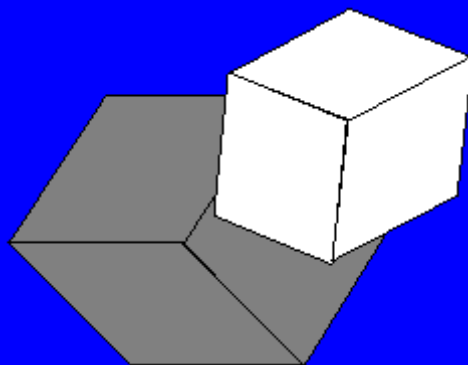


N° 44 – July 2020

Italian Journal of Pure and Applied Mathematics

ISSN 2239-0227

Papers Abstracts



FORUM

Two-level secret sharing schemes based on reverse super edge magic labelings

MD. Shakeel, Sharief Basha and Raja Das

In this paper, we propose two-level secret sharing scheme based on a reverse edge magic labeling of star graphs. It is a scheme which creates two types of hierarchical sets. The first set contains share that are more powerful than the share in the second set. We build banking secret sharing scheme that will share a secret among one bank manager and several sets of authorized staff members.

(pp. 1–6)

Edge maximal W_7 -free graphs

Ahmad Al-Rhayyel

Extremal graph theory is one of the most important subjects in graph theory. In this paper we give an upper bound to the number of edges of graphs which are W_7 -free. In fact we prove that if G is a graph on n -vertices which is W_7 -free, then

$$|E(G)| \leq \lfloor \frac{n^2}{4} \rfloor + \lfloor \frac{n+1}{2} \rfloor + 2.$$

(pp. 7–21)

On Lie ideals of inverse semirings

S. Sara and M. Aslam

The purpose of this paper is to study Lie ideals of inverse semirings, thereby extending a few well-known results of I.N Herstein and C. Lanski in the setting of inverse semirings.

(pp. 22–29)

Modification of conformable fractional derivative with classical properties

SH. Al-Sharif and A. Malkawi

In this paper, a new modification of the conformable fractional derivative that uses limit approach with classical properties, linearity, product rule, semi-chain rule, quotient rule, etc. is given. Moreover, we prove that such generalization formula does not satisfy the classical chain rule.

(pp. 30–39)

Properties of γ - P_S - R_0 and γ - P_S - R_1 spaces

Baravan A. Asaad, Nazihah Ahmad and Zurni Omar

This paper introduces some more γ - P_S - separation axioms called γ - P_S - R_0 and γ - P_S - R_1 by using γ - P_S -open sets and τ_{γ} - P_S -closure of a set. Some properties of these spaces are constructed.

(pp. 40–56)

Synchronization of two three-species food chain system with Beddington-DeAngelis functional response using active controllers based on the Lyapunov function

Rashmi Bhardwaj and Sauresh Das

In this paper master-slave scheme is used to investigate the problem of synchronization of two three species models with Beddington-DeAngelis type of functional response. Using Lyapunov stability theory the analytical expression for nonlinear active controllers have been deduced for the synchronization of (I) two identical three-species web chain but with different growth rate and (II) two identical chaotic three-species food chain with different initial conditions. The bifurcation diagram of the food chain system has been used to find the intrinsic growth rate parameter for which the dynamics of three-species food chain exhibit either regular or chaotic behavior in phase space. Based on the chosen intrinsic growth parameters that characterizes the complex dynamics of the master and slave system, the active controller functions, have been obtained, which causes global asymptotic stability of synchronization errors, for the case I and II respectively. The efficacy of the controller functions, in the synchronization process, is demonstrated using the time series plot of species population and phase plots before and after the activation.

(pp. 57–77)

The complexity of the graph access structures on seven participants

M. Davarzani

In this paper, we deal with determining the values for the complexity of the graph access structures on seven participants. As [10], it was determined exact values of the 91 of the complexities of access structures. In this paper we give simple proof by entropy and shannon inequalities for determining the lower bound of complexity which used for determining of lower bound of the 51 graph access structure. Further, we establish the exact values of the complexity of five graphs, which remained as open problems in [10]. Also we obtain the tight bounds for complexity of five access structures.

(pp. 78–86)

The convergence of the solutions of a system of max-type difference equations of higher order

Guangwang Su, Taixiang Sun and Bin Qin

In this paper, we study the convergence of the solutions of the following system of max-type difference equations

$$x_n = \max\left\{\frac{A}{y_{n-m}}, \frac{1}{y_{n-r}^\alpha}\right\}, \quad y_n = \max\left\{\frac{A}{x_{n-m}}, \frac{1}{x_{n-r}^\alpha}\right\}, \quad n = 0, 1, \dots,$$

where $m, r \in \{1, 2, \dots\}$, $A \in (0, +\infty)$ and $\alpha \in (0, 1)$ and the initial values $x_{-d}, x_{-d+1}, \dots, x_{-1}, y_{-d}, y_{-d+1}, \dots, y_{-1} \in (0, +\infty)$ with $d = \max\{m, r\}$. We show that: (1) If $0 < A \leq 1$ and $\{(x_n, y_n)\}_{n \geq -d}$ is a solution of the above system, then $\lim_{n \rightarrow \infty} x_n = \lim_{n \rightarrow \infty} y_n = 1$; (2) If $A > 1$ and $\{(x_n, y_n)\}_{n \geq -d}$ is a solution of the above system, then for any $0 \leq k \leq 2m - 1$, x_{2mn+k} and y_{2mn+k} are eventually monotone.

(pp. 87–100)

$\Delta^*(\mathcal{H})$ operators and the hyperinvariant subspace problem

Nuha H. Hamada and Adel G. Naoum

This paper is devoted to study the relation between an operator T that satisfies the operator equation $TKKT^* = C$ for some compact operator K and some rank one operator C , and the hyperinvariant subspace problem.

(pp. 101–111)

Reconstructing the diffusion coefficient in fractional diffusion equations

Mohammad F. Al-Jamal and E. A. Rawashdeh

We consider the inverse problem of identifying the diffusion coefficient in a time-fractional diffusion equation from noisy interior measurements of the density. To overcome the instability issue of the problem, we employ a mollification based technique to smooth out the noisy data. We derive consistency and stability results, and provide numerical examples to show the feasibility of the proposed approach.

(pp. 112–123)

Structures in a differentiable manifold and their applications to the tangent bundle

M. N. I. Khan, G. A. Ansari and Z. A. Adhoni

The differential geometry of tangent bundles was studied by several authors, for example: D. E. Blair, E. T. Davies, P. Dombrowski, S. Ianus, A. J. Ledger and K. Yano, V. Oproiu, C. Udriste, Yano and Davies, Yano and Ishihara and among others [15,23,24,25,26]. It is well known that different structures defined on a manifold M can be lifted to the same type of structures on its tangent bundle. However, when we consider the generalized almost r-contact structure not the same type of structure is obtained on the tangent bundle. The aim of this study is to investigate the prolongations of G -structures immersed in the generalized almost r-contact structure on a manifold M to its tangent bundle $T(M)$. Moreover, An almost contact structure, Lorentzian almost paracontact structure etc. on the tangent bundle $T(M)$ are discussed.

(pp. 124–133)

Warped product submanifolds of a generalized Sasakian space form admitting nearly cosymplectic structure

Amira A. Ishan and Meraj Ali Khan

In this paper we consider semi-invariant warped product submanifolds of the type $M = N_T \times_\psi N_\perp$ of a generalized Sasakian space form $\bar{M}(f_1, f_2, f_3)$ admitting nearly cosymplectic structure and obtained a characterizing inequality ($\|\sigma_\mu(D, D^\perp)\|^2 \geq f_2 \cdot \alpha \cdot \beta + 2\|\mathcal{P}_{D^\perp} D\|^2 + 2\|\mathcal{Q}_{D^\perp} D\|^2$) for existence of warped product submanifolds. Moreover, some special cases are also discussed. The results in the present paper generalize the existing results available in the literature.

(pp. 134–149)

Structures on Galois connections

A. V. S. N. Murty

In this paper it is proved that $G(Q, P)$ (the set of all Galois connections of P into Q) is a meet semilattice if and only if both P and Q are meet semilattices and in this case, the meet operation in $G(Q, P)$ is point-wise and P and Q are isomorphic to meet subsemilattices of $G(Q, P)$.

(pp. 150–154)

On exact sequences of the rigid fibrations

T. Nasri, B. Mashayekhy and H. Torabi

In 2002, Biss investigated on a kind of fibration which is called rigid covering fibration (we rename it by rigid fibration) with properties similar to covering spaces. In this paper, we obtain a relation between arbitrary topological spaces and its rigid fibrations. Using this relation we obtain a commutative diagram of homotopy groups and quasi-topological homotopy groups and deduce some results in this field.

(pp. 155–162)

On norm inequalities and orthogonality of commutators of derivations

N.B. Okelo and P.O. Mogotu

Let H be a complex separable Hilbert space and $B(H)$ the algebra of all bounded linear operators on H . In this paper, we give considerable generalizations of the inequalities for norms of commutators of normal operators. Let $S, T \in B(H)$ be positive normal operators with the cartesian decomposition $S = A + iC$ and $T = B + iD$ such that $a_1 \leq A \leq a_2$, $b_1 \leq B \leq b_2$, $c_1 \leq C \leq c_2$ and $d_1 \leq D \leq d_2$ for some real numbers $a_1, a_2, b_1, b_2, c_1, c_2, d_1$ and d_2 we have shown that $\|ST - TS\| \leq \frac{1}{2} \sqrt{(a_2 - a_1)^2 + (c_2 - c_1)^2} \sqrt{(b_2 - b_1)^2 + (d_2 - d_1)^2}$. Moreover, orthogonality and norm inequalities for commutators of derivation are also established. We have shown that if the pair of operators (S, T) satisfies Fuglede-Putnam's property and $C \in \ker(\delta_{S,T})$ where $C \in B(H)$ then $\|\delta_{S,T}X + C\| \geq \|C\|$.

(pp. 163–169)

A fully fuzzy DEA approach for network cost efficiency measurement based on ranking functions

E. Poudineh, M. Rostamy-Malkhalifeh, A. Payan and A. Noura

The purpose of this paper is to evaluate the cost-efficiency of the fully fuzzy network data envelopment analysis. Since actual measurement of real-world data is practically impossible, assuming that data is accurate in solving problems is not a valid hypothesis. One of the ways to deal with inaccurate data is fuzzy data. In this paper, linear ranking functions are used to transform the fully fuzzy cost efficiency model into a precise linear programming problem. By assuming triangular fuzzy numbers, the fuzzy cost efficiency of the decision makers is measured. Finally, a numerical example is shown for the proposed method.

(pp. 170–187)

Numerical solution of nonlinear oscillatory differential equations using shifted second kind Chebyshev wavelet method

Mamta Rani and Pammy Manchanda

A numerical method for solving Oscillatory differential equations using shifted second kind Chebyshev wavelets is presented. An operational matrix of derivative is introduced and utilized to reduce the oscillatory differential equations and its initial conditions to a set of algebraic equations in the unknown expansion coefficients. Illustrative examples are included to demonstrate the validity and applicability of the method. Numerical solution of Van der Pol oscillator problem and Duffing Equations are obtained by using this method.

(pp. 188–197)

Compactness of topological spaces with grills

A.A. Azzam, S.S. Hussein and H. Saber Osman

This work aimed at creation of expansion of topological structures using the concept of grill for the first time. In this respect, we obtained new findings such as αg -compact, αg -compact sets and countably αg -compact spaces. On the other hand, we studied the properties of these concepts and their relationships to each others and their previous counterparts.

(pp. 198–207)

Free commutative B -algebras

A.N. Sebandal and J.P. Vilela

In this paper, the notion free commutative B -algebras was introduced. In order to characterize free commutative B -algebras and obtain its properties, the concept of external direct product of B -algebras was also introduced.

(pp. 208–223)

Associativity of max-min composition of three fuzzy relations

M.A. Shakhathreh and T.A. Qawasmeh

In this paper, we introduce some concepts and definitions related to the Max-Min composition of fuzzy relations. We also prove the associativity of Max-Min composition of three fuzzy relations.

(pp. 224–228)

On centralizers and multiplicative generalized derivations of semiprime ring

Faiza Shujat, Shahoor Khan and Abu Zaid Ansari

In this note we gave the description of commutativity of prime and semiprime rings with the help of some identities involving multiplicative generalized derivation and multiplicative left centralizer.

(pp. 229–237)

Some fixed points theorems in intuitionistic Menger spaces

Rajinder Sharma and Deepti Thakur

In this paper, we established some common fixed point theorems for two pairs of weakly subsequential continuous (wsc) maps with compatibility of type (E) in an Intuitionistic Menger space (briefly IM space). We deduce important results in this line by restricting the number of mappings involved. An example is given to support the main result.

(pp. 238–249)

Nowhere-zero 3-flows in 4-connected simple graphs with independence number 3

Xiaoxia Zhang and Yanhua Yang

It is mainly proved in this paper that every 4-connected simple graph with $\alpha(G) = 3$ admits a nowhere-zero 3-flow, which is a partial result to Tutte's 3-flow conjecture and generalizes the result by Luo *et al.* [Graphs and Combin., (29)(2013)1899–1907] that characterized all graphs with independence number at most 2.

(pp. 250–264)

Modal operators on equality algebras

Ping Song, Xiaolong Xin and Juntao Wang

The main goal of this paper is to investigate modal operators on equality algebras. To begin with, we introduce the notion of modal operators on equality algebras and investigate some important properties of this operator. As applications, we give a characterization of prelinear equality algebras. In the following, we give the concepts of modal filters and modal congruences of equality algebras and obtain some related results. Moreover, we show that there is one to one correspondence relation between modal filters and modal congruences of a

modal equality algebra. Finally, using strong modal filters, we establish the uniform structures on modal equality algebras and we prove that modal equality algebras with uniform topologies are topological modal equality algebras.

(pp. 265–281)

Metric projection in countably seminormed spaces

Nashat Faried, Hany A. El-Sharkawy and Moustafa M. Zakaria

We introduce a definition of metric projection in countably seminormed space. In order to do this, we have to introduce a definition of uniformly convex seminormed space, projection theorem in seminormed space, a new vision of the completion of countably seminormed space and a definition of uniformly convex countably seminormed space.

(pp. 282–290)

Investigation of simulated annealing components to solve the university course timetabling problem

Issam Alhadid, Khalid Kaabneh, Hassan Tarawneh and Aysh Alhroob

Simulated Annealing (SA) is a common meta-heuristic algorithm that has been widely used to solve complex optimization problems. This is due to its ease of implementation and capability to escape from local optimum. This research conducts an investigation on three of SA components: the initial temperature, cooling schedule and neighborhood structure. We observed that the high initial temperature leads SA to accept any solution (wasting more computational time), whilst the lower value leads SA to quickly trap in local optimum. Based on research findings from this phase, for each component we suggested a technique to overcome the limitations. The limitations are: (i) a dynamic initial temperature mechanism that dynamically chose the suitable initial temperature for each instance problem; (ii) adaptive cooling schedule that will adjust the temperature value during the search; and (iii) a new neighborhood structure that will improve the search ability by minimizing the random selection. In the second phase. The experimental results show that the proposed techniques and approaches in all phases have outperformed the SA and comparable to other approaches in the literature (tested on university course timetabling benchmark dataset ITC2007-Track3).

(pp. 291–301)

Solvability for continuous classical optimal control associated with triple hyperbolic boundary value problem

Jamil Amir Ali Al-Hawasy

This article deals with the solvability for continuous classical optimal control associated with triple boundary value problem of linear hyperbolic type; for given continuous classical control vector the Galerkin method is used to prove the existence theorem of a unique state vector solution for the hyperbolic boundary value problem as well as for its adjoint equations. The existence theorem of a continuous classical optimal control vector dominating with the considered triple hyperbolic equations is proved. The directional derivative for the cost functional is derived. Finally the necessity theorem(conditions) for optimality of the problem is stated and proved.

(pp. 302–318)

Residual power series technique for solving Fokker-Planck equation

Mahmoud H. Darassi and Yousef Abu Hour

In this paper we used a numerical method to find the solutions of Fokker-Planck equation. The method used the residual power series method to solve the initial value Fokker-Planck problems. Numerous algorithms for linear and non-linear Fokker-Planck equations are presented. A comparison between residual power series method, Adomian decomposition method (ADM) and the variational iteration method (VIM) is concluded that RPSM is easy to perform and yields very accurate results.

(pp. 319–332)

Fixed point results in $\alpha - \eta$ -complete metric spaces via w -distances

H. Qawaqneh, H. Alsamir, H. Aydi, M.S. Md Noorani and W. Shatanaw

We introduce the concepts of $(\alpha, \eta, \mathfrak{F}, \psi, \phi, p)$ -rational contractions via w -distances. For such type contractions, we ensure the existence and uniqueness of a fixed point in the setting of $\alpha - \eta$ -complete metric spaces. An example is also given to support our given theorems. Our paper generalizes the work of Lakzian et al. [11] and several related articles in the literature.

(pp. 333–347)

New independent paracompact spaces

Hardi N. Aziz, Halgwrđ M. Darwesh and Adil K. Jabar

The purpose of the present paper is to introduce a new type of paracompactness which is called ω_δ -paracompact and to obtain some results of paracompact spaces, one of which is the image of ω_δ -paracompact is paracompact under ω_δ -continuous surjection which maps ω_δ -open sets onto open set. We give an example shows that this type of paracompact is independent with standard paracompact space.

(pp. 348–356)

On a maximal subgroup of the Conway group Co_3

A.B.M. Basheer, F. Ali and M.L. Alotaibi

This paper is dealing with a split extension group of the form $3^5:(2 \times M_{11})$, which is a maximal subgroup of the Conway simple group Co_3 . We refer to this extension by \overline{G} . We firstly determine the conjugacy classes of \overline{G} using the coset analysis technique. The structures of inertia factor groups were determined through deep investigation on the maximal subgroups of the maximal subgroups of $2 \times M_{11}$. We found the inertia factors to be the groups $2 \times M_{11}$, $A_6 2$ (non-split) and $(S_3 \times S_3):2$. We then determine the Fischer matrices of \overline{G} and apply the Clifford-Fischer theory to compute the ordinary character table of this group. The Fischer matrices of \overline{G} are all integer valued, with sizes ranging from 1 to 4. The full character table of \overline{G} is 37×37 complex valued matrix and is given at the end of this paper.

(pp. 357–372)

Minimal left ideals in semirings

Barbora Batíková, Tomáš Kepka and Petr Němec

Minimal left ideals in semirings are investigated.

(pp. 373–387)

Minimal left ideals in some endomorphism semirings of semilattices

Barbora Batíková, Tomáš Kepka and Petr Němec

Minimal left ideals in some endomorphism semirings of semilattices are investigated.

(pp. 388–402)

On some (p, q) - φ relative Gol'dberg type and (p, q) - φ relative Gol'dberg weak type based growth properties of entire functions of several complex variables

Tanmay Biswas and Ritam Biswas

The primary concern of this paper is to introduce the notion of (p, q) - φ relative Gol'dberg type, (p, q) - φ relative Gol'dberg weak type of entire functions of several complex variables and study some growth properties based upon them. (pp. 403–414)

A note on relative φ -order and relative φ -lower order of entire functions of several complex variables

Tanmay Biswas and Ritam Biswas

In this paper we introduce the notions of relative φ -order and relative φ -lower order of entire functions of several complex variables. We study then some growth properties in connection with relative φ -order and relative φ -lower order of entire functions of several complex variables. (pp. 415–430)

On drift parameter estimation for mean-reversion type nonlinear nonhomogeneous stochastic differential equations

Chao Wei

This paper is concerned with the drift parameter estimation for mean-reversion type nonlinear nonhomogeneous stochastic differential equations. Firstly, the Girsanov transformation is used to simplify the equation because of the expression of the drift coefficient. Secondly, we find a closed interval on which the likelihood function is continuous and does not attain the maximum at two endpoints of this interval. Then, we prove that the maximum likelihood estimator exists in the interval when the sample size is large enough. Finally, the strong consistency of the estimator and the asymptotic normality of the error of estimation are proved. (pp. 431–438)

A hybrid DESA-MOLP method for finding most preferred solution

Marzieh Moradi Daleni

Data Envelopment Scenario Analysis (DESA) commonly discussed past performance and Multiple Objective Linear Programming (MOLP) well known to plan for future performance goals. The aim of our study is showing an equivalence relation between MOLP and DESA model with using a direction distance function designed to account for desirable and undesirable inputs and outputs together with uncontrollable variables. In addition, we will use the DESA model because in this model we can see decrease all inputs and increases all outputs and estimate one problem instead of n problems. This equivalence model can be effectively used to support interactive processes and performance measures designed to establish future performance goals while taking into account the preferences of decision makers (DMs). In particular, it allows DMs to consider different efficiency improvement strategies when subject to budgetary restrictions. In this context, we tried to solve IDESA models with interactive STOM procedure. The STOM method is the responsible method, because it can estimate any efficient solution, and it indicates Most Preferred Solution (MPS).

(pp. 439–448)

Prime-valent one-regular graphs of order $8p$

De-Xue Li

A graph is *one-regular* and *arc-transitive* if its automorphism group acts on its arcs regularly and transitively, respectively. In this paper, we classify one-regular graphs of prime valency and order $8p$ for each prime p . By analyzing the structure of the full automorphism group of such graphs and using the classification of arc-transitive graphs of order $2p$, we prove that there are only two infinite families of such graphs: one is the cycle C_{8p} with valency 2, the other is the \mathbb{Z}_p -cover CQ_p of hypercube Q_3 with valency 3 and $3|(p-1)$.

(pp. 449–453)

Prime-valent one-regular graphs of order $16p$

De-Xue Li

A graph is *one-regular* and *arc-transitive* if its automorphism group acts on its arcs regularly and transitively, respectively. In this paper, we classify one-regular graphs of prime valency and order $16p$ for each prime p . By analyzing the structure of the full automorphism group of such graphs and using the classification of arc-transitive graphs of order $2p$, we prove that there are only two infinite families of such graphs: one is the cycle C_{16p} with valency 2, the

other is the \mathbb{Z}_p -cover CF_{16p} of Möbius-Kantor graph F_{16} with valency 3 and $6|(p-1)$.

(pp. 454–459)

Visualization of cordial graph in human excretion track

S.J. Aravindan, D. Sasikala and A. Divya

The quantitative research study of this paper is to show the relationship between cordial graphic topological space and its uses in the blood circulation of the human kidney.

(pp. 460–469)

Stochastic optimal control model practices in development, finance and the industrial production

Youcef Djenaihi

The systems mainly study in this work are dynamic to know, It have unfold all the time, besides are ask by the EDS of ITO and sometimes called models of diffusions. The basic source is the white noise, and since the systems are dynamic, the proposed decision (controls) are based on available information from controllers, it must also change over time.

(pp. 470–482)

Orbit-maximal green sequences and general-maximal green sequences

Diana Ahmad and Fang Li

In this paper we introduce the orbit-maximal green sequences for a skew symmetrizable matrix and set the relation between orbit-maximal green sequences and the maximal green sequences of its folding matrix. We also generalize the concept of maximal green sequences, that is, the so-called general-maximal green sequence and define the red size of this generalization.

(pp. 483–498)

Integral inequalities of Hermite-Hadamard type for (α, s) -convex and (α, s, m) -convex functions

B.-Y. Xi, D.-D. Gao and F. Qi

In the paper, the authors introduce the concepts “ (α, s) -convex function” and “ (α, s, m) -convex function” and establish some new integral inequalities of the Hermite-Hadamard type for (α, s) -convex and (α, s, m) -convex functions in terms of the classical Euler beta, gamma, and polygamma functions.

(pp. 499-510)

Robust non-negative matrix factorization for subspace learning

Xiangguang Dai, Yingyin Tao, Wei Zhang and Yuming Feng

Conventional non-negative matrix factorization methods fail to cluster due to many noisy data. Therefore, this paper proposes a novel non-negative matrix factorization method to learn a robust subspace from the noisy space. Considering matrix completion and non-negative matrix factorization, the proposed method can recover the contaminated data and learn a low-dimensional effective subspace. Experiments on the ORL face dataset with Salt & Pepper noise show that our proposed method is effective and robust.

(pp. 511–520)

Convolution conditions for q -Sakaguchi-Janowski type functions

H. Shamsan, S. Latha and B.A. Frasin

In this paper, we derived convolution conditions for Sakaguchi-Janowski type functions. Those results contains some interesting corollaries as special cases.

(pp. 521–529)

Characterization of 1-uniform dcsL graphs and learning graphs

Germina K. Augusthy, Gency Joseph and L. Benedict Michael Raj

A distance compatible set labeling (dcsL) of a connected graph G is an injective set assignment $f : V(G) \rightarrow 2^X$, X being a non empty ground set, such that the corresponding induced function $f^\oplus : E(G) \rightarrow 2^X \setminus \{\emptyset\}$ given by $f^\oplus(u, v) = f(u) \oplus f(v)$ satisfies $|f^\oplus(u, v)| = k_{(u,v)}^f d_G(u, v)$ for every pair of distinct vertices $u, v \in V(G)$, where $d_G(u, v)$ denotes the path distance between u and v and $k_{(u,v)}^f$ is a constant, not necessarily an integer, depending on the pair of vertices u, v chosen. A dcsL f of G is k -uniform if all the constants of

proportionality with respect to f are equal to k , and if G admits such a dcsl then G is called a k -uniform dcsl graph. Let \mathcal{F} be a family of subsets of a set X . A graph G is defined to be a learning graph, if it is a \mathcal{F} -induced graph of some learning space \mathcal{F} . In this paper, we characterize 1-uniform dcsl learning graphs and discuss the embedding problems.

(pp. 530–537)

Solutions of nonlinear equations to describe physical models in plasma

G.M. Gharib

In this article, the solutions of the models that describe the behavior of one of the physical generators in plasma were obtained using soliton solutions. The behavior of ions and electrons in the plasma, and their relationship to the magnetic field, was demonstrated using the Korteweg–de Vries (KDV) equation and analyzed for its dispersion of the solitons obtained from the KDV equation solutions.

(pp. 538–546)

Integral inequalities of Hermite-Hadamard type for extended (s, m) -GA- ε -convex functions

H.-P. Yin, J.-Y. Wang and B.-N. Guo

In the paper, by introducing the concept of (s, m) -GA- ε -functions and using Hölder's integral inequality, the authors develop several new integral inequalities of the Hermite-Hadamard type for extended (s, m) - ε -GA-convex functions.

(pp. 547–557)

On N_c -continuous functions

Haider Jebur Ali

In this research we introduce new types of c -continuous functions by using N -open sets, also we submit some other kinds of functions by using the same sets such as N^* -open and N^{**} -open functions, we discuss the relation between them. And we show the relation between some types of normal spaces. We support our work by some facts and examples.

(pp. 558–566)

More accurate Young, Heinz-Heron mean and Heinz inequalities for scalar and matrix

Hongliang Zuo and Fazhen Jiang

In this paper, we mainly give some refinements of Heinz mean-Heron mean inequality $F_{\alpha(v)}(a, b) \geq H_v(a, b)$ where $\alpha(v) = 1 - 4(v - v^2)$. More precisely, interpolation between them are established motivated by refinements of Young inequality. The matrix versions of these inequalities are also obtained in the last part.

(pp. 567–575)

Polynomial form fuzzy numbers and their application in linear programming with fuzzy variables

J. Tayyebi and E. Hosseinzadeh

In this paper, a special class of fuzzy numbers, whose members are called polynomial form fuzzy numbers, is considered. Some properties of its members are presented. Furthermore, linear programming problems with 2-degree polynomial form fuzzy variables are studied. A method using a linear ranking function is proposed to solve the problem. The method generalizes the known methods based on linear ranking functions to solve linear programming problems with trapezoidal variables. To illustrate the method, a transportation problem with fuzzy values of the demands and the supplies is solved and the obtained results are discussed.

(pp. 576–588)

Certain types of functions by using supra $\hat{\omega}$ -open sets

Nadia Kadum Humadi and Haider Jebur Ali

The target of this research is to present and discuss some kinds of functions in the supra spaces and some of their strongest and weakest forms, and we will introduce the relation between these forms for each type. The results that we reached will be supported by proofs and examples.

(pp. 589–601)

Hesitant fuzzy soft sets over UP-algebras by means of anti-type

Phakawat Mosrijai and Aiyared Iampan

This paper aims to extend the concept of anti-type of hesitant fuzzy sets on UP-algebras to anti-type of hesitant fuzzy soft sets over UP-algebras by merging the concept of anti-type of hesitant fuzzy sets and soft sets. Further, we discuss the concepts of anti-hesitant fuzzy soft strongly UP-ideals, anti-hesitant fuzzy soft UP-ideals, anti-hesitant fuzzy soft UP-filters, and anti-hesitant fuzzy soft UP-subalgebras of UP-algebras and provide some properties.

(pp. 602–620)

Nonexistence results of global solutions for fractional order integral equations and systems

Bouguetof Khaoula, Haouam Kamel and Rebiai Belgacem

The main objective of this study is to demonstrate the absence of the nontrivial global solutions of some fractional evolution integral equations and systems. We show that the critical exponent of Fujita type coincides with that obtained by S. Fuqin and S. Peihu in the classical case.

(pp. 621–631)

Further properties of Hurwitz series rings and Hurwitz polynomials rings

Hani Kawariq and Hassan Al-Ezeh

For a commutative ring with unity R , a commutative ring is defined called the ring of Hurwitz series, HR . As a subring of this ring, HR , the ring of Hurwitz polynomials is defined, hR . In this paper, we characterize pure ideals in the ring hR . Then we characterize when the ring hR is an almost PP -ring and a PF -ring. Finally, for the ring R satisfying $x^n = x$ for a fixed positive integer n , we prove that every prime ideal of the rings $HR(hR)$ is maximal and so their spectrum is completely characterized.

(pp. 632–638)

On the power of simulation map for almost \mathbb{Z} -contraction in \mathcal{G} -metric space with applications to the solution of the integral equation

Manoj Kumar, Sahil Arora and Sanjay Mishra

In this manuscript, we explore the presence and uniqueness of a fixed point of almost \mathbb{Z} -contraction by means of simulation map in the framework of \mathcal{G} -metric spaces. Also, an illustrative example and an application to solve integral equation are given to help accessibility of the got outcomes.

(pp. 639–648)

A note on dimensions in N-groups

S. Bhavanari, S. Prasad Kuncham, V. Rao Paruchuri and M. Bhavanari

The concepts essential and finite dimension played an important role in the development of the dimension theory of modules over rings. Finite dimension, essential, strictly essential, and some related concepts were studied in nearrings and N-groups by Reddy-Satyanarayana [11], Satyanarayana [14, 20], Satyanarayana-Syam Prasad [22, 23, 24, 25]. In this paper, the authors introduced the concept finite 1-dimension and studied the relationship between finite dimension and finite 1-dimension. Some related examples are also provided.

(pp. 649–657)

Different characterizations of a game-theoretical solution and its application on sports management

Hui-Chuan Wei, Ai-Tzu Li, Wei-Ni Wang and Yu-Hsien Liao

In this paper, we firstly propose some axiomatic results of a game-theoretical solution, and further investigate the relations among these game-theoretical results and the field of sports management. The main investigation methods are as follows. Different from the pre-existing results, we provide different axioms and reduction to characterize of a game-theoretical solution. By applying some rules of management sciences in the real-world, we assign several reinterpretations to these axioms and related game-theoretical results. Finally, these axioms and related game-theoretical results are applied to the framework of sports management.

(pp. 658–668)

Asymptotic behavior of conformable fractional impulsive partial differential equations

K. Logarasi and V. Sadhasivam

In this article, we discuss the asymptotic behavior of conformable fractional impulsive partial differential equations. Some new sufficient conditions possessing a prescribed asymptotic behavior at infinity are derived by using riccati transform and impulsive differential inequalities. Our results extend a number of results reported in the literature. An example is also given to illustrate the validity of our results.

(pp. 669–681)

On Roman domination stability in some simple graphs

Mehdi Amraee and Mohammad Maghasedi

The Roman domination stability of a graph G , denoted by $st_{\gamma R}(G)$, is the minimum number of vertices whose removal changes the Roman domination number of G . In this paper, we continue the study of this concept, and determine the Roman domination stability of some classes of graphs, including paths, cycles, complete bipartite graphs and some Cartesian products of paths and complete graphs.

(pp. 682–686)

Ordered hypervector spaces

Gh. Mahdavi, A. Behzadi and A. Taghavi

In this paper, we first introduce the concept of ordered hypervector spaces, then we present several examples to better explain the introduced concepts. we finally prove that although ordered hypervector spaces do not necessarily satisfy the antisymmetric condition, the positive weak linear functionals on cofinal weak subhypervector spaces can be extended to the whole weak hypervector space.

(pp. 687–697)

Duality of St -closed submodules and semi-extending modules

Muna Abbas Ahmed

The main goal of this paper is to dualize the two concepts St -closed submodule and semi-extending module which were given by Ahmed and Abbas in 2015. These dualizations are called CSt -closed submodule and cosemi-extending module. Many important properties of these dualizations are investigated, as well as some others useful results which mentioned by those authors are dualized. Furthermore, the relationships of cosemi-extending and other related modules are considered.

(pp. 698–713)

Computation of edge metric dimension of barycentric subdivision of Cayley graphs

Z. Saleem Mufti, M. Faisal Nadeem, Ali Ahmad and Zaheer Ahmad

Let $G = (V, E)$ be a connected graph, let $x \in V(G)$ be a vertex and $e = yz \in E(G)$ be an edge. The distance between the vertex x and the edge e is given by $d_G(x, e) = \min\{d_G(x, y), d_G(x, z)\}$. A vertex $t \in V(G)$ distinguishes two edges $e, f \in E(G)$ if $d_G(t, e) \neq d_G(t, f)$. A set $R \subseteq V(G)$ is an edge metric generator for G if every two edges of G are distinguished by some vertex of R . The minimum cardinality of R is called the edge metric dimension and is denoted by $edim(G)$. In this paper, we compute the edge metric dimension of barycentric subdivision of Cayley graphs $Cay(\mathbb{Z}_n \oplus \mathbb{Z}_2)$.

(pp. 714–722)

Ordered LA-groups and ideals in ordered LA-semigroups

N. Kausar, M. Munir, M. Gulzar, M. Alesemi and Salahuddin

Kehayopulu et. al [7], have established a relation between the ideals in ordered semigroups and ordered groups. In this study, we extend these notions for a class of non-associative and non-commutative algebraic structures.

(pp. 723–730)

Ideals in LA-rings

N. Kausar, M. Munir, B. Ul Islam, M. Alesemi, Salahuddin and M. Gulzar

Our aim is to encourage research and maturity of associative algebraic structures by studying a class of non-associative and non-commutative algebraic structures (LA-ring).

(pp. 731–744)

Fuzzy bi-ideals in LA-rings

N. Kausar, M. Munir, B. Ul Islam, M. Alesemi, Salahuddin and M. Gulzar

In this paper, we give the characterizations of different classes of LA-ring in terms of fuzzy left (resp. right, bi-, generalized bi-, $(1, 2)$ -) ideals.

(pp. 745–763)

Characterizations of new open and closed mappings in topological spaces

MD. Hanif Page and V.T. Hosamath

In this paper we present θ -semigeneralized pre-open maps, θ -semigeneralized pre-closed maps, pre- θ -semigeneralized pre-open maps, pre- θ -semigeneralized pre-closed maps by employing θ -sgp-closed sets. We also introduce higher separation axioms θ -semigeneralized pre-regular spaces and θ -semigeneralized pre-normal spaces using θ -sgp-closed sets in topological spaces and we investigate some new characterizations of these mappings and higher separation axioms.

(pp. 764–774)

New separation axioms in binary soft topological spaces

P.G. Patil and Nagashree N. Bhat

The concept of binary soft topological spaces defined on two universal sets and a parameter set was initiated by Benchalli et al. [2]. In the present paper, new separation axioms in binary soft topological spaces are introduced and their properties, characterizations are studied. Further, the interrelationship between these new binary soft topological spaces are investigated.

(pp. 775–783)

On the $(2 + 2)$ -Einstein warped product manifolds with f -curvature-base

Alexander Pigazzini

We study the $(2 + 2)$ -Einstein warped product manifolds, where the scalar curvature of the Base is a multiple of the warping function, and we called this condition (inside a warped product manifold) f -curvature-Base (R_{f_B}). The aim of this paper is to check if there are Base-manifolds with non-flat metrics that satisfy this condition, and this was done in cases where M and Fiber-manifold are not both non-Ricci-flat. As a results of our cases we find that the “ f -curvature-Base” is equivalent to requesting a flat metric on the Base-manifold.

(pp. 784–790)

[Boundedness in a nonlinear gradient chemotaxis model with logistic source](#)

Xiaofei Yang, Qingshan Zhang and Wanyu Wu

This paper deals with a nonlinear gradient chemotaxis system with logistic source motivated by the model of tumor lymphangiogenesis in a smooth bounded domain $\Omega \subset \mathbb{R}^n$. By using the iterative method and the test-function argument, we prove that the problem possesses a unique global solution which is uniformly bounded.

(pp. 791–799)

[Laplace transform of the product of two functions](#)

Rami Alahmad

In this paper, we prove many propositions of Laplace transform. In particular, we prove that the Laplace transform of product of two functions, under certain conditions, satisfies

$$\mathcal{L}_s(f(t)h(t)) = \int_s^\infty (\mathcal{L}^{-1}h)(\xi - s)(\mathcal{L}f)(\xi)d\xi = \int_0^\infty (\mathcal{L}^{-1}h)(\xi)(\mathcal{L}f)(\xi + s)d\xi.$$

Then we find interesting relation between the Laplace of the product of two functions and their convolution. Also, using these results, we prove a generalized result that the Laplace transform of the convolution of two function is the product of their Laplace transforms. Finally, we find particular solutions of integral, differential and difference equations as application for these results.

(pp. 800–804)

[Numerical blow-up time and growth rate of a reaction-diffusion equation](#)

Maan A. Rasheed and Faez N. Ghaffoori

This paper is concerned with the numerical blow-up solutions of a homogeneous Dirichlet problem for a semilinear heat equation with a nonlinear reaction term, defined in one dimensional-space. Namely, we compute the approximate blow-up time and the blow-up growth rate constant for a numerical experiment of this problem by using a finite difference method. The numerical results confirm and support the known theoretical blow-up results.

(pp. 805–813)

Edge-to-vertex and edge-to-edge D -distances

Varma P.L.N., Reddy Babu and T. Nageswara Rao

In a (simple and connected) graph G , the concept of distance is one of the important concept. Earlier we introduced the concept of D -distance between vertices of a graph.

In this article we study edge-to-vertex and edge-to-edge distances w.r.t. D -distance. We obtain relation between their eccentrics and also determine centers of some graphs. We prove the relation between the edge-to-vertex and edge-to-edge D -eccentricities w.r.t. D -distance. We also prove that for any graph G either $C_2^D(G) \subseteq C_3^D(G)$ or $C_3^D(G) \subseteq C_2^D(G)$.

(pp. 814–820)

Hyers-Ulam stability of second order difference equations

R. Murali, A. Ponmana Selvan and D.I. Asuntha Rani

In this paper, we study the Hyers-Ulam stability and Hyers-Ulam-Rassias stability of the homogeneous and non-homogeneous linear difference equations of second order with constant co-efficients by applying Z -Transforms method.

(pp. 821–835)

Schur convexity of the dual form of complete symmetric function involving exponent parameter

Huan-Nan Shi and Shan-He Wu

In this paper, we generalize the dual form of complete symmetric function by introducing an exponent parameter, we also study the Schur-convexity, Schur-geometric convexity and Schur-harmonic convexity of this class of functions. As applications, we establish three new inequalities, which are associated with the arithmetic mean, geometric mean and harmonic mean.

(pp. 836–845)

Testing the equality of two covariance matrices for non-normal high-dimensional data

Jieqiong Shen

This paper focuses on testing the equality of two high-dimensional covariance matrices without the normality assumption. Two new test statistics are proposed by taking the ratio between the unbiased and consistent estimators of the trace of the covariance matrices. Under some mild assumptions, the proposed test statistics are proved to be asymptotically normal. Furthermore, numerical simulations demonstrate that the proposed tests have good size and power with varying dimensions and sample sizes.

(pp. 846–858)

Some common fixed point theorems for four maps in fuzzy metric-like spaces using α - ϕ and β - φ -fuzzy contractions

Satish Shukla and Rajinder Sharma

In this paper, some fixed point theorems for α - ϕ -fuzzy contractive and β - ψ -fuzzy contractive mappings in fuzzy metric-like spaces are proved. The results of this paper generalize, unify and improve the recent results of Shukla and Abbas [12] and Gopal and Vetro [7]. Some examples are provided which justify the importance of the results and notions introduced herein.

(pp. 859–878)

On orbit reflexive tuple of operators and weak orbit reflexivity

Abdelaziz Tajmouati and Youness Zahouan

In this paper we give a various conditions for which the tuple $\mathcal{T} = (T_1, T_2, \dots, T_n)$ of commuting bounded linear operators on an infinite dimensional (real, complex) Banach space X is orbit reflexive. After we introduce the notion of weak orbit reflexive operator and we show some results.

(pp. 879–886)

Numerical solution of fractional order differential equation with different methods

Ting Zhang

Various motion phenomena in natural environment and engineering is regular, but it is often impossible to describe them accurately with linear theory, which promotes the development of nonlinear theory. Nonlinear differential equation is one of them. Solving equations is an important part of theory. In this study, the exponential function expansion method, the first integral method and the wavelet operator matrix algorithm were introduced firstly. Then the steps of the three methods were explained. Finally, the concrete equations were solved by the three methods respectively. The fractional order STO equation was solved by the exponential function expansion method and the fractional order cahn-allen equation was solved by the first integral method. The wavelet operator matrix algorithm was used to solve the fractional order differential equations. The results showed that the exponential function expansion method could obtain the exact solution of STO smoothly and easily, but the amount of calculation was determined by the equilibrium principle. The first integral method could obtain the exact solution of cahn-allen equation smoothly and effectively, and there were many kinds of exact solutions when m was equal to 1. The wavelet operator matrix algorithm could get the exact solution easily and quickly, and with the increase of the value of m' , the absolute error between the numerical solution and the exact solution decreased.

(pp. 887–900)

Secure communication applications of the Chinese remainder theorem

Wei Wang, Peng Xi Yang and Yao Xing

In this paper, we extend the Chinese remainder theorem in the number theory to several applications: (1) Lagrange interpolation formula is proved to be an extension of the Chinese remainder theorem in the polynomial ring. (2) By applying The Chinese Remainder Theorem in distributive lattice, a communication scheme is proposed. (3) Adjusting and combing the Chinese remainder theorem with RSA public-key cryptosystem, a dynamic secure communication on identity is proposed.

(pp. 901–910)

Ideal theory on bounded semihoops

Hai Ling Niu, Xiao Long Xing and Jun Tao Wang

In this paper, we investigate some types of ideals on bounded semihoops. First, we introduce the notion of ideals on bounded semihoops and give some characterizations of ideals on bounded semihoops. Furthermore, we study primary ideals, prime ideals and maximal ideals. We discuss some relations between these ideals. In particular, every primary ideal is a prime ideal on bounded semihoops with $x^2 = x$. Also, we introduce the concept of perfect ideals and find that every perfect ideal is a primary ideal. In addition, we prove that I is a perfect ideal if and only if A/I is a perfect semihoop. Moreover, we introduce the notion of local semihoops. We characterize some equivalent conditions of local semihoops. In fact, A/I is local if and only if I is a primary ideal. Finally, we define the concept of locally finite, and show that I is a maximal ideal if and only if A/I is locally finite.

(pp. 911–925)

Design of university fixed assets file management system and its security mechanism

Yang Yang

In the 21st century, the rapid development of economy in China promotes the development of higher education. The expansion of university enrollment and school scale increases the number and type of fixed assets in colleges and universities, which generates large pressure on fixed assets management in colleges and universities. Therefore, a stable and reliable fixed assets files informatization management system is needed to help universities and colleges to solve the management problems.

A university fixed assets file management system was designed from the perspective of informatization management of fixed assets. Firstly the functional structure of the system was designed, and the technical structure of the system was constructed using JavaEE tool and MVC structure. Then system logic model was established using Unified Modeling Language (UML) tool, and relevant database was set up to support the system. Security mechanism was introduced in the aspects of concept, physical security, network security and database security.

Finally the university fixed assets file management system was developed, and its functions and performance were tested. The results demonstrated that the system had stable performance and normal log-in and functions. Hence it was a relatively perfect fixed assets file management system, which can solve a series problems of university fixed assets file management and provide assistance for university fixed assets file management.

(pp. 926–937)

The maximal hyperrings of quotients

Hasret Yazarli, Damla Yılmaz and Bijan Davvaz

We show that the maximal quotient hyperring $Q_{mr}(R)$ of a semiprime hyperring R can be obtained in a similar way to a maximal quotient ring. In this regard we introduce and study some basic notions of hyperrings such as dense hyperideal, essential hyperideal, singular hyperideal and prove some results satisfying them. Finally, we show that if R is a semiprime hyperring and $Q = Q_{mr}(R)$, then Q is regular (in the sense of von Neumann) if and only if R has a zero right singular hyperideal.

(pp. 938–951)

Study on the optimization selection of cross-border E-commerce logistics distribution path under the O2O mode

Yingkai Wang

The rapid development of cross-border e-commerce in online to offline (O2O) mode has brought more opportunities and challenges to the development of logistics industry. Aviation logistics is the most important way of cross-border logistics, the optimization of which plays an important role in e-commerce enterprises and logistics enterprises. This study studied the types of aircraft and the arrangement of air routes in the process of aviation logistics. The route optimization of passenger cabin and full cargo transportation was discussed respectively. A model was established and the optimization method was designed. Finally example analysis was performed. The results showed the designed method could achieve the maximum profit and the optimization of distribution routes. This study provides some references for the optimization of logistics distribution of cross-border e-commerce and is beneficial to the further development of the cross-border e-commerce logistics industry.

(pp. 952–964)

Falling fuzzy hyper deductive systems of hyper residuated lattices

Yongwei Yang, Kunyun Zhu and Xiaoyun Cheng

This paper introduces and applies the notion of fuzzy hyper deductive systems of hyper residuated lattices as a generalization of the notion of fuzzy deductive systems. It considers hyper deductive systems of hyper residuated lattices, and the relationship between hyper deductive systems and fuzzy hyper deductive systems. Several properties and characterizations of fuzzy hyper deductive systems are given. Based on the falling shadow theory, we establish a theoretical approach by means of exploring the relationships between hyper residuated

lattices and probability spaces, and tend to ascertain a falling fuzzy hyper deductive system of a hyper residuated lattice as a generalization of a fuzzy hyper deductive system. We also show some conditions for a falling fuzzy hyper deductive system to be a falling fuzzy hyper implicative deductive system.

(pp. 965–985)

Robust sparse coding for subspace learning

Xiangguang Dai, Yingyin Tao, Jiang Xiong and Yuming Feng

Conventional sparse coding fails to learn a robust subspace when the data is corrupted by noises or outliers. To remedy this problem, matrix completion is considered into sparse coding to recover the corrupted data by the normal data and the robust sparse representations can be learned from the recovered data and the normal data. Therefore, a robust sparse coding method, called RSC, is proposed to learn a low-dimensional subspace from the corrupted data. Experiments are carried out on the image dataset which is contaminated by noises or outliers. It is demonstrated that our proposed RSC is more effective and robust in subspace learning and image clustering than other dimensionality reduction methods.

(pp. 986–994)

Exponential stabilization of semi-linear wave equation

Abdessamad El Alami and Rabie Zine

In this article, we establish the stabilization of a class of second order semi-linear hyperbolic systems obtained by nonlinear feedback using the observability of the corresponding uncontrollable systems. We obtain the well-posedness of the semi-linear system by standard argument of Ball ([3]), Our technique of proof relies on an appropriate decomposition of the solution, and the energy method. Our result generalizes an earlier one by Haraux [5] who studied the same type of problem for linear systems, and by Louis Tebou [9] for de case of semi-linear systems. Application of our result are provided.

(pp. 995–1002)

More on some generalized soft mappings in soft topological spaces

Sabir Hussain

In this paper, we continue to study the properties of soft pu-semi-continuous and soft pu-semi-open(closed) functions[7] and initiate the notions of soft pu-irresolute function, soft pre-semi-open(closed) functions and explore it properties. Moreover, we develop the characterization, which gives us the relationship between these mappings.

(pp. 1003–1016)

Estimating loss given default based on time of default

J.J. Jaber, N. Ismail, S. Norafidah Mohd Ramli and B. Albadareen

The Basel II capital structure requires a minimum capital to cover the exposures of credit, market, and operational risks in banks. The Basel Committee gives three methodologies to estimate the required capital; standardized approach, Internal Ratings-Based (IRB) approach, and Advanced IRB approach. The IRB approach is typically favored contrasted with the standard approach because of its higher accuracy and lower capital charges. The loss given default (LGD) is a key parameter in credit risk management. The models are fit to a sample data of credit portfolio obtained from a bank in Jordan for the period of January 2010 until December 2014. The best parametric models are selected using several goodness-of-fit criteria. The results show that LGD fitted with Gamma distribution. After that, the financial variables as a covariate that affect on two parameters in Gamma regression will find.

(pp. 1017–1032)

Closed linear transformations of complex space-time endowed with Euclidean or Lorentz metric

E. Vossos, S. Vossos and Ch. G. Massouros

Linear transformations (LTs) are essential for the development of Relativity Theory. Special Relativity is based on Lorentz Boost (LB). This cancels the transitive attribute in parallelism (which is equivalent to the 5th Euclidean Postulate), when three observers are related (successive transformations), because LB is not closed LT. So, LB is combined with Euclidean spatial rotation, in order to obtain Lorentz transformation (which is closed LT) and the corresponding Lorentz group. In this paper, a new closed isometric LT in spaces (V^4) of dimension four ($n = 4$), with Euclidean or Lorentz metric (Minkowski Space), is presented (correlating frames with parallel spatial axes). This LT is represented by a matrix (A_B) containing real and imaginary numbers. Thus, V^4 is based on

the field of complex numbers (C), by using real 0-(temporal) and complex 1, 2, 3- (spatial) coordinates.

(pp. 1033–1053)

On periodicities in cluster algebras

Fang Li and Siyang Liu

The aim of this paper is to study periodicities in cluster algebras. Firstly, we give a proof of Restriction and Extension Theorem for cluster algebras without coefficients. Then, we show that the periodicity of a labeled seed with coefficients from an arbitrary semifield depends only on the corresponding extended exchange matrix, which implies the independence of periodicity relative to coefficients.

(pp. 1054–1065)

Logarithm and space BMO

František Mošna

Functions with bounded mean oscillation create so called BMO space or John Nirenberg space. They have considerable applications in differential equations theory and harmonic analysis. Logarithm presents an important example of function which belongs to this space BMO but which is not bounded. The norm of this function can be obtained by simple means of infinitesimal calculus. The calculations of it can be viewed as a suitable contribution to the teaching/learning of functional analysis.

(pp. 1066–1074)