Hassan II University of Casablanca. – Morocco

Noura Yousfi
Hassan II University of Casablanca. – Morocco

Abstract
In this work, we study the existence of solutions and stability analysis of an epidemic model for COVID-19. The memory effect is described by a new Hattaf fractal-fractional derivative. The existence of solutions of the model is established by Krasnoselskii's fixed point theorem.

Keywords: COVID-19, SARS-CoV-2, Krasnoselskii's fixed point theorem, Hattaf fractal fractional derivative, numerical simulations.

Imposing Neumann or Robin boundary conditions through a penalization method: Application to population dynamics under climate change

Bouchra Bensiali
Centrale Casablanca, Complex Systems and Interactions Research Center, Ville Verte, Bouskoura 27182, Morocco

Jacques Liandrat
Aix-Marseille University, CNRS, I2M, UMR7373, Centrale Marseille, 13451 Marseille, France

Abstract
We will present an n-dimensional extension of a penalization method previously suggested for Neumann or Robin boundary conditions [1, 2]. The existence and uniqueness are obtained using Droniou's approach for non-coercive linear elliptic problems [3], and we develop a boundary layer approach [4, 5] to establish the convergence of the penalization method. Next, we present two-dimensional numerical examples using adequate schemes suitable for advection dominated problems. Finally, we outline the application of this method to the simulation of population dynamics under climate change [6, 7].

Keywords: Fictitious domain method, Penalization, Neumann or Robin boundary conditions, Boundary layer, Population dynamics, Climate change

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Mathematical biology and interdisciplinarity in mathematics education

Nabila Beqqali
Equipe de Recherche en Modélisation et Enseignement des Mathématiques (ERMEM), Centre Régional des Métiers de l'Education et de la Formation (CRMEF), 20340 Derb Ghalef, Casablanca, Morocco
Laboratory of Analysis, Modeling and Simulation (LAMS), Faculty of Sciences Ben M'Scik, Hassan II University of Casablanca, P.O Box 7955 Sidi Othman, Casablanca, Morocco

Khalid Hattaf
Equipe de Recherche en Modélisation et Enseignement des Mathématiques (ERMEM), Centre Régional des Métiers de l'Education et de la Formation (CRMEF), 20340 Derb Ghalef, Casablanca, Morocco
Laboratory of Analysis, Modeling and Simulation (LAMS), Faculty of Sciences Ben M'Scik, Hassan II University of Casablanca, P.O Box 7955 Sidi Othman, Casablanca, Morocco

Naceur Achtaich
Laboratory of Analysis, Modeling and Simulation (LAMS), Faculty of Sciences Ben M'Scik, Hassan II University of Casablanca, P.O Box 7955 Sidi Othman, Casablanca, Morocco

Abstract
Mathematical biology is an interdisciplinary area that does not obey the traditional classification of scientific research categories. It allows, thanks to the interconnection between mathematics and biology, to have the combined perspectives necessary to face the complexity of situations and problems arising from biology. In this work, we are interested in the interdisciplinarity between mathematics and biology in Moroccan education by investigating biology in high school mathematics programs, case of the second year of baccalaureate, life and earth sciences option. We first seek in educational guidelines the place occupied by interdisciplinarity and the mathematical applications in biology. Moreover, we analyse the textbooks. According to the research results, biology is not sufficiently taken into consideration in the mathematics programs of the 2nd year of baccalaureate, life and earth sciences option.

Keywords: Biology, interdisciplinarity, mathematics education, pedagogical guidelines, textbooks.

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Necessary and sufficient condition of exponential stabilization for a class of distributed second order semilinear delayed systems

A. Delbouh
CRMEF, Dakhla Oued Eddahab, Morocco

A. Tsouli
ENSAM, Hassan II University, Casablanca, Morocco

M. Ouarit
FSAC, Hassan II University, Casablanca, Morocco

Abstract
This paper discusses the problem of exponential stabilization for a class of distributed semilinear second order delayed systems. A necessary and sufficent condition is given. Some illustrated examples are given.

Keywords: Distributed second order semilinear systems, Exponential stabilization, Necessary and sufficent condition, Time delay.

NEW FOURTH-ORDER TWO-STEP ITERATIVE METHOD FOR SOLVING NONLINEAR EQUATIONS.

YAU BALARABE MUSA
Department of Mathematics and computer Sciences, Faculty of Natural and Applied Science, Sule Lamido University, Kafin Hausa, Jigawa, Nigeria

MUHAMMAD YUSUF WAZIRI
Department of Mathematical Sciences, Faculty of physical Science , Bayero University Kano, Kano, Nigeria.

ABUBAKAR SANI HALILU.
Department of Mathematics, Sule Lamido University Kafin-Hausa, Jigawa, Nigeria

Abstract
In this paper, we present a new iterative method for solving nonlinear equations. The efficiency of the proposed technique was achieved by convex combination of any two subsequent iterates, x_n and x_{n+1}. Using this combination and for a suitable $t_n \in [0,1]$, which is obtained iteratively, the the simple root of the function is easily found. The method is compared with similar iterative techniques and in terms of less number of iteration and cpu-time, our proposed algorithm competes efficiently. The convergence properties are also presented. In almost all the numerical performances conducted on some benchmark problems, the proposed algorithm has shown that is highly robust.

