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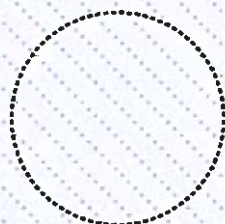
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FOR THE SCIENTIFIC PAPER:

**ANALYTICAL STUDIES FOR A HYBRID MATHEMATICAL MODEL OF COVID-19:
THE INFLUENCE OF THE PANDEMIC ON CHRONICALLY ILL PEOPLE**

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JUNE, 2023
BUCHAREST



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ANALYTICAL STUDIES FOR A HYBRID MATHEMATICAL MODEL OF COVID-19: THE INFLUENCE OF THE PANDEMIC ON CHRONICALLY ILL PEOPLE

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Abstract

This paper discusses and provides some analytical studies for a hybrid mathematical model of COVID-19, which is a SECIRD fractional model that is concerned with the influence of the pandemic on chronically ill people. We compute and derive several stability results based on some parameters that satisfy some conditions that prevent the pandemic from occurring. The paper also investigates the problem of the existence and uniqueness of solutions for the SECIRD model. It does so by applying the properties of Schauder's and Banach's fixed point theorems.

Key words: Mathematical modeling; fractional operators; stability; existence; uniqueness.

1. INTRODUCTION AND STATEMENT OF THE PROBLEM

Mathematical modeling is a useful tool for understanding and controlling infectious diseases [1, 4], but traditional approaches are not highly accurate for modeling such diseases. Therefore, fractional differential equations have been introduced to handle these problems, with applications in various fields, including optimization problems, artificial intelligence, and medical diagnoses. Those interested in further reading on the subject can refer to books by (Samko et al. 1993 [9], Podlubny 1999 [6], Kilbas et al. 2006 [3], Diethelm 2010 [2]).

This model requires the division of the total population N into six epidemiological classes namely Susceptible S , Exposed E , Chronic illnesses C , Infected I , Recovered R , and Death class D . Parameters' definition of the SECIRD model for COVID-19 could be presented as follows:

- $\psi(\mu, N)$ is a function representing the influx rate that expresses the arrival of people (i.e., birth rate and visitors from other society).
- $\mu < 1$ is the rate of natural death population, also $0 < \sigma < 1 - \mu$, with σ is the death rate of people with chronic illnesses other than COVID-19. We put σ in addition to accounting for natural death

because the death rate of people with chronic illnesses is usually more remarkable than any other compartment.

- β_1, β_2 are the rates of contacts per person between susceptible S and infectious population C and I .
- θ, δ are the rates of transfer of exposed E to infectious population C and I .
- p, q are the recovery rates from infectious population C and I .
- κ, γ are the death rates of infectious population C and I due to COVID-19.
- v is the vaccine rate of the suspected population, and τ is the rate of transfer of recovered population R even who were vaccinated to the susceptible population S , (taking into account that Covid-19 has several versions, the vaccine is not always effective against the disease because of its mutation).

For $0 \leq t \leq T < \infty$, and $0 < \alpha \leq 1$, we have:

$$\begin{cases} {}^C\mathcal{D}_{0+}^\alpha S(t) &= N(t)\psi(\mu, N(t)) - \left(\frac{\beta_1 C(t) + \beta_2 I(t)}{N(t)} + v + \mu \right) S(t) + \tau R(t) \\ {}^C\mathcal{D}_{0+}^\alpha E(t) &= \frac{\beta_1 C(t) + \beta_2 I(t)}{N(t)} S(t) - (\theta + \delta + \mu) E(t) \\ {}^C\mathcal{D}_{0+}^\alpha C(t) &= \theta E(t) - (p + \kappa + \sigma + \mu) C(t) \\ {}^C\mathcal{D}_{0+}^\alpha I(t) &= \delta E(t) - (q + \gamma + \mu) I(t) \\ {}^C\mathcal{D}_{0+}^\alpha R(t) &= v S(t) + p C(t) + q I(t) - (\tau + \mu) R(t) \\ {}^C\mathcal{D}_{0+}^\alpha D(t) &= \kappa C(t) + \gamma I(t). \end{cases} \quad (1)$$

Our main goal in this work is to determine the main properties of the solution for the system of nonlinear fractional differential equations (1). First, checking the considered model's stability necessitates establishing some existence results, determining the boundedness and computing the disease-free equilibrium points. Then, by using the fixed-point theory, we give the necessary conditions for getting at least one solution or its uniqueness.

REFERENCES

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Day-1
Wednesday 28th June 2023

Acces link: ... follow emai

9:00-9:30	REGISTRATION	WELCOME		LOCATION: SENATE ROOM, GROUND FLOOR, RECTORATE BUILDING	
9:30-10:30	Opening Ceremony				
10:30-11:00	Break				
11:00-11:30	Plenary Room: Senat	Plenary Lecture Speaker: Title: Chair:	Prof. Dr. Martin BOHNER - Missouri University of Science and Technology (Missouri S&T), Missouri, United States <i>The Beverton-Holt Equation</i> Prof. Antonela TOMA, Prof. Emil SIMION		
11:30-12:00	Plenary Room: Senat	Plenary Lecture Speaker: Title: Chair:	Prof. Dr. Mohsen RAZZAGHI - Mississippi State University, Mississippi, United States <i>Taylor series, hybrid functions, and fractional calculus in engineering and science</i> Prof. Antonela TOMA, Prof. Emil SIMION		
12:00-12:30	COFFEE BREAK				
12:30-13:00	Plenary Room: Senat	Plenary Lecture Speaker: Title: Chair:	Prof. Dr. Poom KUMAM- King Mongkut's University of Technology Thonburi, Bangkok, Thailand <i>Fixed Point Techniques for Approximating Solutions of Nonlinear Problems Beyond Normed Spaces</i> Prof. Antonela TOMA, Prof. Emil SIMION		
13:00-13:30	Plenary Room: Senat	Plenary Lecture Speaker: Title: Chair:	Prof. Dr. Francesco VILLECCO - University of Salerno, Fisciano, Italy <i>Smart devices for a better life.</i> Prof. Antonela TOMA, Prof. Emil SIMION		
13:30-15:00	LUNCH BREAK - Library Building				
	ISIM Moderators	Room 4.1, Library Building, UPB Access link: ... follow email Prof. Ioana Corina BOGDAN, Prof. Octavian POSTĂVARU, Prof. Antonela TOMA	ISIM Moderators	Room 4.2, Library Building, UPB Access link: ... follow email Prof. Elena Corina CIPU, Prof. Mihaela PRICOP-JECKSTADT, Prof. Antonela TOMA	
15:00-15:15	Section 3 Room: 4.1	Live Authors: Affiliation: Title:	Section 2 Room: 4.2	Live Authors: Affiliation: Title:	
15:15-15:30	Section 2 Room: 4.1	Live Authors: Affiliation: Title:	Section 3 Room: 4.2	Online Authors: Affiliation: Title:	
15:30-15:45	Section 1 Room: 4.1	Live Authors: Affiliation: Title:	ISWIM Moderators	Room 4.2, Library Building, UPB Prof. Elena Corina CIPU, Prof. Mihaela PRICOP-JECKSTADT, Prof. Antonela TOMA	
15:45-16:00	Section 1 Room: 4.1	Live Authors: Affiliation: Title:	Section 1 Room: 4.2	Live Authors: Affiliation: Title:	
16:00-16:15	Section 1 Room: 4.1	Live Authors: Affiliation: Title:	Section 2 Room: 4.2	Live Authors: Affiliation: Title:	
16:15-16:30	Section 3 Room: 4.1	Live Authors: Affiliation: Title:	Section 2 Room: 4.2	Live Authors: Affiliation: Title:	
16:30-17:00	COFFEE BREAK				
	ISIM Moderators	Room 4.1, Library Building, UPB Access link: ... follow email Prof. Ioana Corina BOGDAN, Prof. Octavian POSTAVARU, Prof. Laurențiu PREDESCU	ISWIM Moderators	Room 4.2, Library Building, UPB Access link: ... follow email Prof. Elena Corina CIPU, Prof. Mihaela PRICOP-JECKSTADT, Prof. Laurentiu PREDESCU	
17:00-17:15	Section 4 Room: 4.1	Live Authors: Affiliation: Title:	Section 4 Room: 4.2	Live Authors: Affiliation: Title:	
17:15-17:30	Section 3 Room: 4.1	Live Authors: Affiliation: Title:	Section 3 Room: 4.2	Live Authors: Affiliation: Title:	
17:30-17:45	Section 1 Room: 4.1	Online Authors: Affiliation: Title:	Section 3 Room: 4.2	Online Authors: Affiliation: Title:	
17:45-18:00	Section 1 Room: 4.1	Online Authors: Affiliation: Title:	ISIM Moderators	Room 4.2, Library Building, UPB Access link: ... follow email Prof. Elena Corina CIPU, Prof. Mihaela PRICOP-JECKSTADT, Prof. Laurentiu PREDESCU	
18:00-18:15	Section 1 Room: 4.1	Online Authors: Affiliation: Title:	Section 3 Room: 4.2	Online Authors: Affiliation: Title:	
18:15-18:30	Section 1 Room: 4.1	Online Authors: Affiliation: Title:	Section 3 Room: 4.2	Online Authors: Affiliation: Title:	
18:30 - 20:00	DINNER				

Day-2
Thursday 29th June 2023

[Acces link: ... follow email](#)

9:00-9:25	Plenary Room: Senat	Plenary Lecture Speaker: Title: Chair:	Prof. Dr. Juan C. CORTÉS - Universitat Politècnica de València, València, Spain <i>Some tools for Studying Random Differential Equations with Applications to Real-World Problems</i> Prof. Andrei HALANAY, Prof. Savin TREANȚĂ			
9:25-9:50	Plenary Room: Senat	Plenary Lecture Speaker: Title: Chair:	Prof. Dr. Mostafa ADIMY - Senior Researcher at INRIA and Institut Camille Jordan, University Lyon, France <i>Modeling the relationship between Antibody-Dependent Enhancement and disease severity in dengue infection</i> Prof. Andrei HALANAY, Prof. Savin TREANȚĂ			
9:50-10:15	Plenary Room: Senat	Plenary Lecture Speaker: Title: Chair:	Prof. Dr. Dumitru BĂLEANU - Cankaya University, Ankara, Turkey <i>Generalised fractional operators with real world applications</i> Prof. Andrei HALANAY, Prof. Savin TREANȚĂ			
10:15-10:45	COFFEE BREAK					
10:45-11:10	Plenary Room: Senat	Plenary Lecture Speaker: Title: Chair:	Prof. Dr. Thorsten HOHAGE - Georg-August Universität Göttingen, Germany <i>Inverse problems in helioseismology</i> Prof. Andrei HALANAY, Prof. Savin TREANȚĂ			
11:10-11:35	Plenary Room: Senat	Plenary Lecture Speaker: Title: Chair:	Prof. Dr. Suthep SUANTAI - Chiang Mai University, Chiang Mai, Thailand <i>Accelerated Algorithms for Convex Bilevel Optimization Problems and Applications in Data Science</i> Prof. Andrei HALANAY, Prof. Savin TREANȚĂ			
11:35-12:00	Section 3 Room: Senat	Plenary Lecture Speaker: Title: Chair:	Prof. Dr. Paul BOGDAN - University of Southern California, Los Angeles, United States <i>From Biological Intelligence to Artificial General Intelligence: Challenges, Opportunities and Method</i> Prof. Andrei HALANAY, Prof. Savin TREANȚĂ			
12:00-12:25	Plenary Room: Senat	Plenary Lecture Speaker: Title: Chair:	Prof. Dr. Francesco VILLECCO - University of Salerno, Fisciano, Italy <i>Smart devices for a better life.</i> Prof. Andrei HALANAY, Prof. Savin TREANȚĂ			
12:30-14:00	LUNCH BREAK - Library Building					
	ISIM Moderators	Room 4.1, Library Building, UPB Acces link: ... follow email Prof. Antonela TOMA, Prof. Octavian POSTĂVARU, Prof. Laurențiu PREDESCU		ISWIM Moderators	Room 4.2, Library Building, UPB Acces link: ... follow email Prof. Elena Corina CIPU, Prof. Mihaela PRICOP-JECKSTADT, Prof. Mariana Mirela STĂNESCU	
14:00-14:15	Section 1 Room: 4.1	Live Authors: Affiliation: Title:	¹ Clara BURGOS, ¹ Juan Carlos CORTÉS LÓPEZ, ² Laura VILLAFUERTE, ¹ Rafael J. VILLANUEVA MICÓ ¹ Universitat Politècnica de València, València, Spain ² University of Texas at Austin, Texas, United States <i>Extending laplace transform in random fractional framework to solve a fractional second order differential equation with uncertainty</i>	Section 4 Room: 4.2	Live Authors: Affiliation: Title:	¹ Mihai REBENCIUC, ¹ Vlad-Andrei CHIRA, ² Nicolai GĂITAN ¹ University Politehnica of Bucharest, Bucharest, Romania ² Military Technical Academy „Ferdinand I”, Bucharest, Romania <i>Vectors, multivectors and rectangular matrices versus square matrices (with Python implementations)</i>
14:15-14:30	Section 3 Room: 4.1	Live Authors: Affiliation: Title:	¹ Mircea CIMPOEAȘ ¹ University Politehnica of Bucharest, Bucharest, Romania <i>A note on the actions of the Hecke group H(2)</i>	Section 3 Room: 4.2	Online Authors: Affiliation: Title:	¹ Vicente J. BEVIA, ¹ Juan C. CORTÉS, ¹ Rafael J. VILLANUEVA ¹ Instituto de Matemática Multidisciplinar, UPV, València, Spain <i>Boundary Value Problems for a class of random differential equations</i>
14:30-14:45	Section 2 Room: 4.1	Live Authors: Affiliation: Title:	¹ Emil SIMION, ¹ Elena Corina CIPU ¹ University Politehnica of Bucharest, Bucharest, Romania <i>Applications of Hybrid Statistical Models and Quantum Computing in Data Security</i>	Section 2 Room: 4.2	Live Authors: Affiliation: Title:	¹ Vasile NĂSTĂSESCU, ¹ Silvia MARZAVAN ¹ Military Technical Academy "Ferdinand I", Bucharest, Romania <i>On the calculation of functionally graded plates</i>
14:45-15:00	Section 3 Room: 4.1	Live Authors: Affiliation: Title:	¹ Monica BURLICĂ ¹ "Gheorghe Asachi" Technical University of Iași, Iași, Romania <i>On directional subregularity of mappings</i>	Section 2 Room: 4.2	Live Authors: Affiliation: Title:	¹ Eduard-Ștefan SANDU ¹ University Politehnica of Bucharest, Bucharest, Romania <i>Revealing the cyberattacks: phishing</i>
	Section 1	Live Authors:	¹ Sani SALISU, ¹ Poom KUMAM, ¹ Songpon SRIWONGSA, ² Wiyada KUMAM	Section 2	Live Authors:	¹ Iulia-Florentina DARIE, ² Ștefan Răzvan ANTON, ¹ Mirela PRAISLER

15:00-15:15	Room: 4.1	Affiliation: Title:	¹ King Mongkut’s University of Technology Thonburi, Bangkok, Thailand ² Rajamangala University of Technology Thanyaburi, Pathum Thani, Thailand <i>Nonexpansive-type Mappings with Viscosity Iteration in Hadamard Spaces</i>	Room: 4.2	Affiliation: Title:	¹ University ‘Dunărea de Jos’ Galați, Galați, Romania ² University Politehnica of Bucharest, Bucharest, Romania <i>Drug detection using K-nearest neighbors algorithm</i>
15:15-15:30	Section 3 Room: 4.1	Live Authors: Affiliation: Title:	¹Elena Corina CIPU, ¹Cosmin Dănuț BARBU ¹ University Politehnica of Bucharest, Bucharest, Romania <i>New applications for NLEEs based on Estimation Methods</i>	Section 3 Room: 4.2	Live Authors: Affiliation: Title:	¹Ștefan Cătălin PETRESCU, ¹Simona Mihaela BIBIC ¹ University Politehnica of Bucharest, Bucharest, Romania <i>Advanced Optimization Techniques for Unbalanced Allocation Problems using the Modified Hungarian</i>
15:30-16:00	COFFEE BREAK					
	ISIM Moderators	Room 4.1, Library Building, UPB Acces link: ... follow email Prof. Antonela TOMA, Prof. Octavian POSTĂVARU, Prof. Laurențiu PREDESCU		ISWIM Moderators	Room 4.2, Library Building, UPB Acces link: ... follow email Prof. Elena Corina CIPU, Prof. Mihaela PRICOP-JECKSTADT, Prof. Mariana Mirela STĂNESCU	
15:30-15:45	Section 2 Room: 4.1	Live Authors: Affiliation: Title:	¹Cătălin-Ionuț MOLDOVAN, ¹Bogdan SEBACHER ¹ Military Technical Academy “Ferdinand I”, Bucharest, Romania <i>Image reconstruction with a convolutional autoencoder as support for a data assimilation model</i>	Section 1 Room: 4.2	Live Authors: Affiliation: Title:	¹Larisa Georgiana UNGUREANU, ¹Narcisa VOINEA, ¹Elena Corina CIPU, ¹Cosmin Dănuț BARBU ¹ University Politehnica of Bucharest, Bucharest, Romania <i>Applications of Laplace and Sumudu Transforms in Mechanical Engineering</i>
15:45-16:00	Section 3 Room: 4.1	Live Authors: Affiliation: Title:	¹Paul-Florinel CĂȘĂNDROIU, ¹Luciana MOROGAN ¹ Military Technical Academy “Ferdinand I”, București, Romania <i>A new variant of a multimodal romanian voice emotion detection</i>	Section 3 Room: 4.2	Live Authors: Affiliation: Title:	¹Maria CONSTANTINESCU, ¹Simona Mihaela BIBIC ¹ University Politehnica of Bucharest, Bucharest, Romania <i>Solving optimization problems through duality</i>
16:00-16:15	Section 3 Room: 4.1	Live Authors: Affiliation: Title:	¹Daniela ROȘU ¹ Gheorghe Asachi Technical University of Iași, Iași, Romania <i>Existence results for a class of nonlinear evolution systems with delay and nonlocal initial data</i>	Section 3 Room: 4.2	Live Authors: Affiliation: Title:	¹Patrik KOVÁŘ ¹ Czech Technical University in Prague, Prague, Czech Republic <i>Scalable activation function employment in physics informed higher order neural networks for initial value problem approximation</i>
16:15-16:30	Section 3 Room: 4.1	Live Authors: Affiliation: Title:	¹Petcharaporn YODJAI, ¹Poom KUMAM, ²Wiyada KUMAM ¹ King Mongkut’s University of Technology Thonburi, Bangkok, Thailand ² Rajamangala University of Technology Thanyaburi, Pathum Thani, Thailand <i>Image completion using automatic structure propagation and the modified exemplar-based inpainting with two-stage structure-tensor and image sparse representation</i>	Section 3 Room: 4.2	Online Authors: Affiliation: Title:	¹Usman RIAZ ¹ University of Peshawar, Peshawar, Pakistan <i>Global Existence and Finite Time Blow-Up in a New Class of Non-Linear Viscoelastic Wave Equation</i>
16:30-16:45	Section 3 Room: 4.1	Live Authors: Affiliation: Title:	¹Radu STRUGARIU ¹ Gheorghe Asachi` Technical University of Iași, Iași, Romania <i>Generalized differentiation for set-valued maps and applications</i>	Section 1 Room: 4.2	Online Authors: Affiliation: Title:	¹Nicolai GĂITAN ¹ Military Technical Academy „Ferdinand I”, Bucharest, Romania <i>Specific Methods in Digital Image Processing and Computer Vision. Background, implementations, variations, and connections</i>
16:45-17:00	Section 3 Room: 4.1	Live Authors: Affiliation: Title:	¹Geetika GEETIKA, ¹Izhar UDDIN, ²Barahan ALMARRI ¹ Department of Mathematics, Jamia Millia Islamia, New Delhi, India ² College of Sciences, Princess Nourah Bint Abdulrahman University, Saudi Arabia <i>Convergence analysis and of fixed poin iterative process under operators with property (E)</i>	Section 2 Room: 4.2	Live Speaker: University: Title:	¹Ruxandra Ioana CIPU, ¹Stefania Maria MICHNEA, ¹Elena Corina CIPU ¹ University Politehnica of Bucharest, Bucharest, Romania <i>A Beam of Hope: Modelling Approach of Proton Therapy as Cancer Treatment</i>
17:00-17:30	COFFEE BREAK					
17:30-17:35	Section 3 Room: 4.1	Live Authors: Affiliation: Title:	¹Georgeta CREȚU ¹ Gheorghe Asachi Technical University of Iași, Iași, Romania <i>Finslerian Version of Beltrami’s Theorem</i>	Section 3 Room: 4.2	Live Authors: Affiliation: Title:	¹Radu-Ilie HEREȘANU ¹ Military Technical Academy Ferdinand I, Bucharest, Romania <i>Specialized action system commanded with voice signal</i>
17:45-18:00	Section 1 Room: 4.1	Live Authors: Affiliation: Title:	¹Natthaya BOONYAM, ¹Poom KUMAM, ¹Parin CHAIPUNYA ¹ King Mongkut’s University of Technology Thonburi, Bangkok, Thailand <i>Ekeland's Variational Principle on Non-Triangular Metric</i>	Section 1 Room: 4.2	Live Authors: Affiliation: Title:	¹Ștefan Răzvan ANTON, ¹Octavian POSTĂVARU, ¹Antonela TOMA ¹ University Politehnica of Bucharest, Bucharest, Romania <i>Fractional unmatched back projector for Richardson-Lucy deconvolution</i>
18:00-18:15	Section 3 Room: 4.1	Online Authors: Affiliation: Title:	¹Carlos ANDREU VILARROIG, ¹Juan Carlos CORTÉS LÓPEZ, ²Ana NAVARRO-QUILES, ¹Sorina Mădălina SFERLE ¹ Universitat Politècnica de València, València, Spain ² Universitat de València, València, Spain <i>Probabilistic study of the stochastic solution of the pseudo-n order kinetic model applied to a real case</i>	Section 1 Room: 4.2	Live Speaker: University: Title:	¹Mircea-Răzvan LAZA, ¹Simona Mihaela BIBIC ¹ University Politehnica of Bucharest, Bucharest, Romania <i>The study of the evolution in time of a species using the game theory</i>
18:15-18:30	Section 3 Room: 4.1	Online Authors: Affiliation: Title:	¹Wajahat ALI ¹ University of Ostrava, Ostrava, Czech Republic <i>The Global Dynamics of HIV Latency Model Including Cell-to-Cell Viral Transmission</i>	Section 1 Room: 4.2	Online Authors: Affiliation: Title:	¹Nisrine MILIANI, ¹Djillali BOUAGADA, ¹Kamel BENYETTOU ¹ Abdelhamid Ibn Badis University Mostaganem, Mostaganem, Algeria <i>On the positivity analysis of the three-dimensional fractional conformable Fornasini-Marchesini models</i>
	Section 1	Online Authors: Affiliation:	¹Chonjaroen CHAIRATSIRIPONG, ²Anantachai PADCHAROEN, ³Ovidiu BAGDASAR, ¹Tanakit THIANWAN ¹ University of Phayao, Phayao, Thailand	Section 3	Online Authors:	¹Mihaela-Cristina STRÎMTOREANU, ¹Mirela-Violeta MANEA, ¹Mariana-Mirela STĂNESCU, ¹Simona Mihaela BIBIC

18:30-18:45	Room: 4.1	Title:	² Rambhai Barni Rajabhat University, Chanthaburi, Thailand ³ University of Derby, Derby, United Kingdom <i>On some new inertial viscosity fixed point algorithms with applications to convex minimization, image restoration, and polynomiography</i>	Room: 4.2	Affiliation: Title:	¹ University Politehnica of Bucharest, Bucharest, Romania <i>Mathematical Approaches for Biosignals and Applications</i>
18:45-19:00	Section 3 Room: 4.1	Online Authors: Affiliation: Title:	¹Nacer MERIEM ¹ Brothers Mentouri Constantine 1, Constantine, Algeria <i>A boosted Salp Swarm optimization algorithm through the employment of Chaos Theory</i>	Section 3 Room: 4.2	Online Authors: Affiliation: Title:	¹Rawan ABDULLAH ¹ University Politehnica of Bucharest, Bucharest, Romania <i>A Mathematical Model for Allergic Reactions Induced by the Therapy of HIV</i>
19:00-21:00	DINNER					

Day-3

Thursday 30th June 2023

Acces link: ... follow email

ISIM				ISWIM			
Moderators		Prof. Irina BADRALEXI, Prof. Mariana Mirela STĂNESCU		Moderators		Prof. Irina BADRALEXI, Prof. Mariana Mirela STĂNESCU	
9:00-9:15				Section 3	Online Authors: Affiliation: Title:	¹Mohammed Nadjib BENAMAR, ²Mohammed Amine GHEZZAR, ¹Djillali BOUGADA ¹ Abdelhamid Ibn Badis University of Mosyaganem, Mostaganem, Algeria ² National Higher School of Mathematics, Mahelma, Algeria <i>Controller synthesis for positive fractional 2D continuous-discrete linear system</i>	
9:15-9:30				Section 3	Online Authors: Affiliation: Title:	¹Amina FARAOUN, ¹Djillali BOUGADA ¹ Abdelhamid Ibn Badis University of Mosyaganem, Mostaganem, Algeria <i>Analysis of stability and superstability of positive conformable singular continuous time linear systems</i>	
9:30-9:45				Section 3	Online Authors: Affiliation: Title:	¹Ariana GAINA, ¹Rovana BORUG/ ¹ West University of Timișoara, Timișoara, Romania <i>Some criteria for uniform dichotomy of skew-evolution cocycles in Banach spaces</i>	
9:45-10:00				Section 1	Online Authors: Affiliation: Title:	¹Bilal BASTI, ²Maroua Amel BOUBEKEUR ¹ Department of Mathematics, Ziane Achour University of Djelfa, Djelfa, Algeria ² Laboratory of Pure and Applied Mathematics, University of Mostaganem, Mostaganem, Algeria <i>Analytical studies for a hybrid mathematical model of COVID-19: the influence of the pandemic on chronically ill people</i>	
10:00-10:15				Section 1	Online Authors: Affiliation: Title:	¹Sara HAMAIZIA ¹ Universidad Politécnica de Madrid, Madrid, Spain <i>Characterizing chaos in a fractional duffing equation</i>	
10:15-10:30				Section 1	Online Authors: Affiliation: Title:	¹Kamel BENYETTOU, ¹Djillali BOUAGADA, ²Ghezzar MOHAMMED AMINE ¹ Abdelhamid Ibn Badis University Mostaganem, Mostaganem, Algeria ² National Higher School of Mathematics, Mahelma, Algeria <i>On the analysis of the influence of discretization step on the positivity of conformable fractional Roesser models and the Darboux equation</i>	
10:30-10:45				Section 3	Online Authors: Affiliation: Title:	¹Lynda MEZGHICHE, ¹Rabah KHEMIS, ¹Ahlème BOUAKKAZ ¹ LAMAHIS Laboratory, University of 20 Aout 1955, Skikda, Algeria <i>The existence for neutral iterative single-species population growth model with harvesting effort</i>	
10:45-11:00	Section 1	Online Authors: Affiliation: Title:	¹Souad SALMI, ¹Djillali BOUGADA ¹ Abdelhamid Ibn Badis University Mostaganem, Mostaganem, Algeria <i>On the stability radius of a fractional generalized multidimensional state-space systems</i>				
11:00-11:15	Section 1	Online Authors: Affiliation: Title:	¹Shahid SAIFULLAH, ¹Sumbel BEGUM, ¹Akbar ZADA, ²Ioan-Lucian POPA ¹ Department of Mathematics, University of Peshawar, Peshawar, Pakistan ² Exact Science and Engineering, 1 Decembrie 1918 University of Alba Iulia, Alba Iulia, Roma <i>Random Hadamard- type fractional differential equation in generalized spaces with retarded and advanced arguments</i>				
11:15-11:30	Section 1	Online Authors: Affiliation: Title:	¹Idris AHMED, ²Ali AKGUL, ³Kamsing NONLAOPON,⁴Fahd JARAD ¹ Sule Lamido University, Kafin Hausa, Jigawa, Nigeria ² Siirt University, Siirt, Turkey ³ Khon Kaen University, Khon Kaen, Thailand ⁴ Cankaya University, Ankara, Turkey <i>A Caputo-Fabrizio fractional-order cholera model and its sensitivity analysis</i>				
11:30-11:45	Section 3	Online Authors: Affiliation: Title:	¹Mansouria SAIDANI ¹ Abdelhamid Ibn Badis University Mostaganem, Mostaganem, Algeria <i>Growth of solutions of lenear differential equations with entire coefficients of $[P,Q]$- Φ order</i>				
11:45-13:00	Room: CE 304, FIIR	Feedback, discussions and networking activitiesRound Table: DiscussionsLibrary Building, UPB					