8th International Conference on Intuitionistic Fuzzy Sets and Contemporary Mathematics

June 16-19, 2022
Mersin, TURKEY

IFSCOM-2022

Abstract Book

EDITORS

Assoc. Prof. Abdullah ALAZEMI
Kuwait University, KUWAIT

Assoc. Prof. Gökhan ÇUVALCIOĞLU
Mersin University, TURKEY

Dr. Feride TUĞRUL
Kahramanmaraş Sütçü İmam University, TURKEY

PREFACE

Dear Conference Participants,

Welcome to the *Eighth International Conference on Intuitionistic Fuzzy Sets and Contemporary Mathematics* (**IFSCOM-2022**). The aim of our conference is to bring together significant mathematician researchers with different mathematical interests from all over the world. This conference is one of the leading international conferences for presenting novel and fundamental advances in different fields of Mathematics. We want to offer a suitable environment where researchers can exchange ideas, discuss their recent research findings, and collaborate to produce new different ideas. We are pleased to have exceptional researchers in different areas including Algebra, Analysis, Applied Mathematics, Geometry, Graph Theory, Multi-Valued Mathematics, Topology, Statistics, and other fields related to engineering sciences and educational sciences, which are common fields of Mathematics.

It is also the aim of the conference that young researchers and graduate students engage in such exceptional event. Their inputs and participation in such event should encourage them to do more research activities in the future.

We would like to thank all participating scientists who made the most important contribution to this conference. Their contributions are the key ingredient to the success of the conference.
We are sincerely grateful to all participants who really value our work and efforts that we develop every year to improve this conference. We are so proud to reach this respected level of success. Indeed, this was not possible without the outstanding work, efforts and supports from the members of the conference team: Scientific Committee Members, Referee Committee Members and Local Organizing Committee Members.

We are very pleased to present the abstracts of the 8th International Conference on IFS and Contemporary Mathematics **IFSCOM-2022**. The conference was completed with **126** participants and **143** papers. The distribution of research papers delivered by the participants are classified by the following fields: Applied Mathematics (33), Algebra (29), Geometry (17), Topology (16), Analysis (14) Statistics (6) and other fields (23) such as Financial Mathematics, Fuzzy Sets, Game Theory, Geometric Computer Aided Design, Graph Theory, Intuitionistic Fuzzy, Machine Learning and Mathematical Modeling.

Ten invited speakers attended the conference to share information about current studies in different fields with our participants. We have 126 participants participated from 19 countries: Algeria, Australia, Azerbaijan, Bulgaria, France, Greece, India, Indonesia, Kazakhstan, Kuwait, Kyrgyzstan, Mexico, Morocco, North Macedonia, Oman, Russia, Serbia, South Africa and Turkey.

This abstract booklet contains the titles and abstracts of all presented talks during the conference. Many submitted articles to this conference are considered in the following listed journals and books:

Journals:
- Journal of Universal Mathematics (JUM)
- Notes on Intuitionistic Fuzzy Sets (Notes on IFS)
- Sakarya University Journal of Science

Books:
- IFSCOM2022 Abstract Book with an ISBN number
- IFSCOM2022 Proceeding Book with an ISBN number
- SPRINGER Book

We wish that all participants participate in all sessions, ask questions and be active in the conference. We also wish that this conference is a great place where you meet new friends, gain some knowledge, and get yourself involved in some research collaborations.

CHAIRMEN

Assoc. Prof. Abdullah ALAZEMI   Assoc. Prof. Gökhan ÇUVALCIOĞLU

June 2022

INVITED SPEAKERS

Oscar Castillo (MX)
Madhumangal Pal (IN)
Şükran Konca (TR)
Milica Andelic (KW)
Poonam Sharma (IN)
Murat Güzeltepe (TR)
Sakander Hayat (PK)
Krassimir T. Atanassov (BG)
Hanlar Reşidoğlu (TR)
Carlos M. da Fonseca (KW)

SCIENTIFIC COMMITTEE

Bijan Davvaz (IR),
Carlos M. da Fonseca (KW)
Ekrem Kadıoğlu (TR),
Evadokia Sotirova (BG),
Hamza Menken (TR),
Hüseyin Yıldırım (TR),
Janusz Kacprzyk (PL),
Krassimir Atanassov(BG),
Latif Hanna (KW),
Lois Aime Fono (CM),
Madhumangal Pal (IN),
Mehmet Çitil (TR),
Mehmet Küçükaslan (TR),
M`hamed Elomari (MA),
Milica Andelic (KW)
Murat Güzeltepe (TR),
Kyriakos Papadopoulos (KW)
Oscar Castillo (MX),
Panagiotis Chountas (UK),
Piotr Nowak (PL),
Paramajit Kumar (IN),
Said Melliani (MA),
Sotir Sotirov (BG),
Şehmus FINDIK (TR)
Şükran Konca (TR)
Taekyun Kim (KR),
Vassia Atanassova (BG)

REFEREE COMMITTEE

Abdullah Alazemi,
Krassimir T. Atanassov ,
Oscar Castillo,
Gökhan Çuvalcıoğlu,
Latif Hanna,
Sakander Hayat,
Ekrem Kadıoğlu,
Mehmet Küçükaslan,
Said Melliani,
Madhumangal Pal,
Kyriakos Papadopoulos,
Hanlar Reşidoğlu,
Sotir Sotirov,
Hüseyin Yıldırım

LOCAL ORGANIZING COMMITTEE

Feride Tuğrul
Arif Bal
Nihal İnce
Dilara Gündoğdu
Cansu Altıncı

CONTENTS

ON HARMONIC AND RANDIĆ INDICES

HAVVA KIRGIZ AND AYŞE DILEK MADEN

0000-0003-0985-024X and 0000-0001-7717-0241

ABSTRACT

One of the much studied topological index is Randić index. Randić defined it in 1975 as

$$R\left(G\right) = \sum_{ij \in E(G)} \frac{1}{\sqrt{d_i d_j}}.$$

A special case of the Randić index gives Harmonic index defined by Fajtlowicz in 1987. The harmonic index of G can be given as in the following:

$$H\left(G\right) = \sum_{ij \in E(G)} \frac{2}{d_i + d_j}.$$

These two topological indices have many applications in theoretical chemistry. In this study, we give new bounds for harmonic index and Randić index with graph invariants depending on the number of edges, maximum degree, number of pendent vertices, and number of non-pendent edges.

References

[1] M. Randic, Characterization of molecular branching, Journal of the American Chemical Society, 97(23), 6609–6615, (1975).

[2] S. Fajtlowicz, On conjectures of graffiti-ii, Congr. Numer, 60, 187–197, (1987).

[3] L. Zhong, The harmonic index for graphs, Applied mathematics letters, 25(3), 561-566, (2012).

[4] J. M. Rodrıguez, J. M. Sigarreta, New results on the harmonic index and its generalizations, MATCH Commun. Math. Comput. Chem, 78(2), 387-404, (2017).

[5] J. Li, W. C. Shiu, The harmonic index of a graph, The Rocky Mountain Journal of Mathematics, 44(5), 1607-1620, (2014).

---

[6] J. C. Hernández-Gómez, J. A. Méndez-Bermúdez, J. M. Rodríguez, J.M. Sigarreta, Harmonic index and harmonic polynomial on graph operations, Symmetry, 10(10), 456, (2018).

[7] Z. Du, A. Jahanbai, S. M. Sheikholeslami, Relationships between Randic index and other topological indices, Communications in Combinatorics and Optimization, 6(1), 137-154, (2021).

[8] H. Deng, S. Balachandran, S. Elumalai, Some tight bounds for the harmonic index and the variation of the Randić index of graphs, Discrete Mathematics, 342(7), 2060-2065, (2019).

[9] C. Dalfó, On the Randić index of graphs, Discrete Mathematics, 342(10), 2792-2796, (2019).

