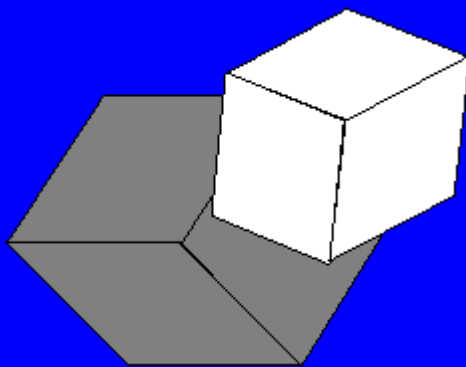


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## Papers Abstracts



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### Implicit hybrid block methods for solving second, third and fourth orders ordinary differential equations directly

O.E. Abolarin, L.S. Akinola, E.O. Adeyefa, B.G. Ogunware

Strong numerical algorithm for simultaneously solving second, third and fourth orders of ordinary differential equations with given initial conditions is considered in this paper. Linear Multi-step collocation approach was applied in the derivation of the new method with the use of power series approximate solution as interpolation polynomial. The numerical integrators that formed the block were derived by evaluating the continuous scheme along with its derivatives at the non-interpolating points within the selected interval of integration. The basic properties of the method were investigated properly. In order to examine the effectiveness of the block, the methods were tested on some second, third and fourth orders ordinary differential equations and the results generated proved its effectiveness over existing methods in terms of accuracy.

(pp. 1–21)

### Modules with quasi-continuous submodules

Saad Abdulkadhim Al-Saadi

The notion of left  $q$ -ring was generalized to the big class of left  $\pi$ -rings. Furthermore,  $q$ -rings extended to module theory under the concept of  $Q$ -module (modules all of whose submodules are quasi-injective). In this article, the concept of  $QC$ -modules (modules all of whose submodules are quasi-continuous) are introduced as a wider class of both  $\pi$ -rings and  $Q$ -modules. Numerous characterizations of  $QC$ -modules have been obtained. Also, properties and results of these modules are investigated. Moreover, strong forms of  $QC$ -modules are given and studied.

(pp. 22–31)

### Dual hesitant fuzzy Bonferroni means and its applications in decision-making

Nausheen Ayub, Aslam Malik

The Bonferroni mean (BM) was initially presented by Bonferroni and afterward more as of late summed up by Yager. The exceptionally solid characteristic of the BM is its ability to catch the interrelationship between input datum. Nevertheless, it appears that the previous work just considers the BM

for aggregating crisp information rather than some other kinds of contentions. In this paper, we explore the BM under dual hesitant fuzzy datum. The dual hesitant fuzzy set (DHFS) is the all-encompassing type of intuitionistic fuzzy sets (IFSs) and hesitant fuzzy sets (HFSs). We build up an dual hesitant fuzzy BM (DHFBS) and talk about its assortment of extraordinary cases. At that point, we apply the weighted DHFBS to multicriteria dynamic. Some numerical models are given to show our outcomes.

(pp. 32–53)

### Gumbel-exponential distribution

Dehaimi Samira, Hadji Mohammed Lakhdar

In this paper we introduce a new distribution denoted (GE) which depends on the Exponential and Gumbel distributions. Some of its mathematical properties like moment generated function, hazard function, quantile functions, mode, median, variance, the  $r$ -th moment about the mean and origin of skewness and kurtosis, a simulation study is carried out to examine the bias and mean square error of the maximum likelihood estimators of the parameters. A real data is adapted to illustrate the importance of the new distribution.

(pp. 54–66)

### Optimality criterion for three proposed methods to unbalanced transportation models

Waleed Mohammed Elaibi, Wafaa Sayyid Hasanain, Aday Taha R

The idea of balancing the transportation table starts by adding a quantity to the supply or demand to fill the shortage and achieve the requirement of equality between the quantities of demand and supply with making the costs of the row (column) added zeroes, on the other hand what is the profit desired from this addition as it cannot display a need made or created effort and money without Price or for any zero cost and vice versa as no need or commodity can be ordered without a small price, and accordingly has been proposed three methods to address the unbalanced transportation table and agencies without resorting to adding a zero-cost column (row) with application work to comparing the three proposed methods with the classical methods.

(pp. 67–79)

### [A matrix expansion solution for a hyperbolic system of time-fractional PDEs with variable coefficients](#)

Ahmad El-Ajou

In this research, we introduce a series solution to a hyperbolic system of time-fractional partial differential equations with variable coefficients in the sense of Caputo fractional derivative. An appropriate expansion of matrix functions is derived and used to create a series solution for the target problem and the residual power series method is also used to determine the coefficients of the series solution. To test our proposed method, we discuss four interesting and important applications. The first three applications are set up so that the exact solution is already known whereas the last application is set up without knowing the solution in advance to test the predictability of the solution or obtain a suitable approximate solution. Numerical results are analyzed to confirm the ability of the used method and to verify the solution obtained. The surface graphs of the solution are plotted to illustrate the behavior of the solution in various conditions. Mathematica 7 software is used to calculate the numerical and symbolic quantities.

(pp. 80–99)

### [Near BE-semigroups](#)

Sh. Kanwal, F. Hussain, K. Hila, Javeria, M.S.A. Khan

In this paper, we introduce a new algebraic structure the so-called near BE-semigroup which is a generalization of a BE-semigroup. We provide some examples to show the existence of the structure. Furthermore, some properties of this structure are investigated.

(pp. 100–108)

### [Deformation problem for a double porous viscoelastic medium using state space approach](#)

Rajneesh Kumari, Aseem Miglani, Sonika Chopra, Monika Kalra

A deformation problem for a homogeneous, isotropic, double porous, viscoelastic medium has been studied by considering a new mathematical model. To solve the problem, state space approach has been used. A normal force has been applied to describe the problem as an illustration. The solution is obtained in the frequency domain and hence the deformation described by the components of normal stress and equilibrated stress has been found in the form of frequency. Then, these components have been converted into physical domain and computed numerically for a particular material. The numerical results thus

obtained have been discussed graphically to show the viscous effect on deformation. A Particular case has also been given to show the generalization of the model taken for the problem.

(pp. 109–124)

### Models and theories for the choice of teaching strategies in mathematics

V. Ventre, U. Dello Iacono, E. Ferrara Dentice, R. Martino

This paper aims to highlight the role of the subject, not only as a school discipline but also a tool to educate students to rational thinking and a means for the development of social skills. The intention is to dispel the myth of a cold and pre-packaged mathematics, accessible to the chosen few: the idea of a mathematics for all is supported through an experience with a student with specific learning disorders, with which a personalized teaching strategy has allowed the achievement of set goals. A case study of a student with specific reading and writing disorders attended the mathematical analysis course 1 of the degree course in architecture and the personalized teaching strategy created for him are described. Finally, some mathematical models for the choice of better teaching strategies are exhibited.

(pp. 125–144)

### The projective character tables of the maximal subgroups of $M_{22}$ and its automorphism group $M_{22}:2$

Abraham Love Prins

In this paper, a routine written in the computational algebra system GAP is presented to compute the irreducible projective characters  $\text{IrrProj}(G, \alpha_i)$  with associated factor sets  $\alpha_i$  for the maximal subgroups of the sporadic simple Mathieu group  $M_{22}$  and its automorphism group  $M_{22}:2$ . The said routine derived its fundamentals from the theory of finding all the irreducible projective characters of a finite group  $G$  from the ordinary irreducible characters of a so-called representation group  $R = M(G).G$  of  $G$ , where  $M(G)$  denotes the Schur multiplier of  $G$ .

(pp. 145–163)

### One point paracompactification (metacompatification)

Nafiz D. Abujaradeh, Hasan Z. Hdeib

The notion of locally paracompact (metacompact) are studied and utilized to obtain the one point paracompactification (metacompatification). Several related results are also introduced.

(pp. 164–172)

### On property $(a\omega)$ and hypercyclic/supercyclic operators

Abdellah Akrym, Abdeslam El Bakkali, Abdelkhalek Faouzi

In this paper, we show that property  $(a\omega)$  holds for the adjoint of hypercyclic/ supercyclic operator. Also, we characterize hypercyclic/ supercyclic operators satisfying the property  $(a\omega)$ . We establish that for a hypercyclic/ supercyclic operators, the property  $(a\omega)$  holds if and only if property  $(\omega)$  holds, if and only if a-Weyl's theorem holds.

(pp. 173–184)

### Coefficient estimates for new subclass of pseudo-type meromorphic bi-univalent functions

Adnan Ghazy Alamoush

In the present article, we define a new subclass of pseudo-type meromorphic bi-univalent functions defined on  $\mathbb{U}^* = \{z \mid z \in \mathbb{C} \text{ and } 1 < |z| < \infty\}$ , and investigate the initial coefficient estimates  $|b_0|$  and  $|b_1|$ . Further we mention several new or known consequences of our results.

(pp. 185–194)

### Transmuted shanker distribution: properties and applications

Loai Alzoubi, Mohammed M. Gharaibeh, Raed Alzghool

In this paper a new continuous distribution is proposed. This distribution will generalize Shanker distribution to the transmuted Shanker distribution using the quadratic rank transmutation map. Some properties of this distribution are studied. A numerical study is conducted to calculate the mean, standard deviation, skewness, kurtosis and the coefficient of variation of this distribution. An application to a data set is conducted. It shows that the new distribution performs better than Shanker distributions and some other distributions, like Shanker itself and Lindley in performance of the values of  $-2\ln L, W, A, AIC, KS$ -statistic and  $p$ -value.

(pp. 195–212)

### Harmonic meromorphic starlike functions of complex order involving Mittag-Leffler operator

M.S. Abdul Ameer, A. Rahman S. Juma, R.A. Al-Saphory

The main goal of the present paper is to introduce the class  $\check{\mathcal{M}}\mathcal{T}_{\mathcal{H}}(\alpha, \gamma, d)$  of harmonic meromorphic starlike functions in order to define the Mittag-Leffler operator. Thus, we give some relations devoted to different classes of harmonic meromorphic functions to be a starlike function. Furthermore, we provide the fundamental and sufficient conditions for these considered functions to characterize some important subclasses of  $\check{\mathcal{M}}\mathcal{T}_{\mathcal{H}}(\alpha, \gamma, d)$ .

(pp. 213–220)

### On time delay velocity feedback control of the composite cantilever beam model subjected to multi-excitation forces

Y.A. Amer, Taher A. Bahnasy, Ashraf M. Elmhlawy

The vibration rate of a structural dynamic design modelling a nonlinear composite cantilever beam at simultaneous sub-harmonic and internal resonance excitation is suppressed using delayed velocity feedback control (DVFC) in this article. This system of second order differential equations with nonlinearity due to quadratic and cubic terms, excited by parametric and external excitations, is presented. The procedure of multiple time scales perturbation is used to achieve an estimated solution for this scheme. At this approximation order, all potential resonance cases are extracted and numerically investigated. Both frequency response formulas and phase-plane trajectories are used to assess the system's stability during the worst resonance. The outcomes of various parameters on the device and controller are numerically investigated. The simulation results are achieved using Matlab and Maple programs. The time-dependent displacements are provided, and excellent consensus is reached as compared to results produced utilizing the Rung-Kutta procedure.

(pp. 221–240)

### Fekete-Szegő inequality for analytic and bi-univalent functions subordinate to Horadam polynomials

Ala Amourah

In the present paper, a subclass of analytic and bi-univalent functions by means of Horadam Polynomials is introduced. Certain coefficients bounds for functions belonging to this subclass are obtained. Furthermore, the Fekete-Szegő problem for this subclass is solved.

(pp. 241–250)

### On the nullity of Nijenhuis torsion of a vector valued 1-form

M. Frédéric Anona, H. Sammy Grégoire Ravelonirina

On a differentiable manifold, the data of a vector valued 1-form  $L$  with a constant rank, and the nullity of Nijenhuis torsion define a foliation. We study on the scalar forms the cohomology of a derivation with degree 1 associated to  $L$ . The obtained results of this study generalize those of Willmore. The vector fields by which Lie derivative of  $L$  is null, constitute a Lie subalgebra of infinitesimal automorphisms of the foliation. We study the Chevalley-Eilenberg cohomology space associated to  $L$  when  $L$  is a product structure and this study is different from the one made by Lehmann-Lejeune who studied the same cohomology in case of  $L$  as a tangent structure. As far as Lie algebra defined by any vector valued 1-form  $L$  is concerned, the derivations are not always adjoint linear applications of vector fields.

(pp. 251–276)

### Orthogonality preserving maps on $B(H)$

E. Ansari Piri, R.G. Sanati, S. Parsania

In this paper, we study the linear maps on  $B(H)$  preserving a class of operators in  $B(H)$ . We also introduce pointwise orthogonality on  $B(H)$  and provide the conditions under which a linear mapping  $\varphi$  on  $B(H)$  preserves pointwise orthogonality on  $B(H)$ . Finally, we prove that a Jordan  $*$ -homomorphism  $\varphi$  preserves OP operators in  $B(H)$ . Moreover, under additional condition of injectivity,  $\varphi$  preserves OP operators in both directions.

(pp. 277–286)

### Signed product cordial labeling of corona product between paths and second power of fan graphs

A. Abd El-Hay, A. Rabie

In this work, we contribute some new results on signed product cordial labeling and investigate necessary and sufficient conditions of the corona product between paths and second power of fan graphs to be signed product cordial.

(pp. 287–294)



### A study on Pythagorean fuzzy soft topological spaces and continuous mappings

T.M. Athira, Jacob John Sunil, T. Baiju

This paper is a study on Pythagorean fuzzy soft topological spaces and continuous mappings. Here, relevant topological notions are generalized into the new setting and proved some fundamental results. Pythagorean fuzzy soft mappings and continuous mappings are defined and illustrated with examples. Also, certain interesting properties of these mappings are obtained. Finally, we proved a couple of characterization theorems for Pythagorean fuzzy soft mappings.

(pp. 295–309)

### Matrix methods for the up and down Steenrod squares

S. Azizi, A.S. Janfada

Let  $P(n)$  be the polynomial algebra which is a graded left module over the Steenrod algebra. The divided power algebra  $DP^d(n)$  is defined as the Hopf dual of  $P^d(n)$ . The dual of the Steenrod square  $Sq^k$  is the linear map  $Sq_k : DP^{d+k}(n) \rightarrow DP^d(n)$ , called the down Steenrod square, defined by  $Sq_k(u) = v$  for  $u \in DP^{d+k}(n)$ , where  $v(f) = (Sq_k(u))(f) = u(Sq^k(f))$  for  $f \in P^d(n)$ . In this article we consider the down Steenrod squares and establish some results about. Further, we show that there is some periodic calculation on the down Steenrod squares hanging on the limited leading period. Finally, using this fact, we exhibit a matrix method for manipulating the down Steenrod squares.

(pp. 310–324)

### The cycle-complete graph Ramsey numbers $R(C_7, K_9)$ and $R(C_8, K_9)$

A. Baniabedalruhman, Ahmad Alrifai, Ahmad A. Al-Rhayyel

The Ramsey number  $R(G, H)$  is the smallest integer  $n$  such that any graph of order  $n$  contains the graph  $G$  or its complement contains the graph  $H$ . In this paper, we prove that  $R(C_s, K_9) = 8s - 7$  for  $s = 7, 8$ , where  $C_s$  is a cycle of order  $s$  and  $K_r$  is the complete graph of order  $r$ .

(pp. 325–335)

### A bi-endomorphism induces a new type of derivations on B-algebras

T. Bantaojai, C. Suanoom, J. Phuto, A. Iampan

The goal of this paper is to introduce the concept of an  $(l, r)$  and an  $(r, l)$ - $\tau$ -derivation on a B-algebra which is induced by a left and a right bi-endomorphism and to provide important properties. The study found that the composition of  $(l, r)$  and an  $(r, l)$ - $\tau$ -derivations is also an  $(l, r)$  and an  $(r, l)$ - $\tau$ -derivation on a 0-commutative B-algebra, respectively. In addition, the relationship among those derivations is also considered.

(pp. 336–348)

### Some results on finite soluble groups and $p$ -supersoluble groups

H. Bao, J. He, L. Gu, Y. Zhao, J. Zhao

In this paper, motivated by the conjecture of Heliel, we firstly investigated the solubility of a group by the properties of primes 3 and 5. Further, we also studied the  $p$ -supersolubility and  $p$ -nilpotency under the conditions on primary subgroups with given order.

(pp. 349–360)

### Some separation axioms on topological $B$ -algebra and the quotient $B$ -topological space

Katrina E. Belleza, Jocelyn P. Vilela

This paper provides some separation axioms on a topological  $B$ -algebra. In particular, a characterization of a discrete topological  $B$ -algebra is presented. Furthermore, this paper introduces the quotient  $B$ -topological space and presents some properties. Moreover, this paper gives some conditions which under a topological  $B$ -algebra (resp. quotient topological  $B$ -algebra), the quotient  $B$ -topological space (resp.  $B$ -topological space) have the topological properties  $T_0$ ,  $T_1$ , and Hausdorff.

(pp. 361–371)

Erratum to: On some  $(p, q)$ - $\varphi$  relative Gol'dberg type and  $(p, q)$ - $\varphi$  relative Gol'dberg weak type based growth properties of entire functions of several complex variables (Ital. J. Pure Appl. Math. N. 44-2020, 403-414)

Tanmay Biswas, Ritam Biswas

(pp. 372–373)

[\( \$p, q\$ \)-order and  \$\(p, q\)\$ - lower order of entire functions of several complex variables on the basis of central index](#)

[Manab Biswas, Debashis Kumar Mandal](#)

In this paper we discuss about the growth rates of the central indices of composition of entire functions of several complex variables with their corresponding left or right factor.

(pp. 374–383)

[Hypothesis test of sample mean of random intervals and comparing between methods based on Hausdorff distance and the maximum likelihood ratio](#)

[Ahssaine Bourakadi, Driss Mentagui, Baraka Achraf Chakir](#)

In this article, we will introduce some important elements of random sets theory, and we will use the tools of topology, probability theory, and statistical inference aims to develop a coherent mathematical framework to analyze random elements whose realization are intervals.

Hypothesis testing is one of the most widely used methods in statistical inference that involves asking a question, collecting data, and then examining what the data tells us about how to proceed.

The hypothesis tests that we will examine in this paper is the test of sample mean of random sets in a Euclidean space, and in particular in the case where these sets are intervals in a Euclidean space. We will use two test statistics, one is based on Hausdorff distance with using central limit theorem and the second is based on the maximum likelihood ratio.

(pp. 384–398)

[Decomposition of continuity via bioperation associated with new sets](#)

[B. Brundha, C. Carpintero, N. Rajesh, E. Rosas](#)

In this paper, we introduce some new types of sets in bioperation topological space. Also we discuss some properties and characterize these new sets and finally, we find some relationships between  $(\gamma, \gamma') - (\beta, \beta') - A_1$  continuous,  $(\gamma, \gamma') - (\beta, \beta') - t$  continuous and  $(\gamma, \gamma') - (\beta, \beta') - B_1$  continuous functions.

(pp. 399–405)

### Hyper $BN$ -algebras: hyperstructure theory applied to $BN$ -algebras

Lyster Rey B. Cabardo, Gaudencio C. Petalcorin Jr.

In this paper, we introduce the notion of hyper  $BN$ -algebras. We prove that it is a generalization of  $BN$ -algebras. We also compare it to other existing hyper algebras. We give some routine properties of hyper  $BN$ -algebra. We also give a certain condition for when a hyper  $BN$ -algebra becomes a hyper  $B$ -algebra and a hypergroup. Finally, we define the notion of hyper sub $BN$ -algebra and obtain some preliminary properties.

(pp. 406–422)

### Almost $\omega$ -continuous functions in bitopological spaces

C. Carpintero, R. Rajalakshmi, N. Rajesh, E. Rosas

In this paper, as a generalization of  $u$ - $\omega$ -continuous functions, we introduce the notion of almost  $\omega$ -continuous functions in bitopological spaces and obtain several characterizations and some of its properties.

(pp. 423–432)

### Lower bound for the index of convergence of the singular integral in a multidimensional analogue of Tarry's problem

Magomed A. Chakhkiev, Nikolay P. Tretyakov, Saif A. Mouhammad

In this paper, a general lower bound is obtained for the index of convergence of the singular integral in a multidimensional analogue of Tarry's problem. In all cases when the exact estimate is known, our estimate coincides with it.

(pp. 433–438)

### Certain efficient techniques to solve the unreported cases of 2019– $nCoV$ epidemic model

A. John Christopher, A. Prakash, N. Magesh, G. Tamil Preethi

One of the furthestmost intimidations that the death faced after the second World War is 2019- $nCoV$  epidemic and most crucial large-scale health disaster of this century. We devote the current work to discuss the epidemic prediction for the epidemic model created for 2019- $nCoV$  in Wuhan, China by certain approximate analytical methods such as differential transform method and variational iteration method. Further, we recognize unreported cases in numbers and the parameters of model are due to reported case data. For the considered system

demonstrating the model of coronavirus, the series solution is conventional in the structure of the differential transform method. The obtained solutions are discussed in figures which show the performance of considered model. The results show that the used schemes are definite and trouble-free to execution for the system of nonlinear ODEs. The solutions exposed that the both schemes are in total agreement, correct and well-organized for solving systems of nonlinear differential equations.

(pp. 439–450)

### Smarandache pseudo-CI algebras

L.C. Ciungu, A. Rezaei, A. Radfar

In this paper, we define the notion of Smarandache pseudo-CI algebras and we investigate their properties. We also define and study the notions of Smarandache filters, pseudo-CI Smarandache homomorphisms and modal Smarandache operators on pseudo-CI algebras. The classes of Smarandache fantastic, implicative and positive implicative filters of Smarandache pseudo-CI algebras are defined and studied by extending some results regarding Smarandache fantastic, fresh and clean ideals in Smarandache BCI-algebras and Smarandache BCH-algebras to the case of Smarandache pseudo-CI algebras. The notion of Smarandache commutative pseudo-CI algebras is defined and a characterization theorem is given. It is proved that in the case of commutative  $Q$ -Smarandache pseudo-CI algebras the notions of Smarandache filters and fantastic filters coincide.

(pp. 451–468)

### Dynamical modelling of Kaziranga wildlife ecology

Saureesh Das, Rashmi Bhardwaj

The ecology, conservation and management of wildlife is an important component in the fields of environmental science and natural resource management. Wildlife management is a very dynamic field. Kaziranga National Park in India has a good conservation history, due to its efficient management policies. The mathematical modelling of the ecosystem in Kaziranga national park located in Assam, India with the interaction of species between Indian Rhinoceros, Bengal Tiger and Swamp deer has been studied. In this system, predator-prey interaction and the effect of poaching for both Indian Rhinoceros and Bengal Tiger have been considered. Also, the indirect dependency between Indian Rhinoceros and Swamp deer accounting for dependency of both grazers on common food resource has been considered. The fixed point for three dimensional nonlinear systems at which all the species remain conserved with the stability conditions

have been estimated. Using the parametric values given in census report of Kaziranga National park the future population of Indian Rhinoceros, Bengal Tiger and Swamp deer have been predicted and numerically verified with phase space and time series plots. Using simulation analysis with base value for 1999, the future value for all the three species have been estimated for the year 2016. It is observed that the forecasted values for Bengal tiger are closest to the actual value of population and the ecosystem remains in coexistence phase despite of poaching and lower growth rate of Bengal Tiger.

(pp. 469–480)

#### Solving the fuzzy assignment problems via utilizing branch and bound algorithm-practically treated

S. Mohammed Dawood, W. Mohammed Elaibi, H. Ali Chachan

In this paper described of assignment cost for the numbers that are fuzzy. Here, the assignment problem, which is fuzzy or invalid, is turned into crisp values throughout robust ranking technique, and by using branch and bound algorithm we gated the optimal solution and at a less cost.

An applied example is taken from Source No. (9) to solving the assignment problem for the Cotton Industries Company in Iraq and find the optimal assignment and total cost.

(pp. 481–490)

#### Optimal investment of DC pension plan based on a weighted utility

Yinghui Dong, Yedan Zhang, Zihan Yin, Chunrong Hua

We investigate the DC pension manager's portfolio problem when he bases decisions on both absolute level of total wealth and comparisons to a certain pre-defined reference point. This setting leads to a non-concave objective utility and therefore a non-concave utility maximization problem. We apply the concavification technique to solve the non-concave optimization problem and obtain the closed-form representations of the optimal wealth process and the optimal strategies.

Numerical results show that if the manager pays much more attention to the change of wealth relative to the reference point, then he will take a more conservative investment strategy due to risk aversion over gains.

(pp. 491–506)

### On the multivariate extension of an increasing, form order-modular on a continuous 0-lattice

M. El Kamli, A. Ould Khal

In the paper [17], we show a theorem, which generalizes the two methods of extensions, namely the theorem of Carathéodory and Daniell. We should be able to directly obtain an extension of modular-forms ("Valuation" under Birkhoff [2]) order-continuous increasing on 0-lattice, the two others that would flow naturally as special cases.

In this paper, we established a Multivariate case of our work intituled extension of an increasing form order-modular on a continuous 0-lattice (see, [17]).

(pp. 507–522)

### Computation of edge-based topological indices for zero divisor graphs of commutative rings

K. Elahi, A. Ahmad, M.A. Asim, R. Hasni

Graph constructing algorithms and their mapping with real life problems for scientific data analysis are getting popular. Standard algorithms construct the graph in a way that it can deal with all possibilities of input data to calculate the desired output. This article gives an algorithmic computational model for edge based eccentric topological indices by constructing zero divisor graph containing finite rings as  $\mathbb{Z}_{p_1 p_2} \times \mathbb{Z}_q$  and  $\mathbb{Z}_{p_2} \times \mathbb{Z}_q$ , where  $p, p_1, p_2$  and  $q$  are primes numbers. At first algorithm classify vertices with common eccentricity and then computes first Zagreb, third Zagreb, geometric-arithmetic, atom-bond connectivity and harmonic index for zero divisor graphs containing commutative rings. Results of algorithms are verified using mathematical formulation so algorithm can be reuse or modify for applications of coding theory, algebraic cryptography, ICT, biology and chemistry easily.

(pp. 523–534)

### An algorithm to solve multi-objective assignment problem by using discrete PSO decomposition

W. Mohammed Elaibi, F. Hassan Ali, A. Sabah Hameed, Hanan A. Cheachan

This paper presents an algorithm to solve a multi-objective assignment problem (MOAP) using discrete particle swarm optimization method under decomposition. The mathematical modeling of the algorithm has been derived to simulate the multi-objective assignment problem that considered as a non-linear function. The approach presented in this work highlights the optimal solution

of every single objective function by decomposition the objective functions. To illustrate the algorithm a numerical examples are presented.

(pp. 535–548)

### [An extended outranking approach for multi attribute group decision making problems with intuitionistic fuzzy data](#)

Zeynab Eslaminasab, Ali Hamzehee

In group decision making problems, decision matrix depends on different attributes. The weight of each attribute indicates its relative importance comparing to others. The objective of this paper, however, is to introduce a linear model in order to determine the importance of each attribute in multi attribute group decision making problems with intuitionistic fuzzy data; so that, this model prevents the decision makers from making mistake in determining the weight and shape of standardization of their mental measurement units. Next, using the determined weights, a new method of ranking alternatives based on ELECTRE III is introduced and illustrated. In this method, group satisfaction index is used to exclude decision makers' personal opinion for selection the best alternative. Finally, a numerical example is considered to elucidate the details of the proposed method, and then the obtained results are compared with other current methods.

(pp. 549–567)

### [Contragredient hom-Lie superalgebras](#)

M.R. Farhangdoost, A.R. Attari Polsangi

In this paper we introduce the notions of  $\mathbb{Z}$ -graded hom-Lie superalgebras and contragredient hom-Lie superalgebras. We introduce the invariant bilinear forms on a  $\mathbb{Z}$ -graded hom-Lie superalgebra and we prove that a consistent supersymmetric  $\alpha$ -invariant form on the local part can be extended uniquely to a bilinear form with the same property on the whole  $\mathbb{Z}$ -graded hom-Lie superalgebra. Furthermore, we check the condition in which hom-Lie superalgebra is simple.

(pp. 568–579)



### Geometric study on modified Koebe functions imposed by confluent hypergeometric functions

Hiba Fawzi Al-Janaby, Firas Ghanim

The current endeavor, employing confluent hypergeometric functions and convolution tool, introduces a new normalized modified Koebe function in the complex open unit disk. Certain sufficient stipulations on parameters of the modified Koebe function to be starlike, convex and close-to-convex are discussed and presented. Moreover, close-to-convexity of modified Koebe functions with respect to specific functions is discussed. In addition, the stipulations on the modified Koebe function to be included in the Hardy space are also studied.

(pp. 580–594)

### Interval valued vague ideals in $\Gamma$ -nearrings

Neha Gahlot, Nagaraju Dasari

In the present paper we propose interval valued (I-V)vague ideals in  $\Gamma$ -nearrings, explain some of their properties and provide some applications related to this work. Also, look at the direct product of I-V vague ideals, as well as the normal I-V vague ideals  $\Gamma$ -nearrings.

(pp. 595–604)

### A graph modelling to measure the frustration index in signed networks

Germina Augusthy Kizhakekunnel

Computing the frustration index of a signed graph is a key step towards solving problems in many fields including social networks, political science, physics, chemistry, and biology. In social networks the frustration index determines network distance from a state of structural balance. The focus of this paper is to provide insight into computing the frustration index and show that exact values of the frustration index can be computed using optimisation models namely, 0/1 Binary Linear Model.

(pp. 605–614)

### [A note on rigid rings](#)

Jebrel M. Habeb

Let  $R$  be an associative ring with identity element and let  $\sigma$  be an endomorphism of  $R$ .  $\sigma$  is called rigid if whenever  $a \in R$  with  $a\sigma(a) = 0$ , then  $a = 0$ .  $R$  is called a  $\sigma$ -rigid ring if it has a rigid endomorphism  $\sigma$ . In this article we study some of the elementary properties of rigid rings which are generalizations of some properties of reduced rings. We show, among other things, that the set of all rigid automorphisms of a ring  $R$  is a normal subgroup of all automorphisms of  $R$ .

(pp. 615–620)

### [Investigation the order elements 3 in certain twisted groups of lie type](#)

Halah Qahtan Hamdi

Suppose  $G$  is a finite group and that  $X$  is a subgroup of  $G$ . The commuting graph is denoted by  $C(G, X)$  which if  $x \neq y$  and  $xy = yx$ , has a set of vertices  $Xx, y \in X$  joining. Assume that  $X$  for elements of order 3 is a  $G$ -conjugacy class. In this article, to evaluate  $X$ , the commuting graphs for unique Twisted Lie form groups of function two over  $X$  are used.

(pp. 621–629)

### [Bayes estimation of Lomax parameters under different loss functions using Lindley's approximation](#)

Wafaa S. Hasanain, Najm A. Oleiwi Al-Ghezi, Alaa Malik Soady

This paper discusses Maximum Likelihood and Base estimation of two parameters shape parameter  $\beta$  and scale parameter  $\Theta$  of the Lomax distribution based on three kinds of Loss Functions; Squared Error Loss Function (SELF), Quadratic Loss Function (QLF), and Linex Loss Function (LLF). Lindley approximation was used to obtain the values for the Lomax distribution parameters and to find the best estimation of the parameters. Many sample sizes (10,20,30,50,100) were used to compare the best estimator using the Monte Carlo simulation and the statistical scale Mean Squared Error (MSE). The results show that the Bayes estimator with both the Linex loss function and the Lindley approximation is the best estimator, and when increasing the values of shape parameter due to decreasing the values of mean square error with various vales of scale parameter.

(pp. 630–640)

### Cusa-Huygens type inequality and a correction for generalized trigonometric functions

L.G. Huang, L. Yin

In this paper, we mainly give several Cusa-Huygens and Kober type inequalities for generalized trigonometric functions by using classical analysis. Finally, we also show that the proof of Theorem 3.9 given by Huang et.al. in the paper "Some Wilker and Cusa-Huygens type inequality for generalized trigonometric functions" is incorrect. In addition, we present a weak result by using l'Hôpital monotone rule.

(pp. 641–649)

### Numerical integration by using polynomial $P_5(x)$ of Newton-Gregory forward interpolation formula

Oras B. Jamil, Khader S. Tanak, Zaid Abdulaziz Abdulrazzaq

In this paper, we will appear that the classical quadrature method for the numerical solution by using polynomial  $P_5(x)$  of Newton-Gregory forward interpolation formula in numerical integration.

(pp. 650–658)

### Every planar graph without 4-cycles and 6-cycles is (2,9)-colorable

Jianqing Ma, Mingfang Huang, Xiaoxia Zhang

Let  $d_1, d_2, \dots, d_k$  be  $k$  nonnegative integers. A graph  $G$  is  $(d_1, d_2, \dots, d_k)$ -colorable if the vertex set of  $G$  can be partitioned into  $k$  sets  $V_1, V_2, \dots, V_k$  such that the subgraph  $G[V_i]$  has maximum degree at most  $d_i$  for  $i = 1, \dots, k$ . Sittitrai and Nakprasit proved that every planar graph without 4-cycles and 5-cycles is (2,9)-colorable [Discrete Math., 341 (2018) 2142-2150]. In this paper, we prove that every planar graph without 4-cycles and 6-cycles is (2,9)-colorable.

(pp. 659–670)

### Study of generalised solutions for piezoelectric material with long memory and damage

Leila Ait Kaki

We consider a dynamic problem that describes a frictional contact with damage between piezoelectric body and a conductive foundation. The constitutive law used is the electro viscoelastic with long term memory. The contact is supposed bilateral and frictional, it is modeled with Tresca's law. The damage is described by a function, its evolution is given by an inclusion of parabolic type. We derive a variational formulation for the model which is in a form of a coupled system for the displacement, the electric potential and damage function. The existence of a unique weak solution for a contact problem is established. The proof is based on the evolutionary variational inequalities, evolution inclusion and Banach's fixed point theorem.

(pp. 671–687)

### Upshots of cataclysmic chemical reaction and thermophoresis on hydromagnetic flow past an inclined plate

Bhriku Kumar Kalita, Rita Choudhury

A probe is made into free convection flow of electrically conducting incompressible viscous fluid passing over a plate inclined at some angle to the vertical direction. The fluid is considered to be flown through a porous medium with invariable permeability with non-uniform temperature and concentration. The very essence of this study is to scrutinize the possible effect of thermophoresis and angle of inclination on the event of fluid flow in presence of cataclysmic chemical reaction and external heat absorption. Governing equations after being transformed into suitable non-dimensional forms have been solved numerically using Matlab solver bvp4c. The effects of pertinent flow parameters are assessed. This particular analysis delineates that externally applied magnetic field, chemical reaction, thermophoresis and angle of inclination contribute in reversal of fluid velocity but permeability of porous medium prevents retardation of the same. Presence of heat sink brings down the warmth of the fluid flow. It is reported that cataclysmic chemical reaction and thermophoresis dilute the fluid concentration. Influence of different flow parameters on skin friction and Nusselt number are also examined. Graphical depictions of all these results are put forth for visual substantiation.

(pp. 688–700)

### [L<sup>p</sup>-boundedness of fractional maximal operator](#)

Santosh Kaushik, Harindri Chaudhary

In this paper, we are introducing a new generalised one-sided fractional maximal operator  $M_{g,\alpha}^+$  and our aim is to study its boundedness between weighted Lebesgue spaces  $L_w^p$ .

(pp. 701–707)

### [A-contractions relative to a weak distance](#)

V. Kiran, V. Siva Rama Prasad

Among self maps of a metric space, Akram et. al have considered a class of contractions called A-contractions. On a metric space the concept of a weak distance was defined by Kada et.al.

In this paper we introduce *A-contraction relative to a weak distance* among the self maps of a metric space and prove three fixed point theorems for such maps.

(pp. 708–715)

### [Isomorphic properties of neighborly irregular cubic graph](#)

Kishore Kumar P.K., Zahra Sadri Irani, Hossein Rashmanlou

Cubic graph can manage the uncertainty relevant to the inconsistent and indeterminate information of all real-world problems, in which fuzzy graphs possibly will not succeed into bringing about satisfactory results. Hence, in this research, we describe weak isomorphism, co-weak isomorphism and isomorphism of neighborly irregular cubic graphs. Some results on order, size and degree of nodes in isomorphic neighborly irregular and isomorphic highly irregular cubic graphs are discussed. Isomorphism between neighborly irregular and highly irregular cubic graphs are proved to be an equivalence relation. Likewise, density and balanced irregular cubic graphs are introduced.

(pp. 716–732)

### Fixed point theorem for non-self mappings satisfying generalized contraction condition of integral type in metrically convex spaces

Ladlay Khan

A common fixed point theorem for single valued non-self mapping from nonempty closed subset  $K$  of a metrically convex metric spaces  $X$  is proved satisfying the contraction condition of integral type on the subset  $K$ . Result generalizing the previous results due to Banach [3], Branciari [4], Ćirić [6], Rhoades [11], Khan [9] and others.

(pp. 733–740)

### Finite groups whose character degrees are products of at most three prime numbers

Shitian Liu, Runshi Zhang

Huppert and Manz determined the structure of nonsolvable groups whose character degrees are products of at most two primes. In this paper, we classify nonsolvable groups satisfying that their character degrees are products of at most three primes.

(pp. 741–750)

### Some characterization of rarely $\omega$ -continuous functions

Wais Al-Luwaici, Ahmad Al-Omari

The notion of rare continuity was introduced by Popa [15]. In this present paper, we introduce a new class of functions, called rarely  $\omega$ -continuous function via  $\omega$ -open sets and we investigate several properties of this function.

(pp. 751–759)

### Fuzzy structures in hyper GR-algebras

A. Macodi, G. Petalcorin, Jr.

In this paper, we consider hyper GR-ideals of a hyper GR-algebra applied to fuzzy sets such as fuzzy hyper GR-ideal of type 2 and fuzzy distributive hyper GR-ideal of type 2. These concepts are introduced including the concept of distributive hyper GR-ideal. Several properties and characterizations of distributive hyper GR-ideals, fuzzy hyper GR-ideals of type 2 and fuzzy distributive hyper GR-ideals of type 2 are obtained. Moreover, a relationship between fuzzy

hyper GR-ideals of type 2 and hyper GR-ideals and fuzzy distributive hyper GR-ideals of type 2 and distributive hyper GR-ideals with respect to its level subset are presented. Furthermore, it is obtained that the family of fuzzy distributive hyper GR-ideals of type 2 of a hyper GR-algebra is a complete distributive lattice with respect to join and meet.

(pp. 760–778)

#### Product of TBCH-algebras and TBCH-algebras involving ideals

J.D. Mancao, S.R. Canoy, Jr.

A BCH-algebra  $(H, *, 0)$  equipped with a topology  $\tau$  on  $H$  (also called a BCH-topology on  $H$ ) is called a topological BCH-algebra (or TBCH-algebra) if the operation  $*$  :  $H \times H \rightarrow H$ , defined by  $*((x, y)) = x * y$  for any  $x, y \in H$ , is continuous, where the Cartesian product topology on  $H \times H$  is furnished by  $\tau$ . In this paper, we show that given two BCH-algebras  $(H_1, *_1, 0_1)$  and  $(H_2, *_2, 0_2)$ , an operation  $*$  can be defined on the product  $H = H_1 \times H_2$  so that  $(H, *, 0)$ , where  $0 = (0_1, 0_2)$ , is a BCH-algebra. Moreover, if  $(H_1, \tau_1)$  and  $(H_2, \tau_2)$  are TBCH-algebras, then  $(H, \tau)$  is a TBCH-algebra, where  $\tau$  is the product topology. We also consider in this paper TBCH-algebras involving ideals.

(pp. 779–787)

#### Weakly semi $\omega$ -continuous functions

S.A. Bani Melhe, A.A. Rawshdeh, H.H. Al-Jarrah, K.Y. Al-Zoubi

In this paper we will use the semi  $\omega$ -open sets to introduce a new type of weaker form of continuous function, namely weakly semi  $\omega$ -continuous. Then we discuss various properties of this form of continuous functions. Finally, we study some separation axioms by using the semi  $\omega$ -open subsets and we obtain some theorems linking the concepts of  $s\omega$ -strongly closed graph,  $s\omega$ -compact spaces and  $s\omega$ -connected with weakly semi  $\omega$ -continuous functions.

(pp. 788–798)

#### $C^*$ -convex sets generated by $C^*$ -convex maps in $*$ -rings and their $C^*$ -faces

Ali Ebrahimi Meymand

In this paper, we identify some  $C^*$ -convex sets generated by  $C^*$ -affine maps and  $C^*$ -convex maps on the unital  $*$ -rings, and we obtain the  $C^*$ -faces of such  $C^*$ -convex sets. Specially, we show that the set  $Fix(f)$  of all fixed points of the  $C^*$ -affine map  $f$  on the unital  $*$ -ring  $\mathcal{R}$ , is a  $C^*$ -convex set. Moreover, we prove that for a  $C^*$ -convex map  $f$  on some  $*$ -rings, the set  $Fix(f)$  is a  $C^*$ -face of some  $C^*$ -convex sets.

(pp. 799–805)

### Cubic fuzzy $\beta$ -ideals of $\beta$ -algebras

P. Muralikrishna, R. Vinodkumar, G. Palani

This paper extends fuzzy  $\beta$ -ideal into cubic fuzzy  $\beta$ -ideal of a  $\beta$ -algebra. Further, some related results using Cartesian product and homomorphism are also studied.

(pp. 806–813)

### Ulam stability of linear difference equations with initial conditions

R. Murali, E. Thandapani, A. Ponmana Selvan, D.I. Asuntha Rani

In this paper, we prove the Hyers-Ulam stability, Hyers-Ulam-Rassias stability, Mittag-Leffler-Hyers-Ulam stability and Mittag-Leffler-Hyers-Ulam-Rassias stability of the linear difference equations with initial conditions by applying Newton's Theorem. Also, the Ulam stability constants are obtained.

(pp. 814–829)

### Some differential subordinations and fuzzy differential subordinations using generalized integral operator

U.H. Naik, R.M. Shaikh, M.T. Gophane, A.K. Wanas

S.S. Miller and P.T. Mocanu introduced differential subordination and derived some properties associated with it. Motivated by this studies the aim of this paper is to establish some properties of differential subordination and fuzzy differential subordination associated with generalized integral operator which defined in the open unit disk.

(pp. 830–842)

### Extensions of $e$ -reversible rings

Sabah A. Nasef, Refaat M. Salem, Ahmed K. Alkholy, Sarah K. El-Din

Kose, et al. in [12] defined and studied the right (left)  $e$ -reversible rings. We introduce a strong condition on the Kose's notion and we call it  $e$ -strongly reversible rings, we define as follows: if  $ab = 0$  implies  $bea = 0$  for any  $a, b \in R$ , and  $e$  is an idempotent element in  $R$ . We show that  $e$ -reversible ring need not be  $e$ -strongly reversible. Also, we study some ring extensions over right (left)  $e$ -reversible rings e.g., Morita context and the Jordan construction.

(pp. 843–854)



### Partial domination in prisms of graphs

Leo Philo Nithya, Joseph Varghese Kureethara

For any graph  $G = (V, E)$  and proportion  $p \in (0, 1]$ , a set  $S \subseteq V$  is a  $p$ -dominating set if  $\frac{|N[S]|}{|V|} \geq p$ . The  $p$ -domination number  $\gamma_p(G)$  equals the minimum cardinality of a  $p$ -dominating set in  $G$ . For a permutation  $\pi$  of the vertex set of  $G$ , the graph  $\pi G$  is obtained from two disjoint copies  $G_1$  and  $G_2$  of  $G$  by joining each  $v$  in  $G_1$  to  $\pi(v)$  in  $G_2$ . i.e.,  $V(\pi G) = V(G_1) \cup V(G_2)$  and  $E(\pi G) = E(G_1) \cup E(G_2) \cup \{(v, \pi(v)) : v \in V(G_1), \pi(v) \in V(G_2)\}$ . The graph  $\pi G$  is called the prism of  $G$  with respect to  $\pi$ . In this paper, we find some relations between the domination and the  $p$ -domination numbers in the context of graph and its prism graph for particular values of  $p$ .

(pp. 855–862)

### Harmonization of some fuzzy subgroups

Babatunde Oluwaseun Onasanya, Xin Ming, Yuming Feng, Wei Zhang

This paper studies a new concept, Harmonized Fuzzy Groups (HFGs), from which different types of improvements on Rosenfeld's fuzzy groups (such as Intuitionistic Fuzzy Groups (IFGs), Pythagorean Fuzzy Groups (PFGs) and a new kind of fuzzy group presented in this paper, which is called Fermatean Fuzzy Groups (FFGs)) can be realized. Also, some properties of HFGs are studied.

(pp. 863–876)

### Analysis of the dynamics of rabies in North Shewa, Ethiopia

S. Osman, G.T. Tilahun, S.D. Alemu, W.M. Onsongo

In this paper, authors proposed and developed a deterministic model that explains the dynamics of rabies infection in human and dog populations in North Shewa, Ethiopia. The rabies model was analysed by determining a feasible region, positivity of the solution set, basic reproductive number, equilibrium points and their stability. Next Generation Matrix approach was employed in computing the basic reproduction number and its entirely dependent on the parameters of dog population. Its the threshold value that determines the dynamics of rabies transmission in North Shewa, Ethiopia. It was established that whenever  $R_0 < 1$ , rabies will die out from the population and whenever  $R_0 > 1$ , rabies persists in the population. Contribution each parameter was conducted using sensitivity analysis of the parameter values of the basic reproductive number. Some parameters were more sensitive and responsible for the spread of rabies in North Shewa region of Ethiopia. Moreover, stability analysis approach was

employed to determine the disease free and endemic equilibrium of the rabies model. The results of the numerical simulation showed that as the contact rate and infection rate increases, the disease spread faster. Moreover, as the removal rate and treatment rate increases, the disease spread decreases.

(pp. 877–902)

### Stability analysis and modeling the dynamics of Hepatitis B with vaccination compartment

D. Otoo, I. Odoi Abeasi, S. Osman, E. Kobina Donkoh

Resources hinder control and prevention of diseases in a number of communities in Ghana and Africa in general. Some measures have been put in place in an attempt to combat infectious diseases. A model that explains the dynamics of hepatitis B was formulated and analysed. The local and global stability of the disease as well as the basic reproduction number were determined. It was established that the hepatitis B infection is locally asymptotically stable whenever the basic reproduction number is less than unity and unstable otherwise. The population dynamics of the susceptible, infectious and recovered were determined numerically. The effects of contact rate between the infectious and susceptible population was established numerically. It was evidence that as contact rate increases, the population infected increase with time. Moreover, as the contact rate between the treated and recovered populations increase, the population of recovery increases with time.

(pp. 903–927)

### sgp-resolvable and sgp-irresolvable spaces

Md. Hanif Page, Anuradha N. Patil, Praveen I. Chandaragi

The fundamental intent of this paper is to developing the idea of SSGP-continuous and SSGP-open functions using sgp-open sets. In addition sgp-resolvable and sgp-irresolvable spaces are introduced. Its various characterisations and properties are established.

(pp. 928–936)

### Continuous mappings in soft lattice topological spaces

Sandhya S. Pai, Baiju T.

The fuzzy set, soft set and their extensions have proven to be a fruitful bridge between precise classical mathematics and the imprecise real world. Soft lattices, which are a generalization of soft sets, are a novel mathematical approach to

the study of uncertainty. Soft lattice topological spaces are introduced over an initial universe  $X$  with a fixed set of parameters  $P$ . In this paper, we introduce the concept of soft lattice continuous mappings (soft L-continuous mappings) in soft lattice topological spaces which are defined with a fixed set of parameters over an initial universe. Further we investigate some properties regarding the continuity of mappings in soft lattice topological spaces. Finally, open mappings, closed mappings and homeomorphism on soft L-topological spaces are defined and some interesting results are obtained.

(pp. 937–949)

### Topologizing a hyper BCI-algebra using its hyper-order

M.T. Panganduyon, S.R. Canoy, Jr.

In this paper, we topologize a given hyper BCI-algebra using the hyper-order associated with the hyper-structure. Specifically, we consider a family of subsets of the hyper BCI-algebra that serves as a basis for some topology on this structure. Properties of the topological spaces generated in this way are subsequently investigated.

(pp. 950–960)

### A penalty-free algorithm for solving nonlinear equality constrained optimization

Yonggang Pei, Lanting Dong, Weiyue Kong

In contrast to standard penalty type methods for nonlinear optimization, penalty-free type methods do not have to determine penalty parameters and have promising numerical results. So they have attracted the attention of many researchers. Filter method is a classical penalty-free method. In this paper, a different filter technique is introduced for solving nonlinear equality constrained optimization. The optimality condition of the nonlinear optimization problem is regarded as a new filter pair which is built in the backtracking line search framework. Then, the trial step size is accepted if one of the two measures in filter is improved after the search direction is determined. Under some reasonable assumptions, the global convergence of the algorithm is proved. Some preliminary numerical results are presented to show the usefulness of the proposed algorithm.

(pp. 961–985)

### Separation axioms in intuitionistic topological spaces

Tamanna Tasnim Prova, Md. Sahadat Hossain

In this paper we study that every classical topological space is also an intuitionistic topological space but the converse is not true in general. This notion opens up a new conception of generalization of classical topological space. Besides this, by using the notions of separation axioms  $(T_0, T_1, T_2)$  under intuitionistic set we define the relations among them. The hereditary and topological properties of intuitionistic topological spaces have been also investigated. Finally, it is showed that under some conditions the images and homeomorphic images preserve in intuitionistic topological spaces.

(pp. 986–995)

### New remarks regarding positive implicative BCK-algebras

Radu Vasile

In this paper, we present a generalization of the Iseki Extension for a BCK-algebra. Furthermore, we prove that the Pseudo-Iseki extension is also a particular case of this generalization. Also, we introduce an algorithm for generating BCK-algebras using a computer and some new results regarding positive implicative BCK-algebras, results obtained with the help of this algorithm.

(pp. 996–1020)

### Geometry of warped product pseudo slant submanifolds in a nearly quasi-Sasakian manifold

Shamsur Rahman, Abdul Haseeb, Hassan Almusawa

In this paper we study distributions of pseudo slant submanifolds of a nearly quasi-Sasakian manifold and obtain some results related to integrability of the distributions and totally geodesic foliations determined by the distributions of pseudo-slant submanifold. Moreover, warped product pseudo slant submanifolds of a nearly quasi-Sasakian manifold are also studied and some characterization theorems for the existence of warped product isometrically immersed into nearly quasi-Sasakian manifolds have been proved.

(pp. 1021–1032)

Decision making application based on parameterization of fuzzy hypersoft set with fuzzy setting

A.U. Rahman, M. Saeed, H.A.E. Khalifa

Fuzzy soft set is considered as an apt parameterization tool to deal with vagueness and uncertainties. There are many situations when attributes need to be further classified into attribute-valued disjoint sets. Such situations are not tackled by the existing fuzzy soft-like structures. Hypersoft set, an extension of soft set, employs multi-argument approximate function which addresses the inadequacy of existing structures for attribute-valued disjoint sets. In this study, theory of fuzzy parameterized fuzzy hypersoft set is characterized and some of its essential properties are discussed. In order to cope with the decision making problems, an algorithm is proposed which employs the fuzzy decision set of fuzzy parameterized fuzzy hypersoft set for dealing with decision making problems under uncertain scenarios. The proposed algorithm is validated with the help of a numerical example.

(pp. 1033–1048)

Applications of Fibonacci matrix to characterize some Banach spaces through weakly unconditional Cauchy series

Kuldip Raj, Anu Choudhary, M. Aiyub, Sonali Sharma

In this article, we introduce new sequence spaces  $U(\mathcal{T}(x), \mathcal{F}, p, u)$ ,  $U(\mathcal{T}_w(x), \mathcal{F}, p, u)$  and  $U(\mathcal{T}_{w^*}(h), \mathcal{F}, p, u)$  by using Fibonacci matrix and sequence of modulus functions. We make an effort to study some characterizations of weakly unconditionally Cauchy series associated to newly formed sequence spaces. Finally, the barreledness of a normed space  $Y$  is characterized by means of *weakly\** unconditionally Cauchy series in  $Y^*$ .

(pp. 1049–1059)

Fuzzy (left)topological  $\beta$ -algebras

V.V.S. Ramachandram, S. Nivetha, M. Chandramouleeswaran, P. Muralikrishna

In this paper we introduce the notions of fuzzy topological spaces on a  $\beta$ -algebra and (left) fuzzy topological  $\beta$ -algebras. We illustrate them with some examples and prove simple but elegant properties.

(pp. 1060–1072)

### Numerical approximation of vorticity transport equation using implicit-Euler finite difference scheme

Maan A. Rasheed, Rasha H. Ibraheem

This paper is devoted to study the numerical solutions of the two-dimensional vorticity transport equation (VTE) with homogenous Dirichlet boundary conditions. For this problem, we derive the implicit-Euler difference equation using Taylor expansion and with approximating the spatial partial derivatives by finite difference operators. In addition, the matrix formulation for the discrete problems are shown. The proof of consistency and the order of accuracy for the proposed scheme is provided by deriving the local truncation errors of the difference equations. Moreover, the necessary and sufficient condition for the stability of the proposed scheme is considered. Furthermore, the stability and convergence of the proposed method are tested by solving a numerical experiment for different space-steps. Additionally, the discrete graphs for the vorticity and stream functions are carried out to support the numerical results. The results show that the obtained numerical solutions are stable, convergent and decreasing over time.

(pp. 1073–1085)

### On some well covered graphs

Eman Rawshdeh, Heba Abdelkarim, Edris Rawashdeh

If all maximal independent sets of a graph  $G$  have the same cardinality, then  $G$  is called a well covered graph. In this paper, we study the well covered property for several classes of graphs. We show that the line graph of a complete graphs  $L(K_n)$  is a well covered graph. Furthermore, we show that  $(m, n)$ -lollipop graph  $L_{m,n}$  is a well covered graph only if  $n = 2$  and the line graph of  $(m, n)$ -lollipop graph  $L(L_{m,n})$  is a well covered graph only if  $m$  is even and  $n = 1$  or  $n = 3$  or if  $m$  is odd and  $n = 2$ .

(pp. 1086–1092)

### An application of improved method of fuzzy matrix composition in medical diagnosis

Taiwo O. Sangodapo, Yuming Feng

In this paper, the Thangaraj and Mallika's approach for the application of fuzzy matrix is studied. Also, we introduce an improved method of fuzzy matrix composition in medical diagnosis. The validity of the improved method is established in comparison to Thangaraj and Mallika's approach using operation of fuzzy matrices. Finally, an application of the improved method to medical

diagnosis is carried out by the operations of fuzzy matrices and the improved method. This improved method could be used to solve other decision making problems.

(pp. 1093–1103)

### Certain fixed point theorems on partial metric spaces

P. Semwal, A.R. Gairola, L.N. Mishra, V.N. Mishra

The existence and uniqueness of common fixed point theorems for two pairs of weakly compatible self mappings satisfying some contractive condition on partial metric space is given. Further proved a theorem for a pair of self mappings satisfying rational type contraction condition without using weakly compatibility. Some examples are also given to support our results.

(pp. 1104–1118)

### Frames and topological spaces in $\mathbf{MSet}$

S. Sepahani, M. Mahmoudi

In this paper we give a definition for frames in the category  $\mathbf{MSet}$  of actions of a monoid  $M$  on sets. We then show that, like in the classical case, frames and (internally) complete Heyting algebras are the same. Further, we give a definition of a topological space in  $\mathbf{MSet}$  and study the relation between frames and topological spaces in this category. We show that the well known adjunction between the two categories still exists in  $\mathbf{MSet}$ .

(pp. 1119–1132)

### Some results on the total graph of a commutative ring

Pravesh Sharma, Sanghita Dutta

In this paper, we study the total graph of a ring and determine its matching, factors and arboricity. We find the independence number of the line graph of the total graph of a ring and give complete characterization of rings for which  $\text{diam } L(T(\Gamma(R))) = \langle \text{or} \rangle \text{diam } T(\Gamma(R))$ . We find the crossing number of all local rings with some bounds in the cardinality of zero divisors and also determine the crossing number of all finite rings with the genus at most two.

(pp. 1133–1146)

### Photothermoelastic deformation in dual phase lag model due to concentrated inclined load

Nidhi Sharma, Rajneesh Kumar

Existing problem is regarding the deformation of photothermoelastic solid with dual phase lag (DPL) by applying inclined load. Here inclined is considered as the consolidation of horizontal and vertical strengths. The displacement, stress, temperature distribution and carrier density are obtained by using Laplace and Fourier transform. These are also computed numerically for silicon material and presented graphically to analyze the photothermal effect on considered physical variables. Notable cases are drawn out from this problem.

(pp. 1147–1160)

### Schur power convex functions with applications to a class of conditional inequalities

Huan-Nan Shi, Shan-He Wu, Dong-Sheng Wang

In this paper, by the use of Schur power convexity, we prove some inequalities involving the condition that the sum of powers of variables is a fixed value. It is shown that the approach proposed is useful for establishing certain conditional inequalities.

(pp. 1161–1173)

### Multi-monad graph

A. Shukur, H. Shelash

Monad graph is a directed graph related to finite group  $G$  where every vertex of the elements of the correspond group  $G$  is adjacent with its image by directed connected edge under the action of given map. In this paper, we introduce multi-monad graph, which is a joint union of finite number of monad graphs.

(pp. 1174–1180)

### Fixed point results in a complex-valued generalized $G_b$ -metric space

P. Singh, V. Singh

In this paper, we introduce the concept of a complex  $G_b^{\alpha\beta}$ -metric space and prove the Banach fixed point principle and Kannan's fixed point theorem. Our results generalize the idea of a complex valued  $G_b$ -metric space.

(pp. 1181–1189)



### Inverse int-fuzzy soft (left, right) ideals over semigroups

P. Suebsan

In this paper, we define inverse int-soft sets, inverse int-fuzzy soft sets, inverse int-soft subsemigroups, inverse int-fuzzy soft subsemigroups and inverse int-soft (left, right) ideals, inverse int-fuzzy soft (left, right) ideals over a semigroup. We also give some of their properties such as AND operation, OR operation, union and intersection of them over semigroups with supported examples. Moreover, we show that the images of inverse int-fuzzy soft (left, right) ideals over semigroups are the inverse int-fuzzy soft (left, right) ideals over semigroups under some conditions.

(pp. 1190–1205)

### Ordered almost ideals and fuzzy ordered almost ideals in ordered semigroups

Sudaporn Suebsung, Winita Yonthanthum, Ronnason Chinram

In this paper, we define ordered almost ideals and fuzzy ordered almost ideals in ordered semigroups and we study some of their properties. We give relationship between fuzzy ordered almost ideals and ordered almost ideals of ordered semigroups.

(pp. 1206–1217)

### Synchronization of chaotic systems via periodically piecewise feedback control

Xingkai Hu, Linru Nie

In this paper, the synchronization of chaotic systems via periodically piecewise feedback control is investigated. An exponential synchronization criterion is given by means of Lyapunov function and inequalities. The effectiveness of theoretical result is confirmed via an example based on Chua's circuit.

(pp. 1218–1226)

### Wrapped Aradhana distribution

Ayat T.R. Al-Meanazel

In this paper, we introduce a new circular distribution generated from Aradhana distribution. We obtained the probability densities and characteristic functions of wrapped Aradhana distribution. The maximum likelihood estimator of the new distribution parameter is also obtained. Then, some properties of the distribution are studied such as means, skewness, and kurtosis.

(pp. 1227–1234)

### Matrices of infinite dimensions and their applications

Lukasz Matysiak, Weronika Przewoźniak, Natalia Rulińska

Matrices are very popular and widely used in mathematics and other fields of science. Every mathematician has known the properties of finite-sized matrices since the time of study. In this paper, we consider the basic theory of infinite matrices. So far, there have been references and few results in certain scientific fields, but they have not been thoroughly researched.

(pp. 1235–1241)

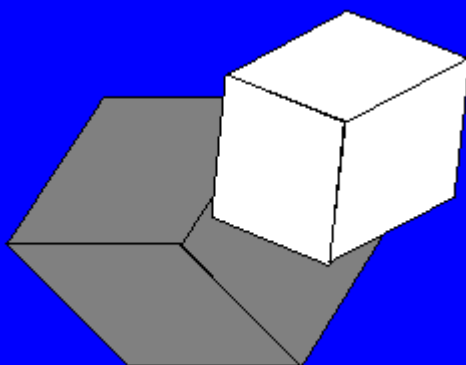
### New conformable fractional HPT for solving systems of linear and nonlinear conformable fractional PDEs

Maher Jneid

In this work, an analytical solution for a linear and nonlinear system of conformable fractional PDEs is obtained by applying a New conformable fractional homotopy perturbation technique (NCFHPT) with the help of fractional series expansion. In fact, the current method is a natural extension of NHPM for partial differential equation of real order in conformable sense. By constructing the homotopy transformation for a given system and gathering the coefficients with the identical power of  $p$ , a system of recursive equations is established. In addition, by a convenient assumption on the initial approximate solution. We can consecutively starting with this solution and working upward until getting general term of the intended coefficients to deduce a closed form series solution. The NCFHPT gives an analytical solution without making any linearization, rough conditions or discretization, especially for non-linear problems. This technique shows a powerful and a promise tool to solve linear and nonlinear systems of CFPDEs. The practicable validation and effectiveness of this method are demonstrated by three typical examples.

(pp. 1242–1253)

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