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24th International Pure Mathematics Conference 2024

from 23rd to 25th August 2024, Islamabad, Pakistan.

The title of his/her talk was Fractal model for predicting the spread of certain pandemics in society.

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The 24th International Pure Mathematics Conference 2024
Algebra, Analysis and Geometry, from 23 to 25 August 2024
Islamabad - Pakistan

Fractal model for predicting the spread of certain pandemics in society

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Abstract
In this paper, we discuss and provide some analytical studies for a mathematical model of fractional-order SIRD for COVID-19 in the sense of the Caputo-Katugampola derivative. We compute and derive several stability results based on some parameters that satisfy some conditions which prevent the pandemic from occurring. The paper also investigates the problem of the existence and uniqueness of solutions for the SIRD model. It does so by applying the properties of Schauder's and Banach's fixed point theorems.

Keywords: COVID-19; SIRD model; fractional derivative; existence and uniqueness.
2020 Mathematics Subject Classification: Primary 34A08; 62P10; 92-10; 92B05; 93-10.

1 Introduction

The coronavirus pandemic was a major worldwide challenge in 2020. The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is the virus responsible for COVID-19 infection. Wuhan city in China is reported to be where this virus originated.
A better understanding and evaluation of the existence, stability and control of infectious diseases can be acquired through modeling them mathematically. However, mathematical models' classical approaches are not highly accurate in modeling such diseases; hence, the introduction of fractional differential equations for handling these problems becomes necessary.
Our model requires the division of the total population $\mathcal{N}$ into four epidemiological classes:

$\mathfrak{S}$: Susceptible class, $\mathfrak{I}$: Infected class, $\mathfrak{R}$: Recovered class, and $\mathfrak{D}$: Death class.

The parameters are positive and could be described as follows:
∘ β is the average number of contacts per person per time t,
∘ γ is the recovery rate,
∘ κ is the death rate.

For $0 < \alpha < 1$ and $\rho > 0$,

$$\begin{cases} {}^{C}\mathcal{D}_{0^+}^{\alpha,\rho}\mathfrak{S}(t) &= -\beta\frac{\mathfrak{S}(t)\mathfrak{I}(t)}{\mathcal{N}_0}, \\ {}^{C}\mathcal{D}_{0^+}^{\alpha,\rho}\mathfrak{I}(t) &= \beta\frac{\mathfrak{I}(t)\mathfrak{S}(t)}{\mathcal{N}_0} - (\gamma+\kappa)\mathfrak{I}(t), \\ {}^{C}\mathcal{D}_{0^+}^{\alpha,\rho}\mathfrak{R}(t) &= \gamma\mathfrak{I}(t), \\ {}^{C}\mathcal{D}_{0^+}^{\alpha,\rho}\mathfrak{D}(t) &= \kappa\mathfrak{I}(t), \end{cases} \tag{1.1}$$

along with the positive initial conditions

$$\mathfrak{S}(0) = \mathfrak{S}_0,\ \mathfrak{I}(0) = \mathfrak{I}_0,\ \mathfrak{R}(0) = \mathfrak{R}_0,\ \mathfrak{D}(0) = \mathfrak{D}_0, \tag{1.2}$$

where $\mathcal{N}_0 > 0$ is the initial total population at the moment $t = 0$, with $0 \leq t \leq T < \infty$.
It is essential to find the solution of (1.1) with an efficient technique. Considering this point, our main goal in this work is to determine the main properties of the solution for the system of non-linear fractional differential equations (1.1), checking the considered model's stability necessitates establishing some existence results.

2 Main Results

Lemma 2.1. *The solution of model (1.1) is restricted to the feasible region given by*

$$u = \left\{(\mathfrak{S},\mathfrak{I},\mathfrak{R},\mathfrak{D}) \in \mathbb{R}_+^4,\ 0 \leq \mathcal{N}(t) \leq \mathcal{N}_0\right\},$$

and the pandemic will occur if $\mathfrak{S}_0 > \frac{\gamma+\kappa}{\beta}\mathcal{N}_0$, *where* $\frac{\gamma+\kappa}{\beta}$ *is called threshold phenomenon or critical community size for the pandemic.*

Theorem 2.1. *The disease-free equilibrium point of (1.1) is*

$$u^* = \left(\frac{\gamma+\kappa}{\beta}\mathcal{N}_0, 0, \mathfrak{R}_0, 0\right).$$

Theorem 2.2. *If the susceptible class* $\mathfrak{S}(t) < \mathfrak{S}^*$, *the pandemic free equilibrium point of (1.1) is locally asymptotically stable and is unstable if* $\mathfrak{S}(t) > \mathfrak{S}^*$.

Let $u = (\mathfrak{S},\mathfrak{I},\mathfrak{R},\mathfrak{D}) \in E$, where $E = [C([0,T],\mathbb{R}_+)]^4$ is a Banach space equipped with the norm

$$\|u\|_E = \|\mathfrak{S}\|_\infty + \|\mathfrak{I}\|_\infty + \|\mathfrak{R}\|_\infty + \|\mathfrak{D}\|_\infty$$

and let $f = (f_1, f_2, f_3, f_4)$, be such that

$$\begin{cases} f_1(t,u(t)) &= -\beta\frac{\mathfrak{S}(t)\mathfrak{I}(t)}{\mathcal{N}_0}, \\ f_2(t,u(t)) &= \beta\frac{\mathfrak{I}(t)\mathfrak{S}(t)}{\mathcal{N}_0} - (\gamma+\kappa)\mathfrak{I}(t), \\ f_3(t,u(t)) &= \gamma\mathfrak{I}(t), \\ f_4(t,u(t)) &= \kappa\mathfrak{I}(t), \end{cases}$$

it is clear that the function $f \in ([0,T]\times E)^4$ is continuous.

By applying the fractional integral to both sides of the system (1.1), we get

$$\begin{cases} \mathfrak{S}(t) &= \mathfrak{S}_0 + \frac{\rho^{1-\alpha}}{\Gamma(\alpha)} \int_0^t \frac{\tau^{\rho-1}}{(t^\rho-\tau^\rho)^{1-\alpha}} f_1(\tau, u(\tau))\, d\tau, \\ \mathfrak{I}(t) &= \mathfrak{I}_0 + \frac{\rho^{1-\alpha}}{\Gamma(\alpha)} \int_0^t \frac{\tau^{\rho-1}}{(t^\rho-\tau^\rho)^{1-\alpha}} f_2(\tau, u(\tau))\, d\tau, \\ \mathfrak{R}(t) &= \mathfrak{R}_0 + \frac{\rho^{1-\alpha}}{\Gamma(\alpha)} \int_0^t \frac{\tau^{\rho-1}}{(t^\rho-\tau^\rho)^{1-\alpha}} f_3(\tau, u(\tau))\, d\tau, \\ \mathfrak{D}(t) &= \mathfrak{D}_0 + \frac{\rho^{1-\alpha}}{\Gamma(\alpha)} \int_0^t \frac{\tau^{\rho-1}}{(t^\rho-\tau^\rho)^{1-\alpha}} f_4(\tau, u(\tau))\, d\tau, \end{cases}$$

By choosing $u_0 = (u_1, u_2, u_3, u_4) = (\mathfrak{S}_0, \mathfrak{I}_0, \mathfrak{R}_0, \mathfrak{D}_0)$, we get

$$u(t) = u_0 + \frac{\rho^{1-\alpha}}{\Gamma(\alpha)} \int_0^t \frac{\tau^{\rho-1}}{(t^\rho-\tau^\rho)^{1-\alpha}} f(\tau, u(\tau))\, d\tau. \tag{2.1}$$

In what follows, we present the principal theorems:

Theorem 2.3. *Let $\beta, \gamma, \kappa, \alpha, \rho, T \in \mathbb{R}_+$, be such that $\alpha \in (0,1)$ and*

$$T < \left(\frac{\rho^\alpha \Gamma(\alpha+1)}{4(\beta+\gamma+\kappa+3)} \right)^{\frac{1}{\rho\alpha}}, \tag{2.2}$$

then the problem (1.1)–(1.2) has at least one solution on $[0,T]$.

Theorem 2.4. *Let $\alpha \in (0,1)$ and $\beta, \gamma, \kappa, \rho, \mu \in \mathbb{R}_+^*$, be such that*

$$\mu = \max\{\beta+\gamma+\kappa+2, \gamma+3, \kappa+3\}.$$

If

$$\frac{4\mu T^{\rho\alpha}}{\rho^\alpha \Gamma(\alpha+1)} < 1, \tag{2.3}$$

then the problem (1.1)–(1.2) admits a unique solution on $[0,T]$.

References

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Programme

24th International Pure Mathematics Conference 2024
23-25 August 2024, Islamabad, Pakistan
(24th IPMC 2024)

Friday, 23rd August 2024, Face-to-Face

Late Professor Peter M. Neumann Day

Late Professor Peter M. Neumann, son of mathematicians Bernhard Neumann and Hanna Neumann, was a distinguished figure in group theory and mathematical history. He co-authored the influential '3N' paper, contributed to computational group theory with Cheryl Praeger, and was recognized with awards like the Order of British Empire (OBE), Senior Whitehead Prize, and the IMA–LMS David Crighton Medal. His work advanced the understanding of figures like Galois and Burnside. He was a sibling of Emeritus Professor Qaiser Mushtaq at Oxford under the supervision of Graham Higman FRS. He was concerned about the adverse consequences of the use of Impact Factor in Pakistan.

10:00 – 10:10	**Recitation**
10:10 – 10:40	**Inaugural Speech** **Emeritus Professor Dr. Qaiser Mushtaq, Quaid-i-Azam University, Islamabad** **Convener 24th IPMC 2024**
10:40 – 11:10	**Report about the IPMC Series** **Dr. M Sarwar Saeed, Secretary of the IPMC Organizing Committee**
11:10 – 11:30	**Dr. Amna Kalsoom, International Islamic University, Islamabad** **Generalized (α, β)-nonexpansive Type-1 Mapping**
11:40 – 12:00	**Dr. M Naseer Khan, Govt. Postgraduate College for Boys, Rawalakot, AJK** **Dual Weak Hopf Quiver and its Representation**
12:10 – 12:20	**Dr. Khizar Hayat, University of Kotli, AJ&K** **New Generalized Interval-Valued q-rung Orthopair Fuzzy Soft Aggregation Operators**
12:30 – 14:00	**Prayer and Lunch Break**
14:00 – 14:20	**Dr. Rizwan Jahangir, Sabanci University, Istanbul, Turkey** **Theory of Polyomino Idelas**
14:20 – 15:20	**Open Discussion: Mathematics in Pakistan**
15:20 – 15:30	**Conclusion**

Saturday, 24th August 2024-Online

Late Professor Boris M. Schein Day

Late Professor Boris M. Schein (1938–2023) was a distinguished Russian-American mathematician known for his work on the Schein index and semigroup theory, including infinite and geometric groups. He characterized semigroups that could be embedded into inverse semigroups and contributed to semigroups of transformations. As a founding editor of *Semigroup Forum*, he earned recognition from the European Mathematical Society. He was added to the list of QAU experts, reviewed several PhD Mathematics theses and gave valuable suggestions to improve the quality of research in Pakistan.

09:00 – 09:40	**Keynote Lecture** **Dr. Agnes Orsolya Pall-Szabo, Babes-Bolyai University, Romania** **Toeplitz Matrices for a Class of Bazilevic Functions**		
09:50 – 10:30	**Keynote Lecture** **Professor Vijay Kumar, Manav Rachna International Institute of Research & Studies, Faridabad, India** **Applications of Fixed Point Theory in Decision Making Under Uncertain Situations**		
	Channel A	**Channel B**	**Channel C**
10:40 – 11:00	**Dr. Saima Mustafa** **Rawalpindi Women University, Rawalpindi** Some geometric properties of subclasses of analytic functions	**Dr. Meddahi Meryem** **Hassiba Benbouali University, Algeria** Metric regularity of multimaps and applications	**Dr. Mehsin Jabel Atteya** **Mustansiriyah University, Iraq** The Additive Maps on Upper Triangular Infinite Matrices
11:05 – 11:25	**Dr. Nazeran Idrees** **Government College University, Faisalabad** Predictive Modeling of Anti-Parkinsons Drugs Using Topological Indices	**Dr. Ahmed Bouchenak** **University Mustapha Stambouli of Mascara, Algeria** Results on second order constant coefficients modified conformable equations	**Miss Amina Chaili** **University of Ain Temouchent Belhadj Bouchaib, Algeria** Global existence and strong stability of coupled wave equations with local fractional dissipation
11:30 – 11:50	**Mrs. MA Mateos Camacho** **EIDUS, Spain** New results on the [k]-Roman Domination in graphs	**Dr. Nesrine Karaterki** **Higher School of Management, Tlemcen, Algeria** Tests and some results in functional autoregressive process	**Dr. Kainane Mezadek Mourad** **Chlef University, Algeria** Cauchy problem of σ-evolution models with some type damping
11:55 – 12:15	**Ms Ramsha Shafqat** **Thammasat University, Thailand** A fixed point theory approach to the mathematical analysis of the SEIRS model with Hilfer fractional-order derivatives	**Dr. Noureddine Elharrar** **Higher Institute of Nursing Professions and Health Techniques "ISPITS", Morocco** Rothe time-discretization method for a nonlinear parabolic problems in weighted Sobolev spaces	**Mr. Abdelhamid Bensalem** **Université Djillali Liabès of Sidi Bel Abbès, Algeria** Integrodifferential equation with non-instantaneous impulsive on semi-infinite intervals using resolvent operator of Grimmer
12:15 – 12:35	**Miss Thobile Ngcamphalala** **Rhodes University, South Africa** β-Normal Spaces	**Miss Attar Kheira** **University of Tlemcen, Algeria** Monostable traveling wave in a reaction-diffusion system coupled to a difference equation with delayed and nonlocal term	**Miss Ghermoul Khedoudja Sirine** **University of Tlemcen, Algeria** Long-time behavior of reaction diffusion difference systems with distributed delay in the bistable case
12:35 – 13:00	**Dr. Ali Raza** **GC University, Lahore** Boyd Indices for Quasi-Normed Spaces	**Dr. Sara Benatmane** **University of Science and Technology Houari Boumediene, Algeria** A novel cryptographic scheme based on the Hao fractal	**Dr. Amirouche Mouhous** **Université of Bejaia, Algeria** Extending the Leggett- Williams fixed point theorem to Mappings of the form T + F via the fixed point index on cones of Banach spaces

13:05 – 14:00	Break		
	Channel A	**Channel B**	**Channel C**
14:00 – 14:20	**Dr. Tehreem** **Air University, Islamabad** A novel methodology for decision support systems using spherical cubic fuzzy numbers	**Dr. Kheireddine Biroud** **Higher School of Management, Tlemcen, Algeria** On some nonlocal elliptic problems with nonlinear singular term revisited	**Miss Asma Sahraoui** **Msila, Algeria** The Radial Schrödinger Equation with the Inverse Decatic Power Potential
14:20 – 14:40	**Miss Hijwaria Taj** **Quaid-i-Azam University, Islamabad** Unveiling 1D CNN's decision boundaries through tropical geometry	**Mr. Sami Loucif** **Echahid Cheikh Larbi Tebessi University, Tebessa, Algeria** Blow-up result of some evolution problems with variable exponent and time delay	**Mr. Ibrahim Lakehal** **University of Mohamed Elbachir Elibrahimi-BB, Algeria** Existence, uniqueness, and stability analysis of a delayed full von Kármán system
14:40 – 15:00	**Mr. Ibrahim Merabet** **Hassiba Benbouali University of Chlef, Algeria** Correlation of Quasiconvex and Rank-One Convex Functions	**Dr. Ibrahim Sadok** **Bechar University, Algeria** An adaptive regularized filter methodology	**Dr. Mahdi Fatima Zohra** **Ahmed Zabana University, Algeria** Existence of global attractor for a model of suspension bridge
15:00 – 15:20	**Dr. Guettai Ghania** **University of Medea, Algeria** Results of associated Fibonacci and Lucas sequences	**Dr. Sami Galleze** **University of Sciences and Technology, Houari Boumediene, Algeria** Ventcel-type condition for a Poisson problem with two attached thin layers	**Dr. Sehili Ismahene** **University of ElBachir El Ibrahimi, Algeria** Some applications of bi-dimensional Legendre polynomials
15:20 – 15:40	**Mr. Miloudi Boudaoud** **Mostaganem University, Algeria** Some results on transcendental entire functions sharing a value a with shift and difference operators	**Dr. Messaoud Guesba** **El Oued University, Algeria** Some generalized numerical radius inequalities for d-tuples of operators	**Dr. Tayeb Bouaziz** **Biskra University, Algeria** On the optimal control of a system governed by a fractional Brownian motion
15:40 – 16:00	**Dr. Lounes Ameur** **University of Skikda, Algeria** A numerical solution for the single-server queue with Phase Type Distribution service times	**Dr. Ahlem Abdelouahab** **University of Tlemcen, Algeria** A free boundary problem	**Dr. Mohammed Abdelmalek** **Higher School of Management, Tlemcen, Algeria** Some results for constant mean curvature hypersurfaces embedded in pseudo Riemannian manifolds
16:00 – 16:15	**Dr. Akram Boukabache** **Teacher Education College of Setif, Algeria** The relationship between finite volume and finite element methods for incompressible flow problems	**Dr. Safa Guerdouh** **Jijel University, Algeria** A primal-dual interior-point algorithm for linear optimization based on a new class of kernel functions	**Dr. Fatma Berrighi** **University of Mohammed Boudiaf, Oran, Algeria** First order impulsive neutral functional evolution equations: Existence criteria using Schauder's fixed point theorem
16:15 – 16:30	**Dr. Bouraada Amel** **University of Mascara, Algeria** Some averaging results for fuzzy differential equation with delay	**Mr. Omar Alimerina** **Hassiba Benbouali University of Chlef, Algeria** Blow-up results for nonlinear wave equations with two dissipative terms	**Dr. Seyf Eddine Ghenimi** **Msila University, Algeria** Exponentially decaying estimates for an axially travelling string with boundary damping
16:30 – 16:45	**Miss Nawal Bettayeb** **Djillali Liabes University of Sidi Bel-Abbes, Algeria** Existence Results for Tempered ψ-Caputo Fractional Differential Equations via Densifiability	**Mrs. Abibssi Imane** **Djillali Liabes University of Sidi Bel-Abbes, Algeria** Second order Neutral functional perturbed pseudo Integrodifferential with finite state	**Mr. Hassan Messaoudi** **University of Souk-Ahras, Algeria** Existence, uniqueness, and general stability of solutions for a nonlinear damping piezoelectric beam system

	Techniques	dependent delay	with thermal and magnetic effects
16:45 – 17:00	**Dr. Dounya Kechiche** **University of Sciences and Technology, Houari Boumediene, Algeria** Asymptotic behavior of a current-actuated piezoelectric beam with different types of damping	**Dr. Bourghida Remissa** **University of Sciences and Technology, Houari Boumediene, Algeria** Exponential energy decay in linear thermoelastic system with Wentzell conditions	**Miss Lachachi Nardjis** **Djillali Liabes University of Sidi Bel-Abbes, Algeria** Fractional Evolution Inclusions with State Dependent Delay with local condition
17:00 – 17:15	**Dr. Zahra Amroune** **University of Msila** Solutions of some Diophantine equations involving arithmetic functions		

Sunday, 25th August 2024-Online

Late Professor Narain Gupta Day

Late Professor Narain Gupta (1936-2008), a Distinguished Professor of Mathematics at the University of Manitoba and Fellow of the Royal Society of Canada, made significant contributions to the Representation Theory of Combinatorial Groups. His solution to the dimension subgroup problem earned him a place in *The Encyclopedia Britannica*. His work was recognized internationally with numerous awards, including the Killam Fellowship and the Senior NATO Scientist Award. He was appointed Professor Emeritus in 2005. He was also in the list of QAU experts, reviewed several PhD theses and visited Pakistan to attend IPMC at the invitation of Emeritus Professor Qaiser Mushtaq.

09:00 – 09:40	**Keynote Lecture** **Dr. Mbekezeli Nxumalo, Rhodes University, South Africa** **Some Relative Version of (i,j)-Baire Bilocales**		
09:50 – 10:30	**Keynote Lecture** **Dr. Assia Bezai, University of Batna 2, Algeria** **The Group Inverse Approach to Solving Certain Operator Equations**		
	Channel A	**Channel B**	**Channel C**
10:40 – 10:55	**Prof. Bilal Basti** **Mohamed Boudiaf University of M'sila, Algeria** Fractal model for predicting the spread of certain pandemics in society	**Mr. Ilias Badaoui** **University of Sciences and Technology, Houari Boumediene, Algeria** Biobjective Stochastic Optimization Over Efficient Stochastic Set	**Dr. Abdessalem Benterki** **University of Medea, Algeria** Overview on the radial solutions for an elliptic system
11:00 – 11:15	**Prof. Abdelatif Bencherif Madani** **University Setif 1 Ferhat Abbas, Algeria** On the Neumann problem in a ball	**Dr. Nacima Rosa Ait-Amrane** **Yahia Fares University of Medea, Algeria** A new generalization of Horadam numbers	**Ms. Fatima Zohra Bengrine** **Abou Bekr Belkaid University, Tlemcen, Algeria** System with Hardy potential
11:20 – 11:35	**Dr. Alliti Bachir** **University of Sciences and Technology, Houari Boumediene, Algeria** Transfer and approximation of the impedance for abstract Cauchy system in a planar domain with thin contrasted multi-layers	**Dr. Youssra Bouhenache** **LMPA, Jijel, Algeria** Complexity analysis of interior-point algorithm for solving linear complementarity problems based on a hyperbolic kernel function	**Mr. Bouzid Houari** **Hassiba Ben Bouali University of Chlef, Algeria** Analytical Examination of Nonlinear Fractional Differential Systems Utilizing Caputo's q-Derivative
11:40 – 11:55	**Dr. Sihem Mahoui** **University of Sciences and Technology, Houari Boumediene, Algeria** Domaine decomposition and virtual optimal control for evolution problems with missing data	**Dr. Ali Khalouta** **Ferhat Abbas Sétif University 1, Algeria** A new coupling method for solving second-order nonlinear fractional partial differential equations	**Dr. Helal Mohamed Mustapha Stambouil University of Mascara, Algeria** Global Uniqueness Results for Neutral Fractional Hyperbolic Differential Equations with Infinite State-Dependent Delay
11:55 – 12:10	**Dr. Zaamoune Faiza** **University Mohamed Khider Biskra, Algeria** A new Hopf bifurcation that is parametrically controlled alongside electronic circuit design	**Dr. Chouia Sarra** **University of badji Mokhtar-Annaba, Algeria** New One Parameter Distribution: Properties and Application	**Dr. Zakarya Malki** **Université Djillali Liabes Sidi-Bel-Abbès, Algeria** Solutions for random system of fractional differential equations

12:10 – 12:25	**Dr. Chahinaz Chenouf** **Ferhat Abbas University Setif 1, Algeria** Global optimization procedure for solving problems of Hölder functions	**Prof. Laissaoui Diffalah** **Dr Yahia Farès University of Médéa, Algeria** Recent Advances in Generalized Fubini Polynomials of Two Variables	**Dr. Rachid Lakehal** **University of Bejaia, Algeria** Exponential decay for a Timoshenko system with thermodiffusion effects
12:25 – 12:40	**Mr. Hamza Benachour** **Abdel Hamid Ibn Badis University, Mostagnem, Algeria** On the flat translation surfaces in Minkowski 3-space with density	**Dr. Zakia Tebba** **Higher Normal School of Kouba, Algeria** Blow up results for a quasilinear wave equation with variable exponents non-linearities	**Dr. Yamina Hamzaoui** **Higher School pf Management Tlemcen, Algeria** Existence of positive solution for a quasilinear elliptic system
12:40 – 12:55	**Mr. Mouaad Bouakkaz** **Kasdi Merbah University of Ouargla, Algeria** Improved Spectral Homotopy Analysis Method Using Orthogonal Polynomials for Solving a Nonlinear ODE	**Mr. Sidi Mohammed Abderrahim** **University of Tlemcen, Algeria** Analysis and asymptotic behavior of a hyperbolic system with fixed-point method	**Dr. Rachid Yahi** **University of Msila, Algeria** The Lipschitz K{p,q} Compactness and Lipschitz K{p,q}-Null Sequences
13:00 – 14:00	**Break**		
	Channel A	**Channel B**	**Channel C**
14:00 – 14:15	**Dr. Abdelhakim Azzedine** **Badji Mokhtar Annaba University, Algeria** Artificial Intelligence for Hot Metal Quality Control	**Miss Mouchira Mansour** **University of Jijel, Algeria** A perturbed differential inclusion governed by a non-convex degenerate sweeping process	**Dr. Ahmed Hamidat** **University of El Oued, Algeria** Thermo-Electro-Elastic-Viscoplastic Contact Problem with Damage and Normal Compliance
14:15 – 14:30	**Prof. Elhadj Dahia** **ENS Bousaada, Algeria** Bilinear asymmetric closed graph theorem	**Miss Sattaf Mebarka** **Djillali Liabes University, Algeria** Nonlocal problem with singular Trudinger-Moser nonlinearities	**Miss Kattar Enada Bensatal** **Djillali Liabes University of Sidi Bel-Abbès, Algeria** Densifiability techniques of impulsive integro-differential equations
14:30 – 14:45	**Dr. Ali Turab** **Northwestern Polytechnical University, China** On Solutions to the Generalized Functional Equations Arising in Mathematical Biology and Learning Theory	**Dr. Selmani Wissame** **University of 20 August 1955 Skikda, Algeria** An iterative regularization method for an abstract ill-posed generalized elliptic problem	**Dr. Maatougui Belaala** **University of Msila, Algeria** James' Theorem and Characterization
14:45 – 15:00	**Dr. Frid Chabane** **University of Ghardaia, Algeria** Analyzing existence and uniqueness of solutions for weighted impulsive fractional DEs with variable coefficients and generic *p*-Laplacian operator	**Dr. Mohamed Mellah** **Chlef University, Algeria** Existence and asymptotic behavior of solutions for non-linear wave equations of Kirchhoff type with viscoelasticity	**Dr. Hanaa Achour** **University of Tlemcen, Algeria** Fractional p-Laplacian in Singular Elliptic Problem with Discontinuous Nonlinearity
15:00 – 15:10	**Miss Louiza Diabi** **University of Larbi Ben M'hidi, Oum El Bouaghi, Algeria** Synchronization and Control of Chaotic Fractional Discrete-time Model	**Miss Chahrazed Boudefla** **Djillali Liabes University of Sidi Bel-Abbès, Algeria** Controllability results for second-order neutral problems with finite state-dependent delay	**Dr. Mazouz Khaoula** **Laboratory of Nonliner PDE and HM, ENS-Kouba, Algeria** Existence and regularity of solutions of nonlinear anisotropic and degenerate elliptic problem with singular natural growth terms

15:10 – 15:20	**Miss Sehar Afsheen** **International ISlamic University, Islamabad** Green's function for boundary value fractional differential equations with general analytic kernel	**Ms Sabrina Ben Hanachi** **Mohamed Cherif Messaadia University - Souk Ahras, Algeria** A new conjugate gradient method with guaranteed descent and global convergence	**Dr. Ilhem Kadri** **University of Oran 1, Algeria** Atomic Solutions of Partial Differential Equations via Tensor Product Theory of Banach Spaces
15:20 – 15:30	**Dr. Asma Hammou** **Ecole Normale Supérieure de Laghouat. Algeria** Ideals of polynomials generated by t(p)-summing operators	**Dr. Adel Lachouri** **University of Science and Technology Houari Boumediene, Algeria** Nonlocal boundary value problem for Ψ-Hilfer fractional differential equations	**Fatima Zohra Benghia** **Laghouat University, Algeria** Orthogonal polynomials corresponding to polynomials zero measure
15:30 – 15:40	**Ms Djellali Noura** **University of Mustapha Stambouli, Mascara, Algeria** Geometric properties of hypersurfaces in Lie group (Nil^4, g)	**Dr. Soheyb Milles** **University Center of Barika, Algeria** On neutrosophic topological spaces in Šostak's sense	**Miss Ahlem Sidi Yekhlef** **Ain-Temouchent University, Algeria** Well-posedness of a wave equation with fractional-damping, memory and time delay
15:40 – 15:50	**Dr. Sara Youcef Achira** **University of Hassiba Benbouali Chlef, Algeria** Generalization and properties of the Bernoulli polynomials	**Mr. Brahim Benaissi** **University of Msila, Algeria** The blow-up existence of solution to generalized fractional partial differential system with fractional Laplacian	**Dr. Bendrici Nadhir** **USTHB, Algeria** About the intersection curves of two parametric surfaces
15:50 – 16:00	**Mr. Mohammed Amine Benmelouka** **University of Oran 1, Algeria** The resolution of a non-autonomous differential equation of elliptic type	**Mr. Mahmoudi Sofiane** **Abdelhamid Ibn Badis University, Mostaganem, Algeria** Some applications of Wiman-Valiron theory of entire functions in fractional calculus	**Mr. Hamza Boutebba** **University of 20 August 1955 Skikda, Algeria** The existence of infinitely many large energy solutions for a general class of superlinear fractional Schrödinger-Poisson systems
16:00 – 16:10	**Dr. Rabah Djemiat** **Mohamed Boudiaf University of M'sila, Algeria** A hybrid model for a class of multidimensional nonlinear free energy equations	**Dr. Asma Allam** **Abdelhafid Boussouf University, Mila, Algeria** Simplifying the Study of a Symmetric System of Higher Order Difference Equations	**Dr. Maroua Meneceur** **University of El Oued, Algeria** On Caputo boundary value problems for fractional differential equations
16:10 – 16:30		**Ms Saba Naz** **Riphah International University Islamabad** Variable Precision Multigranulation Fuzzy Rough sets under Q Rung Orthopair Fuzzy Environment	
Conclusion			

NOTE: There are three parallel channels of talks.

Talks including keynote lectures listed in the column colored blue will be held in Channel A

Talks listed in the column colored red will be held in Channel B

Talks listed in the column colored green will be held in Channel C