Keywords: Nonlinear equations. Iterative method. Convex set. Error equation.

Nonlinear parabolic problems with two lower order terms and data measure

YIsmail Haddani
Laboratory MAIS, Department of Mathematics, Faculty of Sciences and Techniques, Moulay Ismaıl University of Meknes, P.O. Box 509 Boutalamine, Errachidia 52000. – Morocco

Sidi Mohamed Douiri
Laboratory MAIS, Department of Mathematics, Faculty of Sciences and Techniques, Moulay Ismaıl University of Meknes, P.O. Box 509 Boutalamine, Errachidia 52000. – Morocco

Mustafa Ait Khellou
Department of Sciences, Higher Normal School, Moulay Ismail University of Meknes, P.O.Box 3104, Toulal, Meknes 50000, Morocco – Morocco

Abstract
In this research, we study the existence of solutions for nonlinear parabolic equations with measure data in the framework of Musielak spaces involving Leray-Lions operator acting from $W\hat{}1, x0L\phi(Q)$ to its dual and two lower order terms.

Keywords: Lower order term, Musielak, Sobolev spaces, Parabolic equations, Natural growth.

Optimal polynomial approximation

El-khalf Kaoutar
Department of Mathematics, Faculty of sciences Moulay Ismail, Morocco

Abstract
Let $E_n^{\alpha}(f)$ denote the error of best approximation by polynomials of degree at most n in the space $L^2(\mu_\alpha, I)$ where μ_α is the probability measure on $I = [-1;1]$ defined by $\mu_\alpha : C_\alpha(1-x^2)^{\frac{\alpha}{2}-1}$ for $\alpha > 0$. In this paper our target is to give an estimation of $E_n^{\alpha}(f)$ in terms of the error of best approximation for higher derivatives of f in Sobolev spaces.

Keywords: Heat semigroup,Ultraspherical polynomials,Poincaré inequality, Soboles spaces.

PERTURBED NONLINEAR PARABOLIC-ELLIPTIC SYSTEM IN GENERALIZED-ORLICZ-SOBOLEV SPACES

Elarabi Rabab
Equipe EDP et calcul scientifique, laboratoire de mathématiques et leurs interactions, Faculté des Sciences, Moulay Ismail University, Meknes – Morocco

Abstract
In this work, we investigate the existence of a capacity solution for a coupled parabolic-elliptic system. This system describes the evolution of temperature u and electric potential ϕ in a semiconductor material. The equations involve nonlinearity g, a divergence constraint on ϕ, and specific boundary and initial conditions. We apply this study to generalized Orlicz spaces, which may not be reflexive. The nonlinearity g adheres to natural growth and sign conditions.

Keywords: Thermistor problem, Perturbed coulpled system, Capacity solutions, nonlinear parabolic, elliptic equations, Orlicz, Sobolev spaces.

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Regional controllability of Caputo fractional-order linear systems with control delay

Touria Karite
ENSAF – Morocco

Abstract

We investigate the regional controllability problem for delayed fractional control systems employing the standard Caputo derivative. Initially, we review key findings and introduce the family of fractional-order systems under examination. Subsequently, we define regional controllability for fractional systems with control delays and outline some essential properties. Our primary approach involves defining an attainable set, enabling us to establish both exact and weak controllability. Additionally, our main results encompass not only controllability but also a robust Hilbert uniqueness method. This method facilitates the resolution of the minimum energy optimal control problem, yielding an explicit control that guides the system from an initial state to a desired regional state with minimal energy consumption. To illustrate our theoretical findings, we provide an example.

Keywords: regional controllability, fractional, order systems, Caputo derivatives, control delays, optimal control, minimum energy.

Regularized Resolvent For Volterra Equations And Favard Spaces

Ahmed Fadili
Department of Mathematics and Informatics, Laboratory of Mathematics Innovation and Information Technology (LIMATI), Polydisciplinary Faculty, Sultan Moulay Slimane University, PB 592 Beni Mellal, Morocco.

Abstract
The aim of this work is to introduce the domain and the Favard spaces of order α where $\alpha \in]0,1]$ for k-regularized resolvent family, extending some of the well-known theorems for semigroup and resolvent family. Furthermore, we show some relationship between the Favard temporal spaces and the Favard frequentiel spaces for scalar Volterra linear systems in Banach spaces, extending some results in [1,4].

Keywords: Semigroups, Volterra integral equations, Regularized resolvent families, Favard spaces.

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Some Results on Boundary Control Analysis of Riemann–Liouville Fractional Semilinear Equations

Tajani Asmae
Center for Research and Development in Mathematics and Applications (CIDMA), Department of Mathematics, University of Aveiro, 3810-193 Aveiro, Portugal

Fatima-Zahrae El Alaoui
TSI Team, Department of Mathematics, Faculty of Sciences,Moulay Ismail Un iversity, 11201 Meknes, Morocco

Delfim F.M.Torres
Center for Research and Development in Mathematics and Applications (CIDMA), Department of Mathematics, University of Aveiro, 3810-193 Aveiro, Portugal

Abstract
We investigate the boundary regional controllability of a class of Riemann–Liouville fractional semilinear sub-diffusion systems with boundary Neumann conditions. Utilizing semi-group theory, the fractional Hilbert uniqueness method, and Schauder's fixed point theorem, we establish conditions on the derivative order, internal region, and nonlinear part. We also provide sufficient conditions for the fractional system to be regionally controllable and, consequently, boundary regionally controllable. An illustrative example of a population density system with diffusion is presented to demonstrate the theoretical results.

Keywords: Time-fractional systems; Semilinear systems; Boundary regional controllability; Fractional diffusion logistic growth law model.

Study of the necessary and sufficient conditions for the tangent indicatrices of two regular curves generating a translation surface to be remarkable curves for this surface.

Salma Khan
Department of Mathematics and Computer Sciences, Faculty of Sciences Ben M'Sick, University Hassan II of Casablanca

Malika Izid
Department of Mathematics and Computer Sciences, Faculty of Sciences Ben M'Sick, University Hassan II of Casablanca

Amina Ouazzani Chahdi
Department of Mathematics and Computer Sciences, Faculty of Sciences Ben M'Sick, University Hassan II of Casablanca

Abstract
In differential geometry, a translation surface is a surface obtained by translating a curve $\alpha = \alpha(u)$ along another curve $\beta = \beta(v)$. Translation surfaces can be locally parametrized by

$$\psi(u,v) \;=\; \alpha(u) + \beta(v),$$

where $\alpha : I \subset \mathbb{R} \to \mathbb{E}^3$ and $\beta : J \subset \mathbb{R} \to \mathbb{E}^3$, with $\mathbb{E}^3$ a 3-dimensional Euclidean space.
In this study, our focus is on the translation surface defined by

$$M_T : X(u,v) \;=\; T_\alpha(u) + T_\beta(v),$$

where $u \to T_\alpha(u)$ and $v \to T_\beta(v)$ represent the tangent vectors of the two regular curves α and β.
By calculating the normal curvature, geodesic curvature, and geodesic torsion of the curves $u \to T_\alpha(u)$ and $v \to T_\beta(v)$ that lie on M_T, we determine the necessary and sufficient conditions for these curves to be remarkable. Additionally, we explore the implications of these conditions. This study is reinforced by giving examples followed by illustrations.

Keywords: Translation surface, Normal curvature, Geodesic curvature, Geodesic torsion.

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Towards a Nash Game Strategy Approach to Blind Image Deconvolution: A Fractional-Order Derivative Variational Framework

Fatima-Ezzahrae SALAH
Department of Mathematics and Computer Science, LMCSA, FSTM, Hassan II University of Casablanca, Mohammedia, Morocco.

Noureddine MOUSSAID
Department of Mathematics and Computer Science, LMCSA, FSTM, Hassan II University of Casablanca, Mohammedia, Morocco.

Asmaa ABASSI
Department of Mathematics and Computer Science, LMCSA, FSTM, Hassan II University of Casablanca, Mohammedia, Morocco.

Abstract

Image restoration is essential for recovering images degraded by various factors such as motion and sensor blur, defocusing, optical issues, atmospheric effects, and noise. A key challenge is the unknown nature of both the original image and the blur kernel (PSF), complicating effective restoration. This process is vital in areas like sensing, medical imaging, astronomy, remote sensing, and forensic investigations. This paper introduces a novel blind image deconvolution technique leveraging Nash game theory, enabling the restoration of linearly degraded images without prior knowledge of the image or PSF. The method frames deconvolution as a two-player game, with roles assigned to image deblurring and PSF estimation, aiming for a Nash equilibrium as the optimal restoration strategy. Additionally, we enhance this approach by incorporating fractional-order derivatives, aiming to improve the accuracy and robustness of image restoration. This advancement holds promise for the future of blind image deconvolution, expanding its application and effectiveness across multiple fields.

Keywords: Blind Deconvolution, Restoration, Multi-criteria Optimization, Fractional-Order Derivative, Nash Equilibrium.

Uniqueness and stability of nonnegative solutions for a class of nonpositone problems in a ball

Said Hakimi
Department of Mathematics and Computer Science, University of Sultan Moulay Slimane, Polydisciplinary Faculty, Beni Mellal, Morocco

Hajar Chahi
Department of Mathematics and Computer Science, University of Sultan Moulay Slimane, Polydisciplinary Faculty, Beni Mellal, Morocco

Abstract
In this work we study the uniqueness and stability of nonnegative solutions for a class of semilinear elliptic problems on a ball when the nonlinearity has more than one zero, negative at the origin and concave.

Keywords: Nonlinear boundary value problems, radial positive solution, nonpositone problem.