Department of Mathematics, Selçuk University, Faculty of Science, Konya, Turkey
Email address: kirgizhavva@gmail.com

Department of Mathematics, Selçuk University, Faculty of Science, Konya, Turkey
Email address: aysedilekmaden@selcuk.edu.tr

A GROUP-LIKE STRUCTURE ON INTUITIONISTIC FUZZY CLOSURE SPACES

SIBEL DEMIRALP

0000-0002-3977-587X

ABSTRACT

Algebraic topology is a branch of science that facilitates topological problems by making them algebraic. Homotopy theory is one of the main topics of algebraic topology. The H-group (Hopf group) is defined as the generalization of the group with the aid of homotopy. An H-group is a group-like structure with homotopic associative multiplication, homotopy inverse, and homotopy identity. In this study, the H-group structure is built on intuitionistic fuzzy closure spaces, which is a generalization of the intuitionistic fuzzy topological space.

References

[1] M. Citil, G. Cuvalcıoglu, On intuitionistic fuzzy homotopy theory, NIFS 2, 31-36, (2014).

[2] D. Çoker, An introduction to intuitionistic fuzzy topological spaces, Fuzzy sets and systems, 88(1), 81-89, (1997).

[3] A. M. Zahran, M. A. Abd-Allah, K. El-Saady, A. Ghareeb, Sum Intuitionistic Fuzzy Closure Spaces, Journal of Mathematics (ISSN 1016-2526), 40, 71-81, (2008).

[4] S. E. Abbas, Intuitionistic supra fuzzy topological spaces, Chaos, Solitons and Fractals, 21(5), 1205-1214 (2004).

[5] A. Hatcher, H-spaces and Hopf Algebras, Algebraic Topology, Cambridge University Press, Cambridge, New York, (2001).

Department of Mathematics, Faculty of , Kastamonu, Turkey
Email address: sdemiralp@kastamonu.edu.tr

ON INNER AUTOMORPHISMS OF LIE SUBALGEBRAS

NAZAR ŞAHİN ÖĞÜŞLÜ

0000-0001-7407-9178

ABSTRACT

Let L be the relatively free Lie algebra of finite rank over a field of characteristic zero. In this study, we examine the inner automorphism group of the subalgebra of L induced by the symmetric group.

References

[1] Ş. Fındık, N.Ş. Öğüşlü, Palindromes in the free metabelian Lie algebras, Internat. J. Algebra Comput., 29(5), 885-891, (2019).

[2] M.C. Wolf, Symmetric functions of non-commutative elements, Duke Math. J., 2(4), 626-637, (1936).

Department of Mathematics, Çukurova University, Adana, Turkey

Email address: noguslu@cu.edu.tr

ON THE RELATIONS BETWEEN SOME TRUNCATED CATALAN SOLIDS AND THE METRIC GEOMETRIES

ZEYNEP CAN

0000-0003-2656-5555

ABSTRACT

Minkowski geometry is a non-Euclidean geometry in a finite number of dimensions with the same linear structure of the Euclidean one but the distance is not uniform in all directions [1]. Changing the distance function gives rise to chance topics related to distance, for instance instead of the usual sphere in Euclidean space, unit ball is a general convex set. By the studies on metric space geometry is has seen that some metrics and convex polyhedra are closely related [2], [3], [4], [5], [6]. In this paper we introduce some new metrics whose unit balls to be some truncated catalan solids.

ACKNOWLEDGEMENTS

REFERENCES

[1] A.C. Thompson, Minkowski Geometry, Cambridge University Press, Cambridge, (1996).

[2] P. Cromwell. Polyhedra, Cambridge University Press, (1999).

[3] Z. Can, Ö. Gelişgen, R. Kaya, On the Metrics Induced by Icosidodecahedron and Rhombic Triacontahedron, Scientific and Professional Journal of the Croatian Society for Geometry and Graphics (KoG), 19, 17-23, (2015).

[4] Ö. Gelişgen, T. Ermis, I. Gunaltılı, A Note About The Metrics Induced by Truncated Dodecahedron And Truncated Icosahedron, International Journal of Geometry, 6(2), 5-16, (2017).

---

[5] Ö. Gelişgen, Z. Can, On The Family of Metrics for Some Platonic and Archimedean Polyhedra,
     Konuralp Journal of Mathematics, 4(2), 25-33, (2016).

[6] Ö. Gelişgen, Z. Çolak, A Family of Metrics for Some Polyhedra, Automation Computers
     Applied Mathematics Scientific Journal, 24(1), 3-15, (2015).

Department of Mathematics, Faculty of Science and Letters, Aksaray, Türkiye
    Email address: zeynepcan@aksaray.edu.tr

A FINITE DIFFERENCE METHOD FOR THE SINGULARLY PERTURBED FREDHOLM INTEGRO-DIFFERENTIAL EQUATION

MUHAMMET ENES DURMAZ

0000-0002-6216-1032

ABSTRACT

In the present study, the boundary-value problem for a linear second-order singularly perturbed Fredholm integro-differential equation has been considered. By using interpolation quadrature rules and an exponential basis function, a difference scheme has been constructed with an accuracy of $O\left(N^{-2}\ln N\right)$ on a special non-uniform mesh. The difference scheme is demonstrated to be stable and convergent in the discrete maximum norm. A numerical example is presented to demonstrate the efficiency of the proposed method.

REFERENCES

[1] G. M. Amiraliyev, M. E. Durmaz, M. Kudu, A numerical method for a second order singularly perturbed Fredholm integro-differential equation, Miskolc Mathematical Notes, 22(1), 37-48, (2022).

[2] J. Chen, M. He, Y. Huang, A fast multiscale Galerkin method for solving second order linear Fredholm integro-differential equation with Dirichlet boundary conditions, Journal of Computational and Applied Mathematics, 364, 112352, (2020).

[3] M. K. Kadalbajoo, V. Gupta, A brief survey on numerical methods for solving singularly perturbed problems, Applied Mathematics and Computation, 217(8), 3641-3716, (2010).

[4] H. G. Roos, M. Stynes, L. Tobiska, Numerical methods for singularly perturbed differential equations, Springer, Berlin, (1996).

DEPARTMENT OF INFORMATION TECHNOLOGY, KIRKLARELI UNIVERSITY, KIRKLARELI, TURKEY
Email address: menesdurmaz025@gmail.com

A GENERAL FACTOR THEOREM ON MATRIX SUMMABILITY

BAĞDAGÜL KARTAL

0000-0001-6223-0838

ABSTRACT

This article is devoted to the absolute summability of the series $\sum a_n \lambda_n X_n$. The known theorem of Sulaiman [1], which deals with $|A|_k$ summability, is generalized. The sufficient conditions for the $\varphi - | A, \beta; \delta |_k$ summability of the series $\sum a_n \lambda_n X_n$ are established.

REFERENCES

[1] W.T. Sulaiman, Some new factor theorem for absolute summability, Demonstratio Math., 46(1), 149-156, (2013).

[2] H.S. Özarslan, B. Kartal, On the general method of summability. J. Math. Anal., 9(4), 36-43, (2018).

[3] N. Tanović-Miller, On strong summability, Glasnik Mat. Ser. III, 14(34), 87-97, (1979).

[4] A. Karakaş, A new factor theorem for generalized absolute Riesz summability, Carpathian Math. Publ., 11(2), 345-349, (2019).

[5] B. Kartal, On an extension of absolute summability, Konuralp J. Math., 7(2), 433-437, (2019).

[6] B. Kartal, A theorem on absolute summability of infinite series, Cumhuriyet Sci. J.,40(3), 563-569, (2019).

[7] H.S. Özarslan, A new factor theorem for absolute matrix summability, Quaest. Math., 42(6), 803-809, (2019).

[8] H.S. Özarslan, An application of absolute matrix summability using almost increasing and δ-quasi-monotone sequences, Kyungpook Math. J., 59(2), 233-240, (2019).

[9] H. Bor, A new study on generalized absolute Cesàro summability methods, Quaest. Math., 43(10), 1429-1434, (2020).

---

[10] H. Bor, R.P. Agarwal, A new application of almost increasing sequences to factored infinite series, Anal. Math. Phys., 10(3), Paper No. 26, 7 pp. (2020).

[11] H.S. Özarslan, B. Kartal, Absolute matrix summability via almost increasing sequence, Quaest. Math., 43(10), 1477-1485, (2020).

[12] H. Bor, A new factor theorem on generalized absolute Cesàro summability, Quaest. Math., 44(5), 653-658, (2021).

[13] B. Kartal, An extension of a theorem on Cesàro summability, Numer. Funct. Anal. Optim., 42(4), 474-479, (2021).

[14] B. Kartal, An application of almost increasing sequences, Russ. Math.,65, 14-17, (2021).

[15] H.S. Özarslan, Generalized almost increasing sequences, Lobachevskii J. Math., 42(1), 167-172, (2021).

[16] H.S. Özarslan, On the generalized absolute Cesàro summability methods, Russ. Math., 65, 29-33, (2021).

[17] H.S. Özarslan, M.Ö. Şakar, A new application of (ϕ, δ)-monotone sequences, Russ. Math., 3, 38-43, (2022).

[18] B. Kartal, Factors for generalized matrix summability, Erc. Unv. J. Inst. Sci and Tech., 37(3), 461-467, (2021).

DEPARTMENT OF MATHEMATICS, ERCIYES UNIVERSITY, 38039 KAYSERI, TURKEY
Email address: bagdagulkartal@erciyes.edu.tr

SOLVABILITY OF A NONLINEAR THREE-DIMENSIONAL SYSTEM OF DIFFERENCE EQUATIONS WITH CONSTANT COEFFICIENTS

MERVE KARA AND YASIN YAZLIK

0000-0001-8081-0254 and 0000-0001-6369-540X

ABSTRACT

In this paper, we show that the following three-dimensional system of difference equations

$$x_{n+1} = \frac{y_n x_{n-2}}{ax_{n-2} + bz_{n-1}}, \ y_{n+1} = \frac{z_n y_{n-2}}{cy_{n-2} + dx_{n-1}}, \ z_{n+1} = \frac{x_n z_{n-2}}{ez_{n-2} + fy_{n-1}}, \ n \in \mathbb{N}_0,$$

where the parameters a, b, c, d, e, f and the initial values $x_{-i}, y_{-i}, z_{-i}, \ i \in \{0, 1, 2\}$, are complex numbers, can be solved, extending further some results in literature. Also, we determine the forbidden set of the initial values by using the obtained formulas. Finally, an application concerning a three-dimensional system of difference equations are given.

References

[1] R. Abo-Zeid, H. Kamal, Global behavior of two rational third order difference equations, Universal Journal of Mathematics and Applications, 2(4), 212-217, (2019).

[2] A. M. Alotaibi, M. S. M. Noorani, M. A. El-Moneam, On the solutions of a system of third-order rational difference equations, Discrete Dynamics in Nature and Society, 2018, 1-11, (2018).

[3] E. M. Elsayed, A. M. Ahmed, Dynamics of a three-dimensional systems of rational difference equations, Mathematical Methods in The Applied Sciences, 39(5), 1026-1038, (2016).

[4] M. Kara, Y. Yazlik, On a solvable three-dimensional system of difference equations, Filomat, 34(4), 1167-1186, (2020).

[5] A. Sanbo, E. M. Elsayed, Analytical study of a system of difference equation, Asian Research Journal of Mathematics, 14(1), 1-18, (2019).

[6] S. Stević, Representation of solutions of bilinear difference equations in terms of generalized Fibonacci sequences, Electronic Journal of Qualitative Theory of Differential Equations, 2014(67), 1-15, (2014).

[7] S. Stević, On a two-dimensional solvable system of difference equations. Electronic Journal of Qualitative Theory of Differential Equations, 2018(104), 1-18, (2018).

[8] N. Taskara, D. T. Tollu, Y. Yazlik, Solutions of rational difference system of order three in terms of Padovan numbers, Journal of Advanced Research in Applied Mathematics, 7(3), 18-29, (2015).

[9] D. T. Tollu, Y. Yazlik, N. Taskara, On fourteen solvable systems of difference equations. Applied Mathematics and Computation, 233, 310-319, (2014).

[10] N. Touafek, E. M. Elsayed, On a second order rational systems of difference equations, Hokkaido Mathematical Journal, 44(1), 29-45, (2015).

[11] Y. Yazlik, M. Kara, On a solvable system of difference equations of higher-order with period two coefficients, Communications Faculty of Sciences University of Ankara Series A1 Mathematics and Statistics, 68(2), 1675-1693, (2019).

Department of Mathematics, Kamil Ozdag Science Faculty, Karaman, Turkey
Email address: mervekara@kmu.edu.tr

Department of Mathematics, Faculty of Science and Art, Nevsehir, Turkey
Email address: yyazlik@nevsehir.edu.tr

SOLVABILITY OF A SYSTEM OF NON-LINEAR DIFFERENCE EQUATIONS OF HIGHER-ORDER

MERVE KARA

0000-0001-8081-0254

ABSTRACT

In this study, we show that system of non-linear difference equations with constant coefficients can be solved in explicit form by using the convenient transformation. Moreover, periodicity of solutions of aforementioned system of difference equations is investigated. Finally, we give numerical examples to support our results.

References

[1] E. M. Elabbasy, S. M. Eleissawy, Qualitative properties for a higher order rational difference equation, Fasciculi Mathematici, 50, 33-50, (2013).

[2] E.M. Elsayed, Expression and behavior of the solutions of some rational recursive sequences, Mathematical Methods in the Applied Science, 39(18), 5682-5694, (2016).

[3] Y. Halim, N. Touafek, Y. Yazlik, Dynamic behavior of a second-order nonlinear rational difference equation, Turkish Journal Mathematics, 39(6), 1004-1018, (2015).

[4] M. Kara, Y. Yazlik, Solvability of a system of nonlinear difference equations of higher order, Turkish Journal of Mathematics, 43(3), 1533-1565, (2019).

[5] M. Kara, Y. Yazlik, D.T. Tollu, Solvability of a system of higher order nonlinear difference equations, Hacettepe Journal of Mathematics and Statistics, 49(5), 1566-1593, (2020).

[6] M. Kara, Y. Yazlik, On a solvable three-dimensional system of difference equations, Filomat, 34(4), 1167-1186, (2020).

[7] M. Kara, Y. Yazlik, On a solvable system of non-linear difference equations with variable coefficients, Journal of Science and Arts, 1(54), 145-162, (2021).

[8] S. Stević, J. Diblík, B. Iričanin, Z. Šmarda, Solvability of nonlinear difference equations of fourth order, Electronic Journal of Differential Equations, 2014(264), 1-14, (2014).

---

[9] Y. Yazlik, M. Kara, On a solvable system of difference equations of higher-order with period two coefficients, Communications Faculty of Sciences University of Ankara Series A1 Mathematics and Statistics, 68(2), 1675-1693, (2019).

Department of Mathematics, Kamil Ozdag Science Faculty, Karaman, Turkey
Email address: mervekara@kmu.edu.tr

A SCHRÖDER POLYNOMIAL SOLUTION TO NONLINEAR MICRO-ELECTROMECHANICAL OSCILLATOR EQUATION

ÖMÜR KIVANÇ KÜRKÇÜ

0000-0002-3987-7171

ABSTRACT

This study is dedicated to solving a quadratic nonlinear differential equation arising in the micro-electromechanical oscillator model by means of the matrix-colllocation method based on the Schröder polynomial. The method essentially generates a fundamental matrix equation made up of the matrix expansions of the linear and nonlinear terms of the model using the collocation points. With the elimination of this equation along with the initial conditions, the desired numerical solution is immediately obtained. For sake of overseeing the efficiency and precision of the method, some obtained solutions are differently established according to an excitation parameter. To do this, numerical and graphical instruments are included. Upon investigation of the outcomes, one can admit that the method is very proper to handle the model in question.

REFERENCES

[1] D. Jordan, P. Smith, Nonlinear Ordinary Differential Equations: An Introduction for Scientists and Engineers, Oxford University press, New York, (2007).

[2] Ö.K. Kürkçü, E. Aslan, M. Sezer, A numerical method for solving some model problems arising in science and convergence analysis based on residual function, Applied Numerical Mathematics, 121, 134-148, (2017).

[3] Ö.K. Kürkçü, A reduced computational matrix approach with convergence estimation for solving model differential equations involving specific nonlinearities of quartic type, Turkish Journal of Mathematics, 44, 223–239, (2020).

[4] J.-H. He, P.S. Skrzypacz, Y. Zhang, J. Pang, Approximate periodic solutions to microelectromechanical system oscillator subject to magnetostatic excitation, Mathematical Methods in

---

the Applied Sciences, 1-8, (2020).

[5] G. Hetyei, Shifted Jacobi polynomials and Delannoy numbers, Arxiv preprint, arXiv:0909.5512v2, (2009).

Konya Technical University, Department of Engineering Basic Sciences, 42250, Konya, Turkey

Email address, Ömür Kıvanç Kürkçü: `omurkivanc@outlook.com`

TZITZEICA CURVES ACCORDING TO ALTERNATIVE MOVING FRAME

İLKAY GÜVEN, BEYHAN YILMAZ, AND AYKUT HAS

0000-0002-5302-6074, 0000-0002-5091-3487 and 0000-0003-0658-9365

ABSTRACT

In this present study, we introduce the Tzitzeica curves from a different point. These curves have been studied before in many different dimensions and many different spaces. The difference of this study is to describe these curves using an alternative moving frame in Euclidean 3−space. We called these special curves, with which we are defined with the help of this alternative moving frame, alternative Tzitzeica curves.

References

[1] G. Tzitzeica, Sur Certaines Courbes Gauches, Ann. de l'Ec. Normale Sup., 28, 9-32, (1911).

[2] N.V. Bila, M. Eni, Particular solutions to the Tzitzeica curve equation, (2012).

[3] M. Crasmareanu, Cylindrical Tzitzeica curves implies forced harmonic oscillators, Balkan J. Geom. Appl., 7(1), 37-42, (2002).

[4] M.K. Karacan, B. Bükcü, On the elliptic cylindrical tzitzeica curves in Minkowski 3-space, Sci. Manga, 5, 44-48, (2009).

[5] O. Constantinescu and M. Crasmareanu, A new Tzitzeica hypersurface and cubic Finslerian metrics of Berwald type, Balkan J. Geom. Appl., 16(2), 27-34, (2011).

[6] A.F. Agnew, A. Bobe, W.G. Boskoff, B.D. Suceava, Tzitzeica curves and surfaces, The Mathematica Journal, 12, 1-18, (2010).

[7] B. Bayram, E. Tunç, K. Arslan, G. Öztürk, On Tzitzeica curves in Euclidean 3-space $\mathbb{E}^3$, 33(3), 409-416, (2018).

---

[8] D.J. Struik, Lectures on classical differential geometry (Massachusetts), Addison-Wesley Publishing company, Inc, (1961).

[9] H.H. Hacısalihoğlu, Diferensiyel Geometri, Inönü üniversitesi Fen Edebiyat Fakültesi Yayınları, (1983).

[10] B. Uzunoğlu, İ. Gök and Y. Yaylı, A new approach on curves of constant precession, Applied Mathematics and Computation 275, 317-323, (2016).

[11] A. Gray, Modern differential geometry of curves and surface, CRS Press, Inc, (1993).

Gaziantep University, Department of Mathematics, Gaziantep, Turkey
   Email address: iarslan@gantep.edu.tr

Kahramanmaraş Sütçü İmam University, Department of Mathematics, Kahramanmaraş, Turkey
   Email address: beyhanyilmaz@ksu.edu.tr

Kahramanmaraş Sütçü İmam University, Department of Mathematics, Kahramanmaraş, Turkey
   Email address: ahas@ksu.edu.tr

INVESTIGATION OF FRACTIONAL ORDER GENESIO-TESI SYSTEM USING LAPLACE TRANSFORMATION

ZAFER BEKIRYAZICI*, SULEYMAN SENGUL, AND MEHMET MERDAN

0000-0001-5671-9995, 0000-0002-0359-4137 and 0000-0002-8509-3044

ABSTRACT

In this paper the fractional-order Genesio-Tesi chaotic system is investigated with Laplace transformation method. Genesio-Tesi system is a three-dimensional equation system with quadratic nonlinearity and is frequently used for exemplifying chaotic systems. In this study, Caputo fractional derivative is used to obtain the fractional system and Laplace transformation is applied in order to analyze the explicit solutions of the system.

References

[1] R. Genesio, A. Tesi, Harmonic balance methods for the analysis of chaotic dynamics in nonlinear systems, Automatica, 28(3), 531-548, (1992).

[2] T. Tanriverdi, H.M. Baskonus, A.A. Mahmud, K.A. Muhamad, Explicit solution of fractional order atmosphere-soil-land plant carbon cycle system, Ecological Complexity, 48, 100966, (2021).

[3] A. Gokdogan, M. Merdan, A. Yildirim, The modified algorithm for the differential transform method to solution of Genesio systems, Communications in Nonlinear Science and Numerical Simulation, 17(1), 45-51, (2012).

[4] M. Merdan, Z. Bekiryazici, Local fractional derivative operators method for solving nonlinear gas dynamic equation of fractional order, International Journal of Pure and Applied Mathematics, 119(3), 501-517, (2018).

[5] M. Caputo, M. Fabrizio, A new definition of fractional derivative without singular kernel, Progress in Fractional Differentiation & Applications, 1(2), 73-85, (2015).

[6] I. Podlubny, Fractional differential equations, Academic Press, (1998).

Department of Mathematics, Recep Tayyip Erdogan University, Rize, Turkey
Email address: zafer.bekiryazici@erdogan.edu.tr

Department of Mathematics, Recep Tayyip Erdogan University, Rize, Turkey
Email address: suleyman.sengul@erdogan.edu.tr

Department of Mathematical Engineering, Gumushane University, Gumushane, Turkey
Email address: mmerdan@gumushane.edu.tr

STOCHASTIC DYNAMICS OF THE NOVEL CORONAVIRUS TRANSMISSION CONSIDERING ASYMPTOMATIC CASES

ZAFER BEKIRYAZICI* AND AYHAN ONEN

0000-0001-5671-9995 and 0000-0001-5748-7161

ABSTRACT

In this study, the stochastic dynamics of COVID-19 spread are analyzed. The spread of the novel coronavirus that began in late 2019 became a pandemic and claimed millions of lives worldwide. Numerous modeling studies have been conducted on this disease. In this study, an existing deterministic equation system that contains compartments for symptomatic and asymptomatic cases is used to obtain a stochastic model containing multiplicative stochastic noise. Stochastic Euler-Maruyama and Milstein schemes are used to analyze the model. Results are compared with the deterministic findings to interpret the volatility in the transmission dynamics.

References

[1] P.E. Kloeden, E. Platen, Numerical Solution of Stochastic Differential Equations, Springer, (1992).

[2] M. Merdan, Z. Bekiryazici, T. Kesemen, T. Khaniyev, Comparison of stochastic and random models for bacterial resistance, Advances in Difference Equations, 2017, 133, (2017).

[3] World Health Organization, WHO Coronavirus Dashboard (https://covid19.who.int/), Access Date: June 2, 2022, (2022).

[4] I. Ahmed, G.U. Modu, A. Yusuf, P. Kumam, I. Yusuf, A mathematical model of Coronavirus Disease (COVID-19) containing asymptomatic and symptomatic classes, Results in physics, 21, 103776, (2021).

[5] G. Hussain, T. Khan, A. Khan, M. Inc, G. Zaman, K.S. Nisar, A. Akgül, Modeling the dynamics of novel coronavirus (COVID-19) via stochastic epidemic model, Alexandria Engineering

---

Journal, 60(4), 4121-4130, (2021).

Department of Mathematics, Recep Tayyip Erdogan University, Rize, Turkey
Email address: `zafer.bekiryazici@erdogan.edu.tr`

Department of Mathematics, Recep Tayyip Erdogan University, Rize, Turkey
Email address: `ayhanonen08@gmail.com`

CERTAIN RESULTS ON YAMABE SOLITONS

HALİL İBRAHİM YOLDAŞ

0000-0002-3238-6484

ABSTRACT

During the last few years, there has been a rising interest in the study of solitons in Riemannian geometry and mathematical physics. In the present work, we investigate Yamabe solitons, which are a special and important class of solitons, and we find several interesting results about such solitons.

References

[1] E. Barbosa, E. Ribeiro, On conformal solutions of the Yamabe flow, Archiv der Mathematik, (101), 79-89, (2013).

[2] A. M. Blaga, C. Özgür, Almost η-Ricci and almost η-Yamabe solitons with torse-forming vector field, Quaes. Math. 1-21, (2020).

[3] B.-Y. Chen, S. Deshmukh, Yamabe and quasi-Yamabe solitons on Euclidean submanifolds, Mediterranean Journal of Mathematics, 15, 194, (2018).

[4] R. S. Hamilton, The Ricci flow on surfaces, Mathematics and general relativity (Santa Cruz, CA, 1986), Contemp. Math. A.M.S., 71, 237-262, (1988).

[5] H. İ. Yoldaş, Ş. E. Meriç, E. Yaşar, Some Characterizations of α-Cosymplectic Manifolds Admitting Yamabe Solitons, Palestine Journal of Mathematics, 10 (1), 234-241, (2021).

Department of Management Information Systems, Faculty of Business, Adana, Turkey
Email address: hibrahimyoldas@gmail.com

A NEW CLASS OF AUTOMORPHISMS OF LIE ALGEBRAS

ELA AYDIN

0000-0003-4867-0583

ABSTRACT

Let L be the finitely generated free metabelian nilpotent Lie algebra over a field of characteristic zero. We give some new results on pointwise inner automorphisms of the Lie algebra L.

References

[1] G. Endimioni, Pointwise inner automorphisms in a free nilpotent group, Quarterly Journal of Mathematics, 53(4), 397-402, (2002).

[2] Ş. Fındık, Normal and normally outer automorphisms of free metabelian nilpotent Lie algebras, Serdica Mathematical Journal, 35(2), 171-210, (2010).

Department of Mathematics, Çukurova University, Adana, Turkey
Email address: eaydin@cu.edu.tr

GENERALIZATIONS OF INNER AUTOMORPHISMS OF RELATIVELY FREE LIE ALGEBRAS

ŞEHMUS FINDIK

0000-0001-5717-4413

ABSTRACT

In this talk, we examine various automorphisms of relatively free Lie algebras, which are induced by inner automorphisms. We also provide a simple proof of the fact that every central automorphism of the free metabelian Lie algebra of finite rank over a field of characteristic zero is inner.

References

[1] R.M. Bryant, V. Drensky, Dense subgroups of the automorphism groups of free algebras, Canad. J. Math., 45, 1135-1154, (1993).

[2] Ş. Fındık, Normal and normally outer automorphisms of free metabelian nilpotent Lie algebras, Serdica Mathematical Journal, 35(2), 171-210, (2010).

Department of Mathematics, Çukurova University, Adana, Turkey
Email address: sfindik@cu.edu.tr

SYMMETRIC POLYNOMIALS OF LIE GENERALIZATIONS

ŞEHMUS FINDIK

0000-0001-5717-4413

ABSTRACT

Let F be a free algebra generated by $x_1, \ldots, x_n$. A polynomial $p \in F$ is called symmetric if $p(x_1, \ldots, x_n) = p(x_{\mu 1}, \ldots, x_{\mu n})$ for any $\mu \in S_n$. We give generators of the algebra of symmetric polynomials in F, when F is a generalization of the free Lie algebra generated by $x_1, \ldots, x_n$.

REFERENCES

[1] R. Dangovski, V. Drensky, Ş. Fındık, Weitzenböck derivations of free metabelian Lie algebras, Linear Algebra Appl., 439(10), 3279-3296, (2013).

[2] J. Khoury, A Groebner basis approach to solve a conjecture of Nowicki, J. Symbolic Comput. 43, 908-922, (2008).

Department of Mathematics, Çukurova University, Adana, Turkey
Email address: sfindik@cu.edu.tr

ON BAKER-CAMPBELL-HAUSDORFF FORMULA

ŞEHMUS FINDIK

0000-0001-5717-4413

ABSTRACT

Let A be an associative or nonassociative algebra over a field of characteristic zero. Baker-Campbell-Hausdorff formula gives the expression of z for the equation $\exp(x)\exp(y) = \exp(z)$. We examine some algebras where $z \in A$ when $x, y \in A$.

References

[1] V. Drensky, Ş. Fındık, Inner and outer automorphisms of free metabelian nilpotent Lie algebras. Communications in Algebra, 40(12), 4389-4403, (2012).

[2] Ş. Fındık, O. Kelekci, Hausdorff series in a semigroup ring. International Journal of Algebra and Computation, 30(04), 853-859, (2020).

Department of Mathematics, Çukurova University, Adana, Turkey
Email address: sfindik@cu.edu.tr

SYMMETRIC POLYNOMIALS OF RELATIVELY FREE ASSOCIATIVE ALGEBRAS

ŞEHMUS FINDIK

0000-0001-5717-4413

ABSTRACT

Let N be the nonassociative algebra of rank two and I be its ideal generated by all elements of the form $ab - ba$, where $a, b \in N$. In this talk, we examine the symmetric polynomials of the algebra N/I.

REFERENCES

[1] E. Noether, Der Endlichkeitssatz der Invarianten endlicher Gruppen, Math. Ann. 77, 89-92, (1916).

[2] M.C. Wolf, Symmetric functions of non-commutative elements, Duke Math. J., 2(4), 626-637, (1936).

DEPARTMENT OF MATHEMATICS, ÇUKUROVA UNIVERSITY, ADANA, TURKEY
Email address: **sfindik@cu.edu.tr**

ON INVARIANT THEORY FOR THE POLYNOMIAL ALGEBRA OF RANK 4

ŞEHMUS FINDIK

0000-0001-5717-4413

ABSTRACT

Let P_4 be the polynomial algebra of rank 4 over a field K of characteristic zero. We examine invariant subagebras P_4^G of P_4 and give generators of them for certain subgroups G of the general linear group $GL_4(K)$.

References

[1] D. Hilbert, Mathematische Probleme, G¨ottinger Nachrichten, 253-297, (1900).

[2] G.C. Shephard, J. A. Todd, Finite unitary reflection groups, Can. J. Math., 6, 274-304, (1954).

DEPARTMENT OF MATHEMATICS, ÇUKUROVA UNIVERSITY, ADANA, TURKEY
Email address: sfindik@cu.edu.tr

ON CERTAIN SUBALGEBRAS OF GENERIC MATRIX ALGEBRAS

ŞEHMUS FINDIK

0000-0001-5717-4413

ABSTRACT

In this talk, we handle the free associative algebra generated by two generic matrices and examine its subalgebra of symmetric elements together with the algebra of constants determined by a linear nilpotent derivation consisting of a single Jordan cell.

REFERENCES

[1] V. Drensky, Defining relations for the algebra of invariants of 2×2 matrices, Algebr. Represent. Theory, 6(2), 193-214, (2003).

[2] P. Koshlukov, Finitely based ideals of weak polynomial identities, Commun. Algebra 26(10), 3335-3359, (1998).

Department of Mathematics, Çukurova University, Adana, Turkey
Email address: sfindik@cu.edu.tr

THE ALGEBRA OF CONSTANTS OF LIE ALGEBRAS

ŞEHMUS FINDIK

0000-0001-5717-4413

ABSTRACT

Let L be the free Lie algebra of rank two and d be its linear nilpotent derivation sending the first generator to zero, and the latter to the first generator. We examine the Lie subalgebra L^d of L consisting of constants of d.

References

[1] V. Drensky, Generalized Nowicki conjecture, Proceedings of the American Mathematical Society, 148(9), 3705-3711, (2020).

[2] S. Kuroda, A simple proof of Nowicki's conjecture on the kernel of an elementary derivation, Tokyo J. Math., 32, 247-251, (2009).

Department of Mathematics, Çukurova University, Adana, Turkey
Email address: sfindik@cu.edu.tr

HAUSSDORFF SERIES IN CERTAIN MONOID RINGS

ŞEHMUS FINDIK

0000-0001-5717-4413

ABSTRACT

Let $\mathbb{R}(M)$ be the semigroup ring on the field $\mathbb{R}$ of real numbers. In this talk, we consider finite monoids M of low degrees and compute Haussdorff series in $\mathbb{R}(M)$.

References

[1] L. Gerritzen, Taylor expansion of noncommutative power series with an application to the Hausdorff series, J. Reine Angew. Math., 556, 113-125, (2003).

[2] F. Hausdorff, Die symbolische Exponentialformel in der Gruppentheorie, Bericht Königl. Sächs. Ges. der Wiss. zu Leipzig, Math.-phys. Classe, 58, 19-48, (1906).

Department of Mathematics, Çukurova University, Adana, Turkey
Email address: sfindik@cu.edu.tr

ON δ_ω-CONNECTED SPACES

PINAR ŞAŞMAZ AND MURAD ÖZKOÇ

0000-0002-3383-7128 and 0000-0003-0068-7415

ABSTRACT

The concept of connectedness is one of the most important topics in topology. When we say connected space, the first definition that comes to mind is that the space consists of a single piece according to the given topology, that is, the space is a whole. To recall from the literature, a space that is not written as a union of two or more non-empty discrete open sets is called connected, otherwise unconnected space. For instance, the set of all real numbers with the usual topology is a connected space but a discrete space containing more than one point is not. As known, a connected space is characterized as follows: A space is connected if both open and closed sets of a topological space are only the empty set and the set itself in which the topology is defined. Also, the concept of connectedness is a topological property, and the image of a connected topological space under a continuous function is also connected. Furthermore, many different forms of this concept has been studied by many mathematicians. Connected spaces have important applications in geometry, analysis, topology, and algebraic topology. Like connectedness, many types of the notion of open set in topological spaces play an important role in the general topology as well. In 1937, Stone defined the concept δ-open sets [1], in 1968, Veličko defined θ-open sets [2], in 1982, Hdeib defined the concept ω-open sets [3] and addition in 1981, Clay and Joseph introduced the concept θ-connectedness [4], in 2019, Al-Ghour and El-Issa introduced the concept θ_ω-connectedness [5].

In this study, the concept of δ_ω-connectedness is introduced with the help of the notion of δ_ω-closed set [6] which are stronger than the concept of closed sets in general topology. Many important results related to the notion of δ_ω-connectedness have been obtained. Also, the relationships between δ-connectedness, θ-connectedness and θ_ω-connectedness were examined. Finally, it has been shown that the image of a connected set under a weakly δ_ω-continuous function [7] is δ_ω-connected.

References

[1] M.H. Stone, Applications of the theory of Boolean rings to general topology, Trans. Amer. Math. Soc., 41, 375-381, (1937).

[2] N.V. Veličko, H-closed topological spaces, Amer. Math. Soc. Transl. 78(2), (1968).

[3] H.Z. Hdeib, ω-closed mappings, Rev. Colombiana Mat., 16, 65-78, (1982)

[4] J. Clay, J. Joseph, On a connectivity property induced by the θ-closure operator, Illinois journal of mathematics, 25(2), 267-278, (1981).

[5] S. Al-Ghour, S. El-Issa, θ_ω-connectedness and ω-R_1 properties, Proyecciones (Antofagasta, On line), 38(5), 921-942, (2019).

[6] H.H. Al-Jarrah, A. Al-Rawshdeh, E.M. Al-Saleh and K.Y. Al-Zoubi, Characterizations of $R_\omega O(X)$ sets by using δ_ω-cluster points, Novi. Sad. J. Math., 2, 109-122, (2019).

[7] P. Şaşmaz, M. Özkoç, On the topology of δ_ω-open sets and related topics, Konuralp Jor. Math. (KJM) 10(1), 203-209, (2022).

Muğla Sıtkı Koçman University, Graduate School of Applied and Natural Sciences, Mathematics, 48000 Menteşe-Muğla, Turkey

Email address: pinarsasmaz@posta.mu.edu.tr

Muğla Sıtkı Koçman University, Faculty of Science, Department of Mathematics, 48000 Menteşe-Muğla, Turkey

Email address: murad.ozkoc@mu.edu.tr

ON q,ω-CONVOLUTION AND APPLICATIONS

FATMA HIRA

0000-0003-0724-0704

ABSTRACT

In the previous paper [11], the author presented the q,ω-Laplace transform and its properties and also defined the q,ω-convolution of two functions and proved the q,ω-convolution theorem. In this paper, we deal with the same q,ω-convolution and investigate its other properties and give some examples as applications.

References

[1] F.H. Jackson, On q-definite integrals, Q. J. Pure Appl. Math., 41, 193-203, (1910).

[2] W. Hahn, Ein Beitrag zur Theorie der Orthogonalpolynome, Monatsh. Math., 95, 19-24, (1983).

[3] A. E. Hamza, A. M. Sarhan, E. M. Shehata, K. A. Aldowah, A general quantum difference calculus, Adv. Differ. Equ., vol. 2015, (2015).

[4] S. R. Naik, H.J. Haubold, On the q-Laplace transform and related special functions, Axioms, 5:24, 1-16, (2016).

[5] S.K. Al-Omari, The q-Sumudu transform and its certain properties in a generalized q-calculus theory, Adv. Differ. Equ., 2021, 10 (2021).

[6] E.M. Shehata, R.M. El Zafarani, Aβ-convolution theorem associated with the general quantum difference operator, J. Function Spaces, vol. 2022, (2022).

[7] W.H. Abdi, On certain q-difference equations and q-Laplace transform, Proc. Natl. Acad. Sc. India A, 1-15, (1962).

[8] W.H. Abdi, On q-Laplace transforms, Proc. Natl. Acad. Sci. India, 29, 389-408, (1961).

---

[9] N. Kobachi, On q-Laplace transformation, Research Reports of Kumamoto-NCT., 3, 69-76 (2011).

[10] W.S. Chung, T. Kim, H. In Kwon, On the q-analog of the Laplace transform, Russian Journal of Mathematical Physics, 21:2, 156-168, (2014).

[11] F. Hıra, On q, ω-Laplace transform (under review).

[12] M.H. Annaby, A.E. Hamza, K.A. Aldwoah. Hahn difference operator and associated Jackson-Nörlund integrals, J. Optim. Theory Appl., 154, 133-153, (2012).

DEPARTMENT OF MATHEMATICS, FACULTY OF ARTS AND SCIENCE, ONDOKUZ MAYIS UNIVERSITY, SAMSUN, TURKEY

Email address: fatma.hira@omu.edu.tr

A GEOMETRIC DECOMPOSITION OF CONTINUOUSLY DIFFERENTIABLE VECTOR FIELDS

RĂZVAN MICU TUDORAN

0000-0002-9399-2920

ABSTRACT

The purpose of this talk is to show that given a geometric structure on $\mathbb{R}^n$ (e.g. (pseudo-) Euclidean, Minkowski, symplectic) and a continuously differentiable vector field, we provide a unique global decomposition of the vector field as the sum of a left/right gradient-like vector field (naturally associated to the geometric structure) with potential function vanishing at the origin, and a vector field which is left/right orthogonal to the Euler vector field, with respect to the geometric structure. As application, we provide a criterion to decide topological conjugacy of complete continuously differentiable vector fields on $\mathbb{R}^n$, based on topological conjugacy of the corresponding parts given by the associated geometric decompositions.

References

[1] R.M. Tudoran, A global geometric decomposition of vector fields and applications to topological conjugacy, Acta Appl Math, 166, 111-129, (2020).

Department of Mathematics, Faculty of Mathematics and Computer Science, West University of Timişoara, Timişoara, Romania
    Email address: `razvan.tudoran@e-uvt.ro`

φ-FRACTIONAL DELAYED LANGEVIN EQUATIONS

MUSTAFA AYDIN AND NAZIM MAHMUDOV

0000-0003-0132-9636 and 0000-0003-3943-1732

ABSTRACT

In the real-world problems which are generally various kinds of differential equations, there are two important subjects: modeling and solving the problems. Solving a real-world problem is as important as modeling it and vice versa. Just as every problem can not just be mathematically modeled, every modeled problem can not be solved. This reality increases the importance of solving arbitrary problems. When we have a look at many different solutions to any differential problems, each of them has a key function which is a basic ingredient of the solution. It is called as a fundamental or basic function. It is sometimes of a matrix form depending on the problem. To sum up, the most significant task for solving an arbitrary differential equation is to specify its basic function. Thus far, all of the explanations have been also valid for both traditional differential equations and fractional differential equations which is a generalization of (nonnegative) integer orders, that is, orders can be real or even complex numbers. For example, the basic function is the well-known exponential function e^{at} for the differential equation $x^{'}(t) = ax(t)$, $a, x(t) \in \mathbb{R}$. It can be also expanded to the system $x^{'}(t) = Ax(t)$, $x(t) \in \mathbb{R}^n$, $A \in \mathbb{R}^{n \times n}$. In the literature, the basic function which is also the solution is e^{At}. Mahmudov(1) introduces the quite novel delayed perturbation of Mittag-Leffler type matrix function with two parameters present the representation of a solution to fractional linear delay differential equations by using this matrix function as a basic function. Mahmudov and Aydin(2) investigate the global solution to the nonlinear conformable fractional delay differential equations by firstly proposing conformable delay perturbation of Mittag-Leffler type matrix function and then exploiting it as a fundamental function.

In the late 1800s, Paul Langevin who is a French physicist was able to describe Brownian motion which is the progress of physical phenomena in fluctuant media

---

by expressing Langevin equations. For more complex physical systems, the traditional Langevin equations can not specify properly the systems. Thus, Langevin equations are in the need of a generalization to describe more physical phenomena(3). There is no doubt that one of them is a fractional Langevin type equation. To the best of our knowledge, even though there are a lot of studies on the nonlinear Langevin differential equations having two different fractional-order derivatives which are introduced and investigated, quite a few works on delayed Langevin fractional differential equations exist. In the work(4), an exact analytical solution formula to fractional delayed Langevin equations involving two distinct traditional fractional differentiation in the sense of Riemann-Liouville by proposing delayed Mittag-Leffler type function as a basic function. In the study(5), an explicit closed-formed solution to fractional delayed Langevin equations involving two distinct traditional Caputo fractional derivatives via the same delayed Mittag-Leffler type function given in the work(4)

Inspired by the above-cited papers, we consider the nonlinear Caputo delayed Langevin equations involving two general fractional orders with respect to another function ϕ

$$\begin{cases} \left({}^{C}_{0^+}\mathfrak{D}^{\alpha}_{\phi}x\right)(t) - \eta_2 \left({}^{C}_{0^+}\mathfrak{D}^{\beta}_{\phi}x\right)(t) - \eta_1 x\left(t - h\right) = f\left(t, x(t)\right), \quad t \in (0, T], h > 0, \\ \quad x\left(t\right) = \mu\left(t\right), \quad -h \leq t \leq 0, \end{cases}$$

where ${}^{C}_{0^+}\mathfrak{D}^{\alpha}_{\phi}$ and ${}^{C}_{0^+}\mathfrak{D}^{\beta}_{\phi}$ are Caputo fractional derivatives with respect to another function ϕ, $n-2 < \beta \leq n-1$, $n-1 < \alpha \leq n$, $n \geq 2$ with $\alpha - \beta \geq 1$, $\mu : [-h, 0] \to \mathbb{R}$ is an arbitrary $(n-1)$-times continuously differentiable, and $f : [0, T] \times \mathbb{R} \to \mathbb{R}$ is a nonlinear noise. $\eta_1, \eta_2 \in \mathbb{R}$, $T = lh$, $l \in \mathbb{N}$.

In the available paper, the representation of a closed-formed solution to both linear and inhomogeneous and delayed Langevin equations by proposing the new ϕ-delayed function with the Mittag-Leffler function structure. From this representation, we infer the global solution of the nonlinear version of the fractional delayed Langevin system. We investigate the existence and uniqueness of solutions to the nonlinear version of the fractional delayed Langevin system in addition to making the stability analysis of this system.

REFERENCES

[1] N.I. Mahmudov, Delayed perturbation of Mittag-Leffler functions and their applications to fractional linear delay differential equations, Mathematical Methods in the Applied Sciences, 42, 5489-5497, (2019).

[2] N.I. Mahmudov, M. Aydın, Representation of solutions of nonhomogeneous conformable fractional delay differential equations, Chaos, Solitons and Fractals, 150, 111190, (2021).

[3] R. Klages, G. Radons, I.M. Sokolov, Anomalous Transport: Fundations and Applications, Wiley-VCH, Weinheim, (2008).

[4] N.I. Mahmudov, Fractional Langevin type delay equations with two fractional derivatives, Applied Mathematics Letters, 103, 106215, (2020).

[5] I.T. Huseynov, N.I. Mahmudov, A class of Langevin time-delay differential equations with general fractional orders and their applications to vibration theory, Journal of King Saud University – Science, 33, 01596, (2021).

DEPARTMENT OF MATHEMATICS, FACULTY OF SCIENCE AND LETTERS, ISTANBUL, TURKEY
Email address: mustafaaydin@itu.edu.tr

DEPARTMENT OF MATHEMATICS, FACULTY OF ARTS & SCIENCES, FAMAGUSTA, NORTHERN CYPRUS
Email address: nazim.mahmudov@emu.edu.tr

A CLASS OF IDEALS IN NONCOMMUTATIVE RINGS

ALAA ABOUHALAKA

0000-0002-5818-8064

ABSTRACT

In this talk, we introduce the concept of almost prime (right) ideals in noncommutative rings and provide some equivalent definitions and new results.

REFERENCES

[1] M.S. Bhatwadekar, P. K. Sharma, Unique factorization and brith of almost prime, Comm. Algebra, 33(1), 43-49, (2005).

[2] W.D. Blair, H. Tsutsui, Fully prime rings, Comm. Algebra, 22(13), 5389-5400, (1994).

Department of Mathematics, Çukurova University, Adana, Turkey
Email address: alaa1aclids@gmail.com

WEIGHTED SIMPSON'S INEQUALITIES FOR QUATUM INTEGRALS

ZEYNEP ŞANLI

0000-0002-1564-2634

ABSTRACT

Quantum calculus is the modern type for the examination of calculus without limits. It has recently gained attention due to the high demand for mathematics modeling quantum computing. q-calculus is seen as a link between mathematics and physics. It contains many applications different mathematical fields such as number theory, combinatorics, orthogonal polynomials, basic hypergeometric functions and other sciences quantum theory, mechanics and theory relativity. Quantum calculus has been shown to be a subfield of the more general mathematical field of time scales calculation. In recent years, this subject has been widely studied by many researchers and new results can be found in articles [1, 4, 5, 9, 10].

The following inequality well-known in the literature as Simpson's inequality states that, if $f^{(4)}$ exists and is bounded on (a, b), then

$$(1) \quad \left| \int_a^b f(x)\, dx - \frac{b-a}{3} \left[\frac{f(a) + f(b)}{2} + 2f\left(\frac{a+b}{2}\right) \right] \right| \leq \frac{1}{2880} \left\| f^{(4)} \right\|_\infty (b-a)^4,$$

where

$$\left\| f^{(4)} \right\|_\infty := \sup_{t \in (a,b)} \left| f^{(4)}(t) \right| < +\infty.$$

The main aim of this paper is to obtain the new weighted Simpson-type integral identity defined by the quantum integral operators. Using this equality, definite quantum integral inequalities of Simpson-like type are attained.

REFERENCES

[1] N. Alp , M.Z. Sarıkaya ,A new definition and properties of quantum integral which calls $\overline{q}$-integral, Konuralp J. Math., 5(2), 146-159, (2017).

[2] V. Kac, P. Cheung, Quantum Calculus, Springer (2001).

[3] M. Matłoka,Weighted Simpson type inequalities for h-convex functions, J. Nonlinear Sci. Appl., 10 5570-5780, (2017).

[4] M.A. Noor, K.I. Noor, M.U. Awan, Some quantum estimates for Hermite-Hadamard inequalities, Appl. Math. Comput., 251 675-679, (2015).

[5] M.A. Noor, K.I. Noor, M.U. Awan, Some quantum integral inequalities via preinvex functions, Appl. Math. Comput., 269, 242-251, (2015).

[6] W. Sudsutad, S.K. Ntouyas, T. Tariboon, Quantum integral inequalities for convex functions, J. Math. Inequal., 9(3), 781-793, (2015).

[7] M.Z. Sarıkaya, E. Set, E. Özdemir, On new inequalities of Simpson's type for s–convex functions, Comput. Math. Appl., 60, 2191-2199, (2010).

[8] M. Tunç, E. Gov, S. Balgeçti, Simpson type quantum integral inequalities for convex functions, Miskolc Math. Notes, 19(1), 649-664, (2018).

[9] J. Tariboon, S.K. Ntouyas, Quantum calculus on finite intervals and applications to impulsive difference equations, Adv. Difference Equ., 282, 1-19, (2013).

[10] J. Tariboon, S.K. Ntouyas, Quantum integral inequalities on finite intervals, J. Inequal. Appl., 121, 1-13, (2014).

[11] T. Zhu, P. Wang, T.S. Du, Some estimates on the weighted Simpson like type integral inequalities and their applications, J. Nonlinear Funct. Anal., (2020).

Department of Mathematics, Faculty of Science and Letters , Mersin, Turkey
Email address: zeynepsanli@mersin.edu.tr

A NEW TYPE LORENTZIAN ALMOST PARA CONTACT MANIFOLD

OĞUZHAN BAHADIR

0000-0001-5054-8865

ABSTRACT

The present study initially introduced a new type Lorentzian almost para contact manifold using the generalized symmetric metric connections of type (α, β). Later, some results is given about new type Lorentzian almost para contact manifold.

References

[1] N. S. Agashe, M. R. Chafle, A semi symetric non-metric connection in a Riemannian manifold, Indian J. Pure Appl. Math., 23, 399-409, (1992).

[2] O. Bahadir, Lorentzian para-Sasakian manifold with quartersymmetric non-metric connection, Journal of Dynamical Systems and Geometric Theories, 14(1), 17-33, (2016).

[3] S. K. Chaubey, U. C. De, Characterization of the Lorentzian para-Sasakian manifolds admitting a quarter-symmetric non-metric connection, SUT Journal of Mathematics, 55(1), 53-67, (2019).

[4] S. K. Chaubey, U. C. De, Lorentzian para-Sasakian manifolds admitting a new type of quarter-symmetric non-metric ξ-connection, Int. Electron. J. Geom., 12(2), 250-259,(2019).

[5] S. K. Chaubey, A. Yildiz, Riemannian manifolds admitting a new type of semi-symmetric non-metric connection, Turk J Math., 43, 1887-1904, (2019).

[6] S. K. Chaubey, J. W. Lee, S. Yadav, Riemannian manifolds with a semi-symmetric metric P-connection, J. Korean Math. Soc., 56(4), 1113-1129, (2019).

[7] M. Danish Siddiqi, M. Ahmad, J. P. Ojha, CR-submanifolds of a nearly trans-hyperbolic Sasakian manifold with a semi-symmetric non-metric connection, Afr. Diaspora J. Math. (N.S.), 17, 93-105, (2014).

---

[8] U. C. De, D. Kamilya, Hypersurfaces of Rieamnnian manifold with semi-symmetric non-metric connection, J. Indian Inst. Sci., 75, 707-710, (1995).

[9] U. C. De, A. K. Sengupta, CR-submanifolds of a Lorentzian para-Sasakian manifold, Bull. Malaysian Math. Sci. Soc., 23, , 99-106, (2000).

[10] S. Golab, On semi-symmetric and quarter-symmetric linear connections, Tensor N. S., 29, 249-254, (1975).

[11] A. Haseeb, R. Prasad, η-Ricci solitons on ϵ-LP-Sasakian manifolds with a quarter-symmetric metric connection, Honam Mathematical J., 41(3) , 539–558, (2019).

[12] H. A. Hayden, Subspaces of a space with torsion, London Math. Soc., 34, 27-50, (1932).

[13] S. K. Hui, S. Uddin, C. Ozel, A. A. Mustafa, Warped product submanifolds of LP-Sasakian manifolds, Hindawi Publishing Corporation, Discrete Dynamics in Nature and Society, (2012).

[14] D. H. Jin, Lightlike hypersurfaces of an indefinite Kaehler manifold with a symmetric metric connection of type (l, m), Bull. Korean Math. Soc., 53(4), 1171-1184, (2016).

[15] Y. Liang, On semi-symmetric recurrent-metric connection, Tensor N. S., 55 107-112, (1994),

[16] J. W. Lee, C. W. Lee, D. W. Yoon, Inequalities for generalized δ-Casorati curvatures of submanifolds in real space forms endowed with a semi-symmetric metric connection, Revista De La Union Matematica Argentina , 57(2), 53-62, (2016).

[17] C. W. Lee, J. W. Lee, G. E. Vilcu and D. W. Yoon, Optimal inequalities for the Casorati curvatures of submanifolds of generalized space forms endowed with semi-symmetric metric connections, Bull. Korean Math. Soc., 52(5), 1631-1647, (2015).

[18] K. Matsumoto, On Lorentzian Paracontact manifolds, Bull. Yamagata Univ. Natur. Sci., 12(2) (1989), 151-156.

[19] K. Matsumoto, I. Mihai On a certain transformation in a Lorentzian para Sasakian manifold, Tensor N. S., 47, 189-197, (1988).

[20] I. Mihai, R. Rosca, On Lorentzian P-Sasakian manifolds, Clssical Analysis, World Scientific Publ., 155-169, (1992).

[21] I. Mihai, A. A. Shaikh, U. C. De, On Lorentzian para-Sasakian manifolds, Rendiconti del Seminario Mat. di Messina, Serie II, (1999).

[22] C. Ozgur, M. Ahmad, A. Haseeb, CR-submanifolds of a Lorentzian para-Sasakian manifold with a semi-symmetric metric connection, Hacettepe Journal of Mathematics and Statistics, 39(4), 489-496, (2010).

[23] S. Pahan, B. Pal, A. Bhattacharyya, On Einstein warped products with a quarter-symmetric connection, International Journal of Geometric Methods in Modern Physics, 14,(2017).

[24] S. Pahan, B. Pal, A. Bhattacharyya, On Ricