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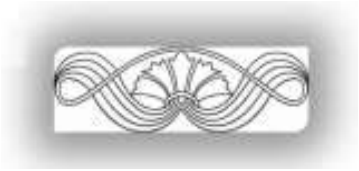

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BOOK OF ABSTRACTS

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Numerical Computation of Generalized Averaged Gaussian and Anti-Gauss Quadrature Rules

Miodrag M. SPALEVIĆ[1]

[1]*Department of Mathematics, Faculty of Mechanical Engineering, University of Beograd, Belgrade-SERBIA*

mspalevic@mas.bg.ac.rs

ABSTRACT

Gauss-Kronrod quadrature rules (named the quadratures of the 20th century) have been developing in the last 60 years in order to solve the question of efficient estimating the error of the Gauss quadrature formula. Anti-Gauss and the generalized averaged Gaussian quadrature rules, as well as their Radau and Lobatto extensions, are introduced lately as alternatives to the Gauss-Kronrod. We present here a survey of the results on their stable numerical calculation.

ACKNOWLEDGEMENT
Research of M.M. Spalević is supported in part by the Serbian Ministry of Science, Technological Development, and Innovations, according to Contract 451-03-47/2023-01/200105 dated on 3 February, 2023.

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The Impact of Vaccination on the Epidemiological Model of Meningitis with Diffuse Transmission

Zakia HAMMOUCH[1]

[1]*Department of Sciences, École normale supérieure, Moulay Ismail University of Meknes, MOROCCO*

z.hammouch@fste.umi.ac.ma

ABSTRACT

This paper presents a novel approach to modeling the dynamics of meningococcal disease by including a compartment for vaccinated individuals. The main objective is to assess the effectiveness of vaccination in reducing disease transmission. To achieve this, we propose a set of partial differential equations to describe the model and demonstrate the existence and uniqueness of a solution. Additionally, we investigate the existence and stability of steady states in the model. Furthermore, we conduct a sensitivity analysis of the basic reproduction number (R0) with respect to the model parameters. Finally, we provide numerical results illustrating the spread of the virus.

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Non-Standart Finite Difference Method to Solve the Mathematical Model of Hepatitis B Epidemic Disease

Ali SHOKRI[1] and Maryam MOLAYI[1]

[1]*Department of Mathematics, Faculty of Basic Science, University of Maragheh, P.O. Box 55181-83111, Maragheh, IRAN*

shokri@maragheh.ac.ir
m.molayi.66@gmail.com

ABSTRACT

This paper aims to present a nonstandard finite difference (NFSD) method to solve the mathematical model of the Hepatitis B with non-cytolytic mechanisms of CTL cells. The proposed method have important properties such as positivity and elementary stability. Numerical comparisons between the proposed method and the other methods indicate that the new method have better accuracy and convergence.

On The Efficacy Of 'Herd Behavior' in The Commodities Market. A Neuro-Fuzzy Agent 'Herding' On Deep Learning Traders

Luca GRILLI[1], Alfonso GUARINO[2], Domenico SANTORO[3], Francesco MESSINA[4] and Rocco ZACCAGNINO[5]

[1]Department of Economics, Management and Territory, University of Foggia, ITALY
[2]Department of Law, Economics, Management and Quantitative Methods, University of Sannio, ITALY
[3]Department of Economics and Finance, University of Bari Aldo Moro, ITALY
[4]Department of Statistical Sciences, University La Sapienza of Rome, ITALY
[5]Department of Computer Science, University of Salerno, ITALY

luca.grilli@unifg.it
alguarino@unisa.it
domenico.santoro@uniba.it
messina.1961177@studenti.uniroma1.it
rzaccagnino@unisa.it

ABSTRACT

This paper analyzes the trading strategies of five state-of-the-art agents based on Reinforcement Learning on six commodity futures: Brent Oil, Corn, Gold, Coal, Natural Gas, and Sugar. Some of these were chosen because of the periods considered (when they became essential commodities), i.e., before and after the 2022 Russia-Ukraine conflict. Agents behavior was assessed using a series of financial indicators, and the trader with the best strategy was selected. Top traders' behavior helped train our recently introduced neuro- fuzzy agent, which adjusted its trading strategy through "herd behavior". The results highlight how the Reinforcement Learning agents performed ex- cellently and how our neuro-fuzzy trader could improve its strategy using competitor movement information. Finally, we performed experiments with and without transaction costs, observing that, despite these costs, there are fewer transactions. Moreover, intelligent agents' performances are outstand- ing and surpassed by the neuro-fuzzy agent.

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The Influence of c-Subnormality of Subgroups on the Structure of Finite Groups

Jehad Al JARADEN[1]

[1]*Department of Mathematics, Faculty of Science, Al-Hussein Bin Talal University, Ma'an, JORDAN*

jjaradeen@ahu.edu.jo

ABSTRACT

Let H be a subgroup of a group G. We say that H is c−subnormal in G if there exists a subnormal subgroup T of G such that HT = G and H ∩T ⩽ HG, where HG is the maximal normal subgroup of G which is contained in H. In this paper, we investigate the structure of a finite group G under the assumption that all maximal subgroups are c−subnormal subgroups and to present some new conditions for supersolvability.

Anderson Acceleration and How It Speeds Up Convergence in Fixed Point Iterations

Leo REBHOLZ[1]

[1]*School of Mathematical and Statistical Sciences, Clemson University, Clemson, SC, 29364, UNITED STATES OF AMERICA*

rebholz@clemson.edu

ABSTRACT

Anderson acceleration (AA) is an extrapolation technique originally proposed in 1965 that recombines the most recent iterates and update steps in a fixed point iteration to improve the convergence properties of the sequence. Despite being successfully used for many years to improve nonlinear solver behavior on a wide variety of problems, a theory that explains the often-observed accelerated convergence was lacking. In this talk, we give an introduction to AA, then present a proof of AA convergence which shows that it improves the linear convergence rate based on a gain factor of an underlying optimization problem, but also introduces higher order terms in the residual error bound. We then discuss improvements to AA based on our convergence theory, and show numerical results for the algorithms applied to several application problems including Navier-Stokes, Boussinesq, and nonlinear Helmholtz systems.

The Consistency and Efficiency of Regularization Methods for Factor Loading Estimation in Structural Equation Modeling

Nurul Raudhah ZULKIFLI[1], Nazim AIMRAN[1] and Sayang Mohd DENI[1]

[1]School of Mathematical Sciences, College of Computing, Informatics and Media, Universiti Teknologi MARA, 40450 Shah Alam, Selangor, MALAYSIA

nurulraudhahzulkifli@gmail.com
nazim@tmsk.uitm.edu.my
sayang@tmsk.uitm.edu.my

ABSTRACT

In structural equation modeling (SEM), among the desirable properties of an estimator is consistency and efficiency. The mean squared error (MSE) provides a numerical measure of the overall accuracy and goodness of fit of the model, with lower values indicating better performance. Meanwhile, an efficient estimator achieves smaller estimation variability and provides estimates that are closer, on average, to the true parameter value. In this study, a traditional regularization method namely RegSEM has been used to cater the improvement of the effect of unique variance in SEM. However, the method is seen less efficient as the method regularized directly on the specific parameter matrix such as factor loading matrix, that leads to over shrinkage of the estimates issue which introduces some level of bias, hence reducing the consistency and efficiency of factor loading estimation. In SEM, the factor loading estimates must be unbiased in order to ensure the reliability and validity of further analyses. Therefore, the regularized ULS method, a new approach of regularization is introduced in this study. Multivariate non-normal data with specified population parameters and sample sizes were generated using Pro-Active Monte Carlo simulation, and the data were analyzed using R Programming Environment using lavaan and regsem packages. The outcome of this study demonstrates the capability of regularized ULS in estimating unbiased factor loading more consistently and efficiently than the RegSEM approach.

Repel Effects of Heat Transference from Brinkman Fluid under Ferromagnet via Non-Singularized Differentials

Ambreen SIYAL[1], Kashif Ali ABRO[1,2,3]

[1]Department of Basic Sciences and Related Studies, Mehran University of Engineering and Technology, Jamshoro, PAKISTAN
[2]Institute of Ground Water Studies, Faculty of Natural and Agricultural Sciences, University of the Free State, SOUTH AFRICA
[3]Department of Mathematical Sciences, United Arab Emirates University P.O. Box 15551, Al Ain, UNITED ARAB EMIRATES

kashif.abro@faculty.muet.edu.pk

ABSTRACT

When Brinkman fluid exhibits a net and strong magnetization then such Brinkman fluid leads to ferro-magnetized Brinkman fluid with high permeabilities for magneto-strictive flow behavior. This manuscript aims to present the magneto-resistive analytical solutions for the governing equations of ferro-magnetized Brinkman fluid under an effective and powerful approach Atangaan-Baleanu differential operator. The governing equations of ferro-magnetized Brinkman fluid have been constructed from classical to Atangaan-Baleanu differential operators. The analytical solutions are emphasized in terms of magnetized domains for velocity field, temperature and concentration profiles. Integral transforms approach is invoked to tackle the fractional verses classical solutions and ferro-magnetized verses non-ferro-magnetized solutions. Our results investigate that the transfer of heat in the presence of a ferro-magnetic has generated ripples in Brinkman fluid showing several rheological similarities and rheological dis-similarities.

Smoothing Mixed Integer Nonlinear Chance Constrained Optimization and Its Applications

Agegnehu TESFAYE[1], Berhanu GUTA[1] and Abebe GELETU[2]

[1]Department of Mathematics, Addis Ababa University, Addis Ababa, ETHIOPIA
[2]German Research Chair, African Institute of Mathematical Sciences (AIMS), KN 3 Rd, Kigali, RWANDA

agegnehutesfaye09@gmail.com
berhanu.guta@aau.edu.et
ababe.galetu@aims.ac.rw

ABSTRACT

Numerous engineering fields can use the Mixed Integer Nonlinear Chance Constrained Programming Problem (CCMINLP). Yet, due to the structural nature of CCMINLP, it is extremely challenging for existing solvers to handle this kind of problem.

The main challenge is caused by MINLP's NP nature and the conventional method's evaluation of the probabilistic restriction. Consequently, in our work, we present new approximate techniques, namely modified inner and outer approximation approach. By using a continuously differentiable function, we approximate the probabilistic constraint. Next, the optimization problem is approximated by a series of nonlinear programming problems (NLPs), which may be resolved by an NLP solver.

In our work, we also discussed the feasibility and convergence features of an optimal solution that closely matched the original problem.

Quantitative Prediction of Effective Porous for Optimal Thermal Analysis Based on Fractional Analytical Model

Kashif Ali ABRO[1,2], Ambreen SIYAL[2] and Qasem M. AL-MDALLAL[1]

[1]Department of Mathematical Sciences, United Arab Emirates University P.O. Box 15551, Al Ain, UNITED ARAB EMIRATES
[2]Department of Basic Sciences and Related Studies, Mehran University of Engineering and Technology, Jamshoro, PAKISTAN

kashif.abro@faculty.muet.edu.pk

ABSTRACT

This manuscript dedicatedly presents the thermal analytical fractional model for the sake of optimization of heat and mass transfer in the presence of porous media subject to the functionality and characterization of nanoparticles. The thermoviscoelastic nanofluid is considered for investigating the conjugate effects under the suspension of nanoparticles in ethylene glycol via analytical approaches for two types of fractional differential operators. The formulation of governing equations of thermoviscoelastic nanofluid for velocity, temperature and concentration has been derived by means of non-singular and non-local kernels. The analytical solutions have been traced out by means of special functions and Laplace transforms as a first and second translation respectively. The rheological optimization of nanofluid by incorporating four types of nanoparticles exhibits isothermal efficiency during the suspension process. The comparative profile of temperature distribution is depicted under suspended/adsorbed nanoparticles in ethylene glycol for describing the major characteristics for thermal analysis. Our results suggest that accurate and simple quantitative analysis for four different types of nanoparticles is quite relevant to experimental techniques for the sake of enhancement of the thermal conductivity.

On the Other Forms of Near Perfect Numbers

Dannielle ENRIQUEZ[1] and Eman C. AHMAD[1]

[1]*Department of Mathematics and Statistics, College of Science and Mathematics, Western Mindanao State University*

ahmad.eman@wmsu.edu.ph

ABSTRACT

We introduce a new form of near perfect number where these numbers are the product of two numbers that are relatively prime and we investigate these results concerning the near perfect numbers with fixed redundant divisor.

Stable Locating-Dominating Sets in Graphs

Eman C. AHMAD[1], Gina A. MALACAS[2] and Sergio R. CANOY[2]

[1]Department of Mathematics and Statistics, College of Science and Mathematics, Western Mindanao State University
[2]Department of Mathematics and Statistics, College of Science and Mathematics, Mindanao State University-Iligan Institute of Technology, Iligan City

ahmad.eman@wmsu.edu.ph
gina.malacas@msuiit.edu.ph
sergio.canoy@msuiit.edu.ph

ABSTRACT

A set $S \subseteq V(G)$ of a (simple) undirected graph G is a locating-dominating set of G if for each $v \in V(G) \setminus S$, there exists $w \in S$ such tha $vw \in E(G)$ and $N_G(x) \cap S \neq N_G(y) \cap S$ for any distinct vertices x and y in $V(G) \setminus S$. S is a *stable locating-dominating set* of G if it is a locating-dominating set of G and $S \setminus \{v\}$ is a locating-dominating set of G for each $v \in S$. The minimum cardinality of a stable locating-dominating set of G, denoted by $\gamma_l^s(G)$, is called the *stable locating-domination number* of G.

In this study, the concept of stable locating-dominating set and the corresponding parameter of some graphs are investigated. Further, we introduce other related concepts and use them to characterize the stable locating-dominating sets in some graphs.

Mathematical Models for Evaluation of Students Performance

Miloš VUČIĆ[1] and Davorka JANDRLIĆ[1]

[1]Department of Mathematics, Faculty of Mechanical Engineering, University of Belgrade, SERBIA

mvucic@mas.bg.ac.rs
djandrlic@mas.bg.ac.rs

ABSTRACT

Developing mathematical models for assessing students' performance is a multifaceted endeavor that encompasses various educational objectives, including grading, performance prediction, proficiency identification, and more. Here, we were focused on establishing correlations among subjects that students typically pass together and other parameters that influence individual student success in those subjects.

ACKNOWLEDGEMENT
This research was supported in part by the Serbian Ministry of Science, Technological Development and Innovation according to contract number 451-03-47/2023-01/200105 dated February 3, 2023.

Anisotropic Elliptic Problems Involve Two Types of Terms: A Lower-Order Term and A Hardy Potential

Riyadh NESRAOUI[1] and Hichem KHELIFI[2]

[1]National Higher School of Advanced Technologies, Algiers, ALGERIA
[2]Department of Mathematics and Informatics, University of Algiers, Algeria, Laboratory of Mathematical Analysis and Applications

riyadh.nesraoui@gmail.com
khelifi.hichemedp@gmail.com

ABSTRACT

This work studies the existence and regularity of solutions for an anisotropic elliptic problem that includes a lower order term and a Hardy potential. Our approach is based on approximating the initial problem with a new problem that is well-posed. We then establish the necessary estimates to pass to the limit.

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Application of General Transform to Atangana-Baleanu Fractional Operators

Meryem MEDDAHI[1]

[1]*Faculty of Technology, Hassiba Benbouali University, Chlef-ALGERIA*

mdhmrm@yahoo.fr
m.meddahi@univ-chlef.dz

ABSTRACT

In this work we investigate a new integral transform introduced recently by Jafari. Specically, we explore the applicability of this integral transform on Atangana-Baleanu fractional derivatives and the associated fractional integral. It is shown that by applying specific conditions on this integral transform, other integral transforms are deduced. We provide examples to reinforce the applicability of this new integral transform.

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Finite Element Method (FEM) for a Class of Nonlocal Elliptic and Parabolic Equations

Tahar BELHADI[1]

[1]*Department of Mathematics, Faculty of Science,*
University 20 August 1955, Skikda, ALGERIA

t.belhadi@univ-skikda.dz

ABSTRACT

In this paper, we consider the numerical solutions of two nonlocal fractional problems using the finite element method (FEM). Many papers that dealt with the elliptic problem took the second member into account f = 1, which is a simple form, which made us deal with f in our current paper according to different formulas. As for the second parabolic problem, we use the matrices calculated in the first problem to obtain an ordinal differential equation. We use (2, 2) Pade approximation to calculate the exponential matrix in the analytical solution of the ordinary differential equation. These methods were dropped on three numerical examples to prove the accuracy and efficiency of this technique, so we found it a very effective and fast method.

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Investigating the Dynamics of Fractional-Order Chaotic System and Its Application on Image Encryption

Hasna YOUSFI[1], Gasri AHLEM[1] and Yousef ISLAM[2]

[1]Laboratory of Mathematics, Informatics and Systems (LAMIS)
Echahid Cheikh Larbi Tebessi University, Tebessa, 12002, ALGERIA
[2]School of Physics and Electronics Central South University, Changsha 410083, CHINA

hasna.yousfi@univ-tebessa.dz
ahlem.gasri@univ-tebessa.dz
222219004@csu.edu.cn

ABSTRACT

This article describes Halvorsen circulant systems (HCS) with fractional order Caputo derivative and its qualitative properties. We represent the Adomian decomposition technique (ADM) to study the dynamics of fractional-order Halvorsen circulant chaotic system. Lyapunov exponents (LEs), bifurcation diagrams, and phase diagrams are used to analyse the chaotic behaviors of the fractional-order Halvorsen circulant system. This paper also discusses the stabilization and synchronization of identical Halvorsen circulant chaotic systems and stability theory proves adaptive feedback control and synchronization. Additionally, using the fractional-order system's remarkable properties, we developed a Halvorsen circulant chaotic image encryption technique using the enhanced Halvorsen circulant chaotic sequences. The suggested method uses a keystream generator for high security based on the enhanced Halvorsen circulant chaotic behavior. While efficient and quick for secure image transport, the approach is extremely safe against statistical analysis and differential assaults. The algorithm's effectiveness is confirmed by extensive simulation and research.

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Isogeometric Approximation of Newtonian Incompressible Fluid Flow in a Square Medium

Ouadie KOUBAITI[1] and Ahmed ELKHALFI[2]

[1]MSISI Laboratory, Faculty of Sciences and Technics of Errachidia,
Moulay Ismail University of Meknes, MORROCO
[2]Mechanical engineering Laboratory, Faculty of Sciences and Techniques,
B.P. 2202 Route Imouzzer, Fes, MOROCCO

Kouba108@gmail.com

ABSTRACT

The aim of the study is to establish the superiority of the IGA method in solving nonlinear Navier-Stokes equations, providing valuable insights into fluid dynamics and practical implications for engineering simulations.

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Internality of Averaged Gaussian Quadrature Rules

Dušan ĐUKIĆ[1], Rada MUTAVDŽIĆ ĐUKIĆ[1], Lothar REICHEL[2] and Miodrag SPALEVIĆ[1]

[1]Department of Mathematics, Faculty of Mechanical Engineering, University of Belgrade, Belgrade-SERBIA
[2]Department of Mathematical Sciences, Kent State University, Kent, OH-USA

ddjukic@mas.bg.ac.rs
rmutavdzic@mas.bg.ac.rs
reichel@math.kent.edu
mspalevic@mas.bg.ac.rs

ABSTRACT

The averaged and optimal averaged quadrature rules provide a convenient method of approximating the error in the Gauss quadrature. However, they are fully applicable only if their nodes are internal. We discuss two approaches to determine averaged quadrature rules with internal nodes: (i) truncating the Jacobi matrix associated with the optimal averaged rule, and (ii) weighting the optimal averaged quadrature rule. A survey of our results on internality of averaged Gaussian quadrature rules will be presented.

ACKNOWLEDGEMENT
Research of D. Đukić, R. Mutavdžić Đukić, and M. Spalević is supported in part by the Serbian Ministry of Science, Technological Development and Innovations, according to Contract 451-03-47/2023-01/200105 dated on February 3, 2023.

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On Orthogonal and Related Polynomials with Respect to the Abel Weight

Dušan DJUKIĆ[1]

[1]*Department of Mathematics, Faculty of Mechanical Engineering, University of Belgrade, Belgrade-SERBIA*

ddjukic@mas.bg.ac.rs

ABSTRACT

While a lot is known about the classical orthogonal polynomials, their counterparts with respect to non-classical weights are not as well explored. Nevertheless, sometimes such weights come handy as well. For example, the famous Abel-Plana summation formula offers a convenient method of summing an infinite series, reducing the sum to an integral with the Abel weight function on the real line. Orthogonal polynomials with respect to this weight naturally arise when we have to numerically evaluate this integral using the Gauss quadrature rule. These orthogonal polynomials are our object of study. We obtain a number of explicit formulas and algebraic relations between these and related polynomials, including the associated polynomials. In particular, for many of these polynomials we obtain Fourier expansions with the orthogonal polynomials as the basis. We also determine the weight functions whose orthogonal polynomials are the polynomials we discussed. At the end, we discuss the asymptotic properties of these polynomials and perform numerical experiments.

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Error Estimates of Gauss-type Quadrature Rules for Variable-Sign Weight Functions

Jelena TOMANOVIĆ[1]

[1]*Department of Mathematics, Faculty of Mechanical Engineering, University of Belgrade, Belgrade-SERBIA*

jtomanovic@mas.bg.ac.rs

ABSTRACT

The n-point Gauss quadrature formula G_n is known to be a unique optimal interpolatory quadrature rule. In practical applications of G_n, it is important to be able to estimate its error. For that purpose, (2n+1)-point extensions that inherit the n nodes of G_n, such as the Gauss-Kronrod, averaged Gauss, and generalized averaged Gauss quadrature rules, can be used. When G_n is applied, the weight function (or the measure) is usually assumed to be non-negative on the integration interval. In the present paper, we consider the recently introduced n-point Gauss-type quadrature formula Q_n with respect to weight functions that change the sign in the interior of the integration interval. To estimate the error of Q_n, we construct its (2n+1)-point extensions that inherit the n nodes of Q_n and that are analogous to the Gauss-Kronrod, averaged Gauss, and generalized averaged Gauss quadrature rules. Numerical examples illustrate the accuracy of the error estimates obtained by these extensions.

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Error Estimates for Gaussian Quadrature of Analytic Functions

Davorka JANDRLIĆ[1], Aleksandar PEJČEV[1] and Miodrag SPALEVIĆ[1]

[1]Department of Mathematics, Faculty of Mechanical Engineering, University of Belgrade, SERBIA

djandrlic@mas.bg.ac.rs
apejcev@mas.bg.ac.rs
mspalevic@mas.bg.ac.rs

ABSTRACT

We studied the error bound of Gaussian quadrature for analytic functions. The basic idea is to express the remainder of Gaussian quadrature as a contour integral, then the error bound is reduced to find the maximum of the kernel function:

$$K_n(z;\omega)=\frac{\varrho_n(z;\omega)}{\pi_n(z)},\quad \varrho_n(z;\omega)=\int_{-1}^{1}\frac{\pi_n(t)}{z-t}\,dt,\quad z\in\mathbb{C}\backslash[-1,1]. \tag{1}$$

The integral representation of the error term leads directly to the error bound

$$|R_n(f)|\le\frac{l(\Gamma)}{2\pi}\left(\max_{z\in\Gamma}|K_n(z)|\right)\left(\max_{z\in\Gamma}|f(z)|\right), \tag{2}$$

where $l(\Gamma)$ represents the length of the chosen contour Γ.

We studied the estimates (2) for various weight functions with respect to this particular Γ.

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Uniqueness of the Solution of the Inverse Scattering Problem for a Discontinuity Sturm-Liouville Problem

Khanlar R. MAMEDOV[1] and Shabnur R. ALIZADEH[2]

[1]Department of Mathematics, Faculty of Science and Letters,
Igdir University, Igdir-TÜRKİYE
[2]Department of Mathematics and Informatics, Faculty of Natural Sciences,
Lankaran State University, Lankaran-AZERBAIJAN

hanlar.residoglu@igdir.edu.tr
shabnuralizade@gmail.com

ABSTRACT

We consider the boundary value problem generated by the differentia equation

$$-z'' + p(x)z = \mu^2 z, \quad 0, < x < \infty \tag{1}$$

Boundary condition

$$z'(0) + b\mu^2 z(0) = 0, \tag{2}$$

and discontinuity conditions at a point $x_0 \in (0,\infty)$

$$\begin{aligned} z(x_0 - 0) &= \gamma z(x_0 + 0), \\ z'(x_0 - 0) &= \gamma^{-1} z(x_0 + 0), \end{aligned} \tag{3}$$

Where $\gamma > 0, \gamma \neq 1,\ p(x)$ is a real-valued function such that

$$\int_0^\infty (1+x)|p(x)|dx < \infty \tag{4}$$

and b is a real number.

In this paper, by using the integral representation of the solution of the equation (1) we defined the scattering data of the boundary value problem (1)-(4), some properties of the scattering data are investigated and the uniqueness of the solution of the inverse problem is shown.

In the case $\gamma = 1$ the similar problem is shown in [1]

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On Recovering Nonselfadjoint Sturm-Liouville Operators on the Half-Line from the Scattering Data

Ramin G. FARZULLAZADEH[1] and Khanlar R. MAMEDOV[2]

[1]Department of Mathematics and Informatics, Faculty of Natural Sciences, Lankaran State University, Lankaran-AZERBAIJAN
[2]Department of Mathematics, Faculty of Science and Letters, Igdir University, Igdir-TÜRKİYE

ramin.ferzulla@gmail.com
hanlar.residoglu@igdir.edu.tr

ABSTRACT

In this work, is considered the inverse scattering problem on the half-line $[0,\infty)$ with a nonlinear spectral parameter in the boundary condition:

$$-u''+q(x)u=\lambda^2 u\,,\quad 0<x<\infty\,, \tag{1}$$

$$(a_0+a_1\lambda+a_2\lambda^2)u'(0)-(b_0+b_1\lambda+b_2\lambda^2)u(0)=0\,, \tag{2}$$

where the potential $q(x)$ is a real valued function and

$$\int_0^\infty (1+x)|q(x)|dx<\infty\,, \tag{3}$$

a_i, b_i $(i=0,\ 1,\ 2)$ are real numbers, λ is a complex parameter.

The direct and inverse problems of scattering theory on the half-line for the equation (1) with a spectral parameter contained in the boundary condition were investigated in [1, 2, 3]. In the case of nonselfadjoint, the similar problem was worked in [4].

In the present work, the scattering data is defined and the properties of the scattering data are investigated. It turns out that the potential in the equation (1) is determined by specifying: the scattering function, non-real singular values and normalization polynomials.

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On the Simulation of Shallow Water Confluences

Nuray ÖKTEM [1]

[1]*Department of Mathematics, Faculty of Engineering and Natural Sciences, Ankara Yıldırım Beyazıt University, ANKARA-TURKEY*

nbozkaya@gmail.com

ABSTRACT

In this paper, a two dimensional numerical model is presented to examine the flow structure at water confluences. The junction flow is a complex physical phenomena mainly due to its hyperbolic behaviour so it is not strange that transcritical and supercritical flow regimes may occur at the immediate vicinity of the junction. The numerical model in this study is set up for the simple junction flow which is formed by a main channel with an adjacent right-angled lateral branch. The flow is governed by the shallow water equations. These equations are derived from the Navier-Stokes equations under the assumption that the vertical scale of flow fluctuations is much smaller than the horizontal scale. The numerical method presented here is based upon Godunov type finite volume solvers on an unstructured triangular grid. The use of unstructured grids is advantageous due to its flexibility for more complex geometries, however, it brings difficulties in the interface flux computations where discontinuous solutions take place. Moreover, the solutions are required in large computational domains with real time calculations. Therefore, the use of flux limiters becomes inevitable and the gradient approach has to be modified for the unstructured grids. In this study, a novel computer code is developed to simulate the flow dynamics in the neighbourhood of confluences and downstream of main channel. The gradient computation is improved so that the proposed numerical technique can deal with the discontinuous solutions on the control volume interfaces of unstructured mesh. The numerical results are visualized by the water surface elevation profiles. It is revealed that the presence of a lateral branch creates a variability of flow depth and velocities and so that a separation zone is observed at the downstream corner of the junction.

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On a Differential Game with Players Moving Under Undamped Oscillations

Ulmasjon SOYIBBOEV [1] and Muhammadsodik ABDUMANNOPOV [2]

[1]Department of Mathematical analysis, Faculty of Mathematics, Namangan State University, Namangan-UZBEKISTAN
[2]Department of Mathematical Analysis and Differential Equations, Faculty of Mathematics-Information Technology, Fergana State University, Fergana-UZBEKISTAN

ulmasjonsoyibboev@gmail.com
muhammadsodiq1917@gmail.com

ABSTRACT

In the abstract, we study a differential game with two players (Pursuer and Evader) moving under undamped oscillations. Geometric constraints are imposed on controls of both players. The controls function as the acceleration vectors. In a pursuit problem, the $\Pi-$strategy is proposed for the Pursuer, and capture conditions and guaranteed capture time are determined. In an evasion problem, a special strategy is proposed for the Evader, and evasion conditions are identified. By the $\Pi-$strategy, we construct an attainibility domain of the players with the property of monotonicity in time. Moreover, a reachability set of the Evader is built in order to solve the "Life-line" problem in favour of the Evader.

Consider the differential game when Pursuer X and Evader Y having radius vectors x and y correspondingly move in the space R^n. If their acceleration vectors are u and v, then the game will be described by the equations:

$$X: \quad \ddot{x} + x = u, \; x(0) = x_0, \; \dot{x}(0) = x_1,$$
$$Y: \quad \ddot{y} + y = v, \; y(0) = y_0, \; \dot{y}(0) = y_1,$$

where $x, y, u, v \in R^n$, $n \geq 2$; $x(0) = x_0$ and $y(0) = y_0$ are the initial positions of the objects X and Y, respectively; $\dot{x}(0) = x_1$ and $\dot{y}(0) = y_1$ are the initial velocity vectors of the objects X and Y, respectively. It is assumed that $x_0 \neq y_0$ and $x_1 = y_1$. Here, the control function $u(\cdot)$ of the Pursuer satisfies the geometric constraint $|u(t)| \leq \alpha$ for almost every $t \geq 0$, and the control function $v(\cdot)$ of the Evader meets the geometric constraint $|v(t)| \leq \beta$ for almost every $t \geq 0$. In the "Life-line" game, it is supposed that a closed subset $M \subset R^n$ is given, and $y_0 \notin M$. The aim of Pursuer X is to capture Evader Y, i.e. to reach the equality $x(t) = y(t)$ at a finite time $t > 0$ while Evader Y is in the zone R^n / M. The aim of Evader Y is to reach the zone M before being caught by Pursuer X or to keep the relation $x(t) \neq y(t)$ for all $t \geq 0$, and if it is impossible, to delay the time of the meeting as far as possible.

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New Estimations for P-Functions with the Help of Caputo-Fabrizio Fractional Integral Operators

Sinan ASLAN[1], Ahmet Ocak AKDEMİR[2] and Erhan SET[3]

[1]Ağrı Türk Telekom Social Sciences High School, Ağrı Türkiye
[2]Department of Mathematics, Faculty of Science and Arts,
Ağrı İbrahim Çeçen University, Ağrı-TURKEY
[23]Department of Mathematics, Faculty of Science and Arts,
Ordu University, Ordu-TURKEY

sinanaslan0407@gmail.com

ABSTRACT

In this paper, some novel integral inequalities for different kinds of convex functions have been proved by using Caputo-Fabrizio fractional integral operators. The findings includes several new integral inequalities P-functions. We have used the properties of Caputo-Fabrizio fractional operator, definitions of different kinds of convex functions and elemantery analysis methods.

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Some Novel Integral Inequalities on the Co-ordinates for Log-Exponentially Convex Functions

Sinan ASLAN[1], Ahmet Ocak AKDEMİR[2] and Alper EKİNCİ[3]

[1]Ağrı Türk Telekom Social Sciences High School, Ağrı-TÜRKİYE
[2]Department of Mathematics, Faculty of Science and Arts,
Ağrı İbrahim Çeçen University, Ağrı-TURKEY
[2]Bandırma Vocational School,
Bandırma Onyedi Eylül University, Balikesir-TURKEY

sinanaslan0407@gmail.com

ABSTRACT

The main motivation of this work is to give some new definitions for Log-Exponential Convex Functions and prove new integral inequalities. To obtain the main findings, we used some classical inequalities such as Hölder and Young's inequality for certain powers of functions. Special results were obtained by taking $\alpha = 0$ in the main results.

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Hadamard-Type Inequalities for m-Geometrically Convex Functions via Riemann-Liouville Integrals

Harun Emre SEYHAN[1] and Ahmet Ocak AKDEMİR[2]

[1]Department of Mathematics, Institute of graduate Studies,
Ağrı İbrahim Çeçen University, Ağrı-TURKEY
[2]Department of Mathematics, Faculty of Science and Arts,
Ağrı İbrahim Çeçen University, Ağrı-TURKEY

aocakakdemir@gmail.com

ABSTRACT

In this paper some new inequalities of Hadamard-type are established for the classes of functions whose derivatives of absolute values are geometrically m-geometrically convex functions via Riemann-Liouville integrals.

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Fault-tolerant Locating-Dominating Sets in Graphs

Eman C. AHMAD[1]

[1]*Department of Mathematics and Statistics, College of Science and Mathematics, Western Mindanao State University*

ahmad.eman@wmsu.edu.ph

ABSTRACT

A set $S \subseteq V(G)$ of a (simple) undirected graph G is a locating-dominating set of G if for each $v \in V(G) \setminus S$, there exists $w \in S$ such tha $vw \in E(G)$ and $N_G(x) \cap S \neq N_G(y) \cap S$ for any distinct vertices x and y in $V(G) \setminus S$. S is a *fault-tolerant locating-dominating set* of G if it is a locating-dominating set of G and $S \setminus \{v\}$ is a locating-dominating set of G for each $v \in S$. The minimum cardinality of a fault-tolerant locating-dominating set of G, denoted by $\gamma_l^s(G)$, is called the *fault-tolerant locating-domination number* of G.

In this study, the concept of fault-tolerant locating-dominating set and the corresponding parameter of some graphs are investigated. Further, we introduce other related concepts and use them to characterize the fault-tolerant locating-dominating sets in some graphs.

Keywords: locating, fault-tolerant, domination

Tutte Polynomials for Interval Graphs

Abdulgani ŞAHİN[1]

[1]*Department of Mathematics, Faculty of Science and Letters,*
Ağrı İbrahim Çeçen University, Ağrı-TURKEY

rukassah@gmail.com

ABSTRACT

Although graph theory is a field of study in itself, graphs are frequently used in studies in other branches of science and to facilitate human life in all areas of modern living spaces. One such class of graphs is interval graphs which model the intersection structure of a set of intervals of any linearly ordered structure on the real line, and have applications in various fields such as combinatorics, molecular biology, measurement theory and scheduling. The Tutte polynomial is one of the most well-known and frequently used types of polynomials in graphs. In this work, we investigate Tutte polynomials of interval graphs. For this purpose, certain classes of interval graphs are considered and their Tutte polynomials are tried to characterize.

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Absolute Monotonicity Properties of the Generalized Elliptic Integral of the First Kind

Fei WANG[1]

[1]*Department of Mathematics, Zhejiang Institute of Mechanical and Electrical Engineering, Hangzhou-CHINA*

wf509529@163.com

ABSTRACT

In this talk, the authors present certain combinations defined the generalized elliptic integral of the first kind $\K_a$ and inverse hyperbolic tangent $\arth\,r$. such as $f(r)=\left[3p(\arth\,r)/r+1-3p-2\K_a/\pi\right]/r^4$,$g(r)= \left[2\K_a/\pi-q(\arth\,r)/r+q-1\right]/r^2$ and $F(r)\equiv r^3f(r)/(\arth\,r-r)$,are proved to be absolutely monotone on $(0,1)$. Moreover, these propertiesprovide lower and upper bounds for $\K(r)$, $\K_a(r)$.

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Strongly Nonlinear Coupled System in Orlicz-Sobolev Spaces without Δ_2-Condition

Rabab ELARABI[1]

[1]*Department of Mathematics, Faculty of Science, Meknès, MOROCCO*

rababelarabi162@gmail.com

ABSTRACT

The aim of this paper is to prove in Orlicz-Sobolev Spaces, the existence of capacity solution to a strongly nonlinear coupled system without assuming the Δ_2- condition on the N-funtion. This system may be regarded as a modified version of the well-known thermistor problem; in this case, the unknowns are the temperature in a conductor and the electrical potential.

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The Local Linear Estimation of the Conditional Distribution Function for Functional Data

Bouanani OUSSAMA[1]

[1]*Department of Mathematics, Faculty of Exact Sciences and Computer Science, University Abdelhamid Ibn Badis Mostaganem, ALGERIA*

oussama.bouanani@univ-mostadz

ABSTRACT

In this paper, we present an alternative statistical method for kernel estimation, specifically the local linear estimation (L.L.E), applied to the conditional distribution function. This approach is examined in a scenario where the response variable is real, and the explanatory variable varies in an infinite-dimensional space. The main goal of this research is to establish the asymptotic normality of the constructed estimator, accompanied by explicit rates. Furthermore, we illustrate the effectiveness of our results through a simulated study.

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On Some Inequalities for Geometrically Convex Functions via Hadamard Fractional Integrals

Mehmet Zeki SARIKAYA[1]

[1]*Department of Mathematics, Faculty of Science and Arts,*
Düzce University, Düzce-TURKEY

sarikayamz@gmail.com
mzekisarikaya@duzce.edu.tr

ABSTRACT

In this study, we present a new generalization of the Hermite-Hadamard type inequalities for geometrically convex functions via Hadamard fractional integras. Also, we give some new inequalities for Hadamard fractional integrals by using two identities.

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Novel Simpson Type Inequalities for Fractional Integrals with Respect to Another Function

Hüseyin BUDAK[1] and Mehmet Zeki SARIKAYA[1]

[1]Department of Mathematics, Faculty of Science and Arts,
Düzce University, Düzce, TÜRKİYE

hsyn.budak@gmail.com
sarikayamz@hotmail.com

ABSTRACT

In this study, we first prove two new identities for differentiable functions. Then by using these equalities, we obtain some Simpson type inequalities involving fractional integrals with respect to another function. For this aim, we use the functions whose derivatives in absolute value are convex and Hölder inequality.

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On New Improvements of Hermite-Hadamard Inclusions through Interval-Valued Convex Functions

Hasan KARA[1], Hüseyin BUDAK[1] and Fatih HEZENCİ[1]

[1]Department of Mathematics, Faculty of Science and Arts,
Düzce University, Düzce, TÜRKİYE

hasan64kara@gmail.com
hsyn.budak@gmail.com
fatihezenci@gmail.com

ABSTRACT

This research presents a new refinement method for Hermite-Hadamard inclusions in the context of interval-valued convex functions, utilizing the weighted Jensen inclusion approach. Furthermore, the study demonstrates that special choices can lead to extensions of the Hermite-Hadamard inclusion. A practical example is provided to illustrate the principal outcomes of this approach. The proposed method offers a more accurate refinement of Hermite-Hadamard inclusions, which can facilitate the development of new mathematical techniques for interval-valued convex functions.

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New Milne Type Inequalities in the Context of the Proportional Caputo-Hybrid Operator

Tuba TUNÇ[1]

[1]*Department of Mathematics, Faculty of Science and Arts,*
Düzce University, Düzce-TURKEY

tubatunc03@gmail.com

ABSTRACT

Fractional calculus plays a fundamental role in both mathematics and applied sciences, serving as an invaluable tool. Also, the new operator proportional Caputo-Hybrid provides improved applications in various fields of mathematics and computer sciences. In consideration of the significance of applications, our emphasis is on this operator. This work introduces novel Milne-type inequalities for the proportional Caputo-Hybrid operator. Initially, we present a new identity. Then, taking advantage of this identity, we establish results with the help of convex functions. Later, we explore specific instances of the outcomes obtained.

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From A General Representation of Spherical Indicatrices to Sabban Frame for Helix Curve

Süleyman ŞENYURT[1] and Davut CANLI[1]

[1]Department of Mathematics, Faculty of Science and Arts,
Ordu University, Ordu-TÜRKİYE

senyurtsuleyman52@gmail.com
davutcanli46@gmail.com

ABSTRACT

In the study, we are interested in defining a general form for the spherical indicatrices of the helix curve. Then, we establish a generalization of Sabban frame. By using the general form of these Sabban vectors, we also study some special Smarandache curves and define their generalized version of geodesic curvatures. Finally, we discuss some specific cases as a corollary and provide the graph of each curve and its geodesic curvature.

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Some Results on Radical Anti-Invariant Lightlike Hypersurfaces of Locally Product-like Manifolds

Esra ERKAN[1]

[1]*Department of Mathematics, Faculty of Arts and Sciences,*
Harran University, Şanlıurfa-TURKEY

esraerkan@harran.edu.tr

ABSTRACT

In this study, some relations and examples of radical anti-invariant lightlike hypersurfaces of a locally product-like semi-Riemannian manifolds is presented. With the help of statistical structures and Riemannian curvature invariants, some characterizations on these hyperurfaces is obtained.

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On the Biquadratic Bezier Surfaces as Paraboloids and Parabolic Cylinder

Şeyda KILIÇOĞLU[1]

[1]*Department of Mathematics, Faculty of Education, Başkent University, Ankara-TURKEY*

seyda@baskent.edu.tr

ABSTRACT

In this study first, it is stated the matrix representation of the biquadratic (2x2) Bézier surfaces in E^3. Second, for the examples elliptic, hyperbolic paraboloid and parabolic cylinder have been examined as biquadratic Bézier surface. Further it has been explained the way how to find the control points of a given elliptic, hyperbolic paraboloid and parabolic cylinder as any biquadratic Bézier.

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On the Tangent and Arctangent Curves by Modelling on the Cubic, 5th, and 7th Order Bézier Curve in E²

Şeyda KILIÇOĞLU[1]

[1]*Department of Mathematics, Faculty of Education, Başkent University, Ankara-TURKEY*

seyda@baskent.edu.tr

ABSTRACT

In this study, it has been researched the tangent curve and arctangent curve as Bézier curve. Also, tangent and arctangent curves as a cubic, 5th, and 7th order Bézier curve have been investigated by modelling and found the control points with matrix form in plane.

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On Some Integral Inequalities for s-logarithmically Convex Functions and Their Applications

Zuhal BAYRAM[1] and Ahmet Ocak AKDEMİR[2]

[1]Department of Mathematics, Institute of Graduate Studies,
Ağrı İbrahim Çeçen University, Ağrı-TURKEY
[2]Department of Mathematics, Faculty of Science and Arts,
Ağrı İbrahim Çeçen University, Ağrı-TURKEY

aocakakdemir@gmail.com

ABSTRACT

In this paper, we describe s−logarithmically convex functions in the first sense which are connected with the ordinary logarithmically convex functions and s−convex functions in the first sense. Afterwards, some new inequalities are given related to s−logarithmically convex functions in the first and second sense.

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The New Integral Inequalities for Geometrically Convex Functions via Conformable Fractional Integrals

Metin ERGÜL[1] and Ahmet Ocak AKDEMİR[2]

[1]Department of Mathematics, Institute of Graduate Studies,
Ağrı İbrahim Çeçen University, Ağrı-TURKEY
[2]Department of Mathematics, Faculty of Science and Arts,
Ağrı İbrahim Çeçen University, Ağrı-TURKEY

aocakakdemir@gmail.com

ABSTRACT

In this paper, we have proved a new integral inequality of Hadamard's type for geometrically convex functions via conformable fractional integrals. Also, we have obtain a new integral identity and by using this identity, we have established some new integral inequalities for quasi-geometrically convex functions via conformable fractional integrals.

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Some New Inequalities for $(h-s)_{1,2}$−Convex Functions via Further Properties

Ali ŞİMŞEK[1] and Ahmet Ocak AKDEMİR[2]

[1]Department of Mathematics, Institute of Graduate Studies,
Ağrı İbrahim Çeçen University, Ağrı-TURKEY
[2]Department of Mathematics, Faculty of Science and Arts,
Ağrı İbrahim Çeçen University, Ağrı-TURKEY

aocakakdemir@gmail.com

ABSTRACT

In this paper, we establish some new inequalities of the Hermite-Hadamard like for class of $(h-s)_{1,2}$−convex functions which are ordinary, super-multiplicative or similarly ordered and nonnegative.

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Inequalities Involving Conformable Approach for Exponentially Convex Functions and Their Applications

Gözde DURAN[1] and Ahmet Ocak AKDEMİR[2]

[1]Department of Mathematics, Institute of Graduate Studies,
Ağrı İbrahim Çeçen University, Ağrı-TURKEY
[2]Department of Mathematics, Faculty of Science and Arts,
Ağrı İbrahim Çeçen University, Ağrı-TURKEY

aocakakdemir@gmail.com

ABSTRACT

In the present note, we prove some Hermite-Hadamard type inequalities via the conformable fractional integrals for exponentially convex functions. In the applications part, we give new inequalities for the bivariate and generalized logarithmic means.

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Error Bounds of Gaussian Quadrature Formulae with Legendre Weight Function for Analytic Integrands

Aleksandar V. PEJCEV[1]

[1]*Department of Mathematics, University of Belgrade, Faculty of Mechanical Engineering, Kraljice Marije 16, 11120 Belgrad 35, SERBIA*

apejcev@mas.bg.ac.rs

ABSTRACT

In paper D. LJ. ĐUKIC, R. M. MUTAVDŽIC ĐUKIC, A. V. PEJCEV and M. M. SPALEVIC, *Error estimates of Gaussian-type quadrature formulae for analytic functions on ellipses – a survey of recent results*, Electron. Trans. Numer. Anal., 53 (2020), pp. 352–382, Lemma 4.1 can be applied to show the asymptotic behaviour of the modulus of the complex kernel in the remainder term of all the quadrature formulas in the recent papers that are concerned with error estimates of Gaussian-type quadrature formulae for analytic functions on ellipses. However, in the paper D. R. JANDRLIC, DJ. M. KRTINIC, LJ. V. MIHIC, A. V. PEJCEV, M. M. SPALEVIC, *Error bounds of Gaussian quadrature formulae with Legendre weight function for analytic integrands*, Electron. Trans. Anal. 55 (2022), pp. 424–437, which this note is concerned with, there is a kernel whose numerator contains an infinite series, and in this case the mentioned lemma cannot be applied. This note shows that the modulus of the latter kernel attains its maximum as conjectured in the latter paper.

Reliability Assessment of Folded Divide-and-Swap Cube in terms of Structure and Substructure Connectivity

Muhammed TÜRKMEN[1], Canan ÇİFTÇİ[1] and Gülnaz BORUZANLI EKİNCİ[2]

[1]Department of Mathematics, Faculty of Arts and Sciences
Ordu University, Ordu-TÜRKİYE
[2]Department of Mathematics, Faculty of Science
Ege University, İzmir-TÜRKİYE

muhammedturkmen831@gmail.com
cananciftci@odu.edu.tr
gulnaz.boruzanli@ege.edu.tr

ABSTRACT

Structure and substructure connectivity were introduced by Lin et al. [1] based on their reasoning that vertices that are related can affect each other, and those that are nearby a faulty vertex are more likely to become faulty. Let H be a connected subgraph of a graph G. The structure connectivity of G is the minimum number of a set of connected subgraphs in G, whose removal disconnects G and each element in the set is isomorphic to H. The substructure connectivity of G is the minimum number of a set of connected subgraphs in G, whose removal disconnects G and each element in the set is isomorphic to a connected subgraph of H. The structure connectivity and substructure connectivity are studied on several hypercube variants [1,3,4]. The n-dimensional folded divide-and-swap cube $FDSC_n$ was introduced by Kim et al. [2] as a novel hypercube variant to decrease the network cost. In this study, we fully investigate $K_{1,m}$-structure connectivity and $K_{1,m}$-substructure connectivity of $FDSC_n$ for $d \geq 1$ and $n = 2^d$ where $2 \leq m \leq d + 2$.

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Frequency Analysis of Moderately Thick Composite Panels with Negative Gaussian Curvature

İlke ALGÜL[1] and Ahmet Sinan ÖKTEM[1]

[1]Department of Mechanical Engineering,
Gebze Technical University, 41400, Gebze-TURKEY

ilkees@gtu.edu.tr
sinan.oktem@gtu.edu.tr

ABSTRACT

Panel structures have always been of high preference in major industries such as aerospace, naval and construction due to their high efficiency in supporting the high amount of loads and moments by the integrated membrane and bending action mechanism. Laminated composite materials are increasingly preferred in major industries such as aerospace, marine, automotive and wind energy sectors due to their high strength-to-weight and stiffness- to-weight ratios (reducing fuel consumption), and more importantly tailoring capabilities to achieve the optimum design through manipulating the composition of composite materials, stacking ply orientation, etc. Analysis of the composite structures with varying curvatures such as spherical, cylindrical or hyperbolic paraboloid panel can introduce additional difficulties. These difficulties may include resolving the issues related to anisotropic behavior, satisfying the boundary conditions, and involving radius of curvature definition correctly. Thus, finding the necessary natural frequency and mode characteristics of these composite panels with varying curvature in the preliminary design stages is of great importance for a clear understanding of dynamic response of those structures. For that reason, numerical results are presented for the free vibration analysis of moderately thick laminated cylindrical, spherical and negative Gaussian curvature panel for various combinations of boundary conditions. Generalized differential quadrature method is employed here to solve the free vibration of plates and panels shells made up from symmetric and antisymmetric cross-ply laminated composites. Utilizing the GDQ method in the governing differential equation transforms the problem into a generalized eigenvalue problem, leading to the determination of the frequency parameter and mode shapes. The natural frequency and mode shapes are explained with comprehensive tabular and graphical representations by investigating the effect of various parameters such as effects of stacking lamination, boundary conditions and the effect of curvature.

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Riemann-Liouville Fractional Differential Equations with Three Point Boundary Conditions

Fulya YÖRÜK DEREN[1] and Tuğba ŞENLİK ÇERDİK[2]

[1]Department of Mathematics, Ege University, Izmir, TÜRKİYE
[2]Department of Mathematics, Beykent University, Istanbul, TÜRKİYE

fulya.yoruk@ege.edu.tr
tugbacerdik@beykent.edu.tr

ABSTRACT

Recently, fractional differential equations have gained wide popularity for researchers. Because important applications in science and engineering can be better modeled through fractional derivatives and integral operators, the fractional derivative is used in many different fields such as engineering and science [1]. For example, topics such as diffusion processes and fractals can be better described with the help of the fractional analysis.

This study is concerned with a Riemann Liouville fractional boundary value problem with three point boundary conditions

$$D^r u(t) + f\big(t, u(t)\big) + g\big(t, u(t)\big) = 0,\ t \in (0,1),\quad r \in (n-1, n],\ n \geq 3$$

$$\mathrm{u}(0) = \mathrm{u}'(0) = \cdots = \mathrm{u}^{(n-2)}(0) = 0, \qquad \mathrm{D}^{\mu}\mathrm{u}(1) = \lambda \mathrm{D}^{\mu}\mathrm{u}(\xi)$$

where $0 < \mu \leq 1$, $0 < \xi < 1$, $\lambda \in (0, \infty)$, D is the Riemann-Liouville fractional derivative, $f, g \in \mathrm{C}([0,1] \times [0, \infty), [0, \infty))$. Here, under some assumptions on the nonlinear terms, the existence and uniqueness of positive solutions are obtained by means of a fixed point theorem. Furthermore, an iterative sequence is derived for approximating the unique solution.

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Star-Structure Connectivity and Star-Substructure Connectivity of Generalized and Double Generalized Petersen Graphs

Canan ÇİFTÇİ[1] and Gülnaz BORUZANLI EKİNCİ[2]

[1]Department of Mathematics, Faculty of Arts and Sciences,
Ordu University, Ordu-TÜRKİYE
[2]Department of Mathematics, Faculty of Science,
Ege University, İzmir-TÜRKİYE

cananciftci@odu.edu.tr
gulnaz.boruzanli@odu.edu.tr

ABSTRACT

Structure connectivity is a reliability measure introduced by Lin et al. [1] as a generalization of the classical connectivity. Let F be a set of connected subgraphs of G. Then F is called a subgraph-cut of G if G − V(F) is disconnected or an isolated vertex. Let H be a connected subgraph of G. Then F is an H-structure-cut if F is a subgraph-cut, and every element of F is isomorphic to H. The H-structure connectivity of G gives the minimum cardinality of all H-structure-cuts of G. Similarly, F is an H-substructure-cut if F is a subgraph-cut, and every element of F is isomorphic to a connected subgraph of H. The H-substructure connectivity of G is the minimum cardinality of all H-substructure-cuts of G. The class of generalized Petersen graphs was introduced by Coxeter [2] and named by Watkins [3]. By modifying the generalized Petersen graphs, Zhou and Feng [4] introduced the double generalized Petersen graphs. In this study, we investigate the star-structure connectivity and the star-substructure connectivity of generalized and double generalized Petersen graphs.

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Compactness of Sum of Generalized Weighted Composition Operators between Weighted Spaces of Analytic Functions

Jasbir S. MANHAS[1]

[1]*Department of Mathematics, College of Science,*
Sultan Qaboos University, Muscat-OMAN

manhas@squ.edu.om

ABSTRACT

Let $H(\mathrm{D})$ be the space of analytic functions on the unit disc D and let S(D) denotes the set of analytic self-maps of D. Let $\Psi = (\psi_j)_{j=0}^{k}$ be such that $\psi_j \in H(\mathrm{D})$ and $\varphi \in S(D)$. We characterize the compactness of the sum of generalized weighted composition operators

$$T_{\Psi,\varphi}^{k} f = \sum_{j=0}^{k} \psi_j . f^{(j)} o\varphi = \sum_{j=0}^{k} \mathfrak{D}_{\psi_j,\varphi}^{j} f, \qquad f \in H(\mathrm{D})$$

between weighted Banach spaces of analytic functions $H_v^{\infty}(H_v^0)$ and $H_w^{\infty}(H_w^0)$ which unifies the study of products of composition operators, multiplication operators and differentiation operators. As applications, we obtain the compactness of the generalized weighted composition operators between weighted Bloch-type spaces.

Analyzing Stochastic Dynamics in Dispersed Polluted Environments: A Study of the Gilpin-Ayala Model

A. Nait BRAHIM, B. HARCHAOUI, M. EL IDRISSI, A. SETTATI, A. LAHROUZ, M. EL JARROUDI

Department of Mathematics and Applications
Abdelmalek Essaadi University
Laboratory of Mathematics and Applications, FSTT, Abdelmalek Essaadi University, Tetouan, Morocco
MOROCCO

abdeladim.naitbrahim@etu.uae.ac.ma
Bilal.harchaoui@outlook.com
mourad.elidrissi@etu.uae.ac.ma
settati adel@yahoo.fr
lahrouzadil@gmail.com
eljarroudi@hotmail.com

ABSTRACT

This study explores the examination of a stochastic Gilpin-Ayala model operating within an environment characterized by heightened uncertainty, focusing on the diffusion phenomenon between two distinct geographical regions under investigation. The research establishes stringent criteria to determine the survival or extinction of the species. Additionally, empirical evidence is presented to confirm the existence of a stable distribution. A key milestone in this investigation involves the identification and comprehensive delineation of the critical factors intricately governing extinction dynamics and persistence, particularly in the context of pollution parameters. The findings underscore the significant impact of pollution on ecological dynamics and emphasize the imperative inclusion of pollution parameters in environmental investigations. Notably, the study reveals that, in the absence of pollution, conventional criteria governing extinction and persistence closely align with those observed in unpolluted environments, validating the robustness of the mathematical analysis. To support and validate the obtained results, a series of numerical depictions are introduced in this scientific inquiry.

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Dynamic Analysis of a Stochastic SIR Epidemic Model Incorporating Non-linear Power Functions and Logistic Growth

Soulaimane AZNAGUE[1], Adel SETTATI[1] and Aadil LAHROUZ[1]

[1]Laboratory of Mathematics and Applications, FSTT,
Abdelmalek Essaadi University, Tetouan, Morocco.

soulaimane.aznague@etu.uae.ac.ma
settati_adel@yahoo.fr
lahrouzadil@gmail.com

ABSTRACT

In this paper, we formulate a stochastic SIR epidemic model with logistic growth and non-linear power functions. We establish the existence of a unique global positive solution. Furthermore, our objective is to analyze the long-term performance of the system and provide valuable insights into disease extinction within a population. Our investigation explores the necessary conditions for disease extinction, which are essential for predicting and controlling the spread of deadly diseases. Additionally, by constructing a stochastic Lyapunov function, we establish sufficient conditions for the existence of a unique ergodic stationary distribution. Finally, we present some numerical simulations to substantiate our theoretical results.

ACKNOWLEDGEMENT

This investigation was undertaken independently, without the receipt of any external funding or financial assistance.

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Decay of a Porous Thermoelastic System of Type III with Distributed Delay

Zineb NID[1] and Abdelfeteh FAREH[2]

[1]Department of mathematics Faculty of Exact Sciences University of El Oued P.O.B. 789, 39000, El Oued- ALGERIA
[2]Department of mathematics Faculty of Exact Sciences University of El Oued P.O.B. 789, 39000, El Oued- ALGERIA

nidzineb2@gmail.com
farehabdelf@gmail.com

ABSTRACT

In this paper we are concerned with the well-posedness and asymptotic stability of solutions of a delayed porous thermoelastic type III, where the delay is distributed and acts on the heat equation. We investigate the cases of equal and non-equal wave speeds. In the first case, we proved an exponential rate of decay provided that the weight of delay is strictly less than the weight of the thermal dissipation. In the second case and under the same condition on the weights of the damping and the delay, we obtain a polynomial decay rate.

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Analysis Mathematical of an Anomalous Reaction Diffusion System

Maroua MEBARKI[1]

[1]*Department of Mathematics and computer science, Faculty of Science and Technologic, Amine Elokkal El Hadj Moussa Eg Akhamouk University, Tamanghasset - ALGERIA*

maroua.mebarki@yahoo.fr

ABSTRACT

This paper deals with an anomalous diffusion system which describes the spread of epidemics among a population. The analysis includes someresults of the asymptotic behavior of global bounded solutions for this system with homogeneous Neumann boundary conditions.

ACKNOWLEDGEMENT
The auther would like to thank the anonymous referee for his/ her comments.

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Elliptic System Without Divergence Constraint

Saliha BOUKASSA[1]

[1]*University M'Hamed Bougara of Boumerdes, Algeria Cherif Amrouche Universite de Pau et des Pays de l'Adour, FRANCE*

s.boukassa@univ-boumerdes.dz
cherif.amrouche@univ-pau.fr

ABSTRACT

We study a linear elliptic system without divergence constraint involving Navier-type boundary conditions in a three-dimensional bounded domain, possibly multiply connected and with boundary possibly non connected. We establish an appropriate Inf-Sup condition and then we prove the existence and uniqueness of the generalized solutions in Lp−Theory.

Some Applications on the Darboux Vector of Viviani's Curve

Süleyman ŞENYURT[1] and Davut CANLI[1]

[1]*Department of Mathematics, Faculty of Science and Arts,*
Ordu University, Ordu-TÜRKİYE

senyurtsuleyman52@gmail.com
davutcanli46@gmail.com

ABSTRACT

The study examines special Viviani's curve and its Darboux vector to construct corresponding Sabban frame for the curve. Then, as an application, new Smarandache curves are derived with respect to these Sabban vectors. The geodesic curvature for each curve is expressed by the curvature and the torsion of Viviani's curve. Graphical illustrations for each curve and their geodesic curvatures are presented to support the claimed relationships.

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On a Necessary Condition for an Optimal Control Problem in a Parabolic System

Yeşim AKBULUT[1]

[1]*Department of Mathematics, Faculty of Science,*
Atatürk University, Erzurum-TURKEY

ysarac@atauni.edu.tr

ABSTRACT

This study deals with obtaining an optimal solution for the optimal control of the parabolic initial-boundary value problem. We show that the optimal control problem is well-known and prove that the cost functional is differentiable. In this paper, a variational method for the optimal control problem is suggested. A necessary condition for the optimal solution is given.

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Gröbner Bases and Applications of Toric Ideals

Merve EKER[1] and Abdullah ÇAĞMAN[2]

[1]Ağrı İbrahim Çeçen University, Institute of Graduate Studies, Ağrı-TÜRKİYE
[2]Ağrı İbrahim Çeçen University, Faculty of Science and Letters,
Department of Mathematics, Ağrı-TÜRKİYE

merve9eker@gmail.com
acagman@agri.edu.tr

ABSTRACT

The aim of this study is to investigate the Gröbner bases of toric ideals and some of their applications. After discussing the basic issues regarding Göbner bases and toric ideals, some applications of Gröbner bases of toric ideals are mentioned.

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Some Cryptographic Applications of Hash Functions

Ömer Faruk ÇETİN[1] and Abdullah ÇAĞMAN[2]

[1]Ağrı İbrahim Çeçen University, Institute of Graduate Studies, Ağrı-TÜRKİYE
[2]Ağrı İbrahim Çeçen University, Faculty of Science and Letters,
Department of Mathematics, Ağrı-TÜRKİYE

omerfarukcetin18@hotmail.com
acagman@agri.edu.tr

ABSTRACT

Our aim in this study is to investigate hash functions and their various applications in cryptography. The discussion extends to traditional hash functions and provides a comprehensive review of their properties. The article also touches upon the types of attacks these functions may encounter. It examines the potential vulnerabilities and risks associated with hybrid functions, providing insights into the security challenges they face.

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Hash Functions and Key Exchange Protocols

Merve Beyza ÇUBUK[1] and Abdullah ÇAĞMAN[2]

[1]Ağrı İbrahim Çeçen University, Institute of Graduate Studies, Ağrı-TÜRKİYE
[2]Ağrı İbrahim Çeçen University, Faculty of Sicence and Letters, Department of Mathematics, Ağrı-TÜRKİYE

mbeyza2@gmail.com
acagman@agri.edu.tr

ABSTRACT

In this work, basic information about cryptographic hash functions and key agreement protocols will be given and the relationships between them will also be discussed.

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Some Analysis for the Maximal C_6 Class of Classical Groups with Dimensions 6 and 8

Zehra ÇELİK ÇÖP[1], Abdullah ÇAĞMAN[2] and Kadirhan POLAT[2]

[1]Institute of Graduate Studies,
Ağrı İbrahim Çeçen University, Ağrı-TURKEY
[2]Department of Mathematics, Faculty of Science and Arts,
Ağrı İbrahim Çeçen University, Ağrı-TURKEY

zcelikcop@gmail.com
acagman@agri.edu.tr
kadirhanpolat@agri.edu.tr

ABSTRACT

In this notes Aschbacher' s Thorem will be given and the Aschbacher' s classical group classes will be defined. We will do some analysis for the maximal C_6 class of classical groups with dimensions 6 and 8.

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Milne-Type Inequalities for Various Function Classes

Fatih HEZENCİ[1] and Hüseyin BUDAK[1]

[1]Department of Mathematics, Faculty of Science and Arts,
Düzce University, Düzce, TÜRKİYE

fatihezenci@gmail.com
hsyn.budak@gmail.com

ABSTRACT

The present abstract considers Milne-type inequalities for the case of differentiable functions. Firstly, we give some Milne-type inequalities for bounded functions by fractional integrals. Moreover, we present several fractional Milne-type inequalities for the case of Lipschitzian functions. Furthermore, we obtain fractional Milne-type inequalities for functions of bounded variation.

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Generalizations of Different Type Inequalities for η-Convex Function

Barış ÇELİK[1], Erhan SET[1] and Alper EKİNCİ[2]

[1]Department of Mathematics, Faculty of Science and Arts,
Ordu University, Ordu-TURKEY
[2]Bandırma Vocational School,
Bandırma Onyedi Eylül University, Balikesir-TURKEY

bariscelik15@hotmail.com
erhanset@yahoo.com
alperekinci@hotmail.com

ABSTRACT

Several extensions, generalizations and new variant of different types of inequalities for different kinds of convex functions obtained by researchers. In this paper, we establish the Bullen, Midpoint, Trapezoid and Simpson type inequalities, respectively, for η-convex function, with the help of identities existing in the literature.

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Some Integral Inequalities for Different Classes of Functions via Atangana-Baleanu Fractional Integral Operators

Ali KARAOĞLAN[1], Erhan SET[1] and Ahmet Ocak AKDEMİR[2]

[1]Department of Mathematics, Faculty of Science and Arts,
Ordu University, Ordu-TURKEY
[2]Department of Mathematics, Faculty of Science and Arts,
Ağrı İbrahim Çeçen University, Ağrı-TURKEY

aliblackboy80@hotmail.com
erhanset@yahoo.com
aocakakdemir@gmail.com

ABSTRACT

In this paper, we obtained some integral inequalities via Atangana-Baleanu fractional integral operators for $s-$convex functions and P $-$functions using the identity by proved Set et al. Some of the inequalities proved are reduced to existing inequalities in the literature for some special values of the parameters. And also, the inequalities obtained produce new results for some special values of the parameters.

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Ostrowski and Hermite-Hadamard Type Inequalities Involving Quantum Symmetric Integrals

Ammara NOSHEEN[1], Sana IJAZ[1], Khuram Ali KHAN[1] and Khalid Mahmood AWAN[1]

[1]Department of Mathematics, University of Sargodha, Sargodha 40100, PAKISTAN

ammara.nosheen@uos.edu.pk
sanaijaz894@gmail.com
khuram.ali@uos.edu.pk
khalid.muhammad@uos.edu.pk

ABSTRACT

We estabished Ostrowski and Hermite Hadamard type inequalities in the context of quantum variational calculus using the Montogmery identity involving quantum symmetric integrals. Holder's and Power mean inequalities involving quantum symmetric integrals are also helping tools to prove the main results. Some examples are provided along with graphical illusions to demonstrate the validity of the new discoveries. Our latest findings are regarded as generalisations of some known inequities in the literature.

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$g^{\#}p^{\#}$ −Continuous and $g^{\#}p^{\#}$ −Irresolute Mappings in Topological Spaces

Raja Mohammad LATIF[1]

[1]*Department of Mathematics and Natural Sciences*
Prince Mohammad Bin Fahd University, Al Khobar, SAUDI ARABIA

rajamlatif@gmail.com

ABSTRACT

In 2013, K. Alli, A. Subramanian and S. Pious Missier introduced a new class of sets namely, $g^{\#}p^{\#}$ −closed and investigated properties of this set. Also, they studied and discussed some of its properties and compared this new notion with some other classes of sets and investigated some of their basic properties in topological spaces. We introduce $g^{\#}p^{\#}$ −continuous function, $g^{\#}p^{\#}$ −irresolute function, $g^{\#}p^{\#}$ −open function, $g^{\#}p^{\#}$ −closed function, pre-$g^{\#}p^{\#}$ −-open function, and pre-$g^{\#}p^{\#}$ −-closed function and investigate several properties and characterizations of these new types of mappings in topological spaces.

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Almost g~α Topological Vector Spaces

Raja Mohammad LATIF[1]

[1]*Department of Mathematics and Natural Sciences*
Prince Mohammad Bin Fahd University, Al Khobar, SAUDI ARABIA

rajamlatif@gmail.com

ABSTRACT

In 2010, Saeid Jafari, M. Lellis Thivagar and Nirmala Rebecca Paul introduced a new class of sets called g~α-closed sets and g~α-open sets in topological spaces and studied some basic properties and characteristics of these sets. The purpose of the present paper is to introduce a new class of g~α topological vector spaces. We study several basic and fundamental properties of g~α topological vector spaces and investigate their relationships with certain existing spaces. Along with other results, we prove that transformation of an open (resp. closed) set in a g~α topological vector space is g~α open (resp. g~α-closed). In addition, some important and useful characterizations of g~α topological vector spaces are established. We also introduce the notion of almost g~α topological vector spaces and present several general properties of almost g~α topological vector spaces.

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$\theta g^{*}\alpha$ −Compactness in Topological Spaces

Raja Mohammad LATIF[1]

[1]*Department of Mathematics and Natural Sciences*
Prince Mohammad Bin Fahd University, Al Khobar, SAUDI ARABIA

rlatif@pmu.edu.sa

ABSTRACT

In 2017, Sakkraiveeranan Chandrasekar, Velusamy Banupriya and Jeyaraman Suresh Kumar introduced and studied properties of a new class of sets in topological spaces namely $\theta g^{*}\alpha$ −closed sets and $\theta g^{*}\alpha$ −open sets. We will extend the concept of compactness via $\theta g^{*}\alpha$ −open sets by introducing $\theta g^{*}\alpha$ −compactenss in topological spaces and will investigate their relationships among them as well as their characterizations by making use of generalized mappings including $\theta g^{*}\alpha$ −continuous functions and $\theta g^{*}\alpha$ −irresolute functions. The objective of this paper is to introduce the new concepts called $\theta g^{*}\alpha$ −compact space, $\theta g^{*}\alpha$ −Lindelöf space, countably-$\theta g^{*}\alpha$ −compact space, almost $\theta g^{*}\alpha$-compact space, and mildly $\theta g^{*}\alpha$ −compact space in topological spaces and investigate fundamental properties and characterizations of these new notions in topological spaces.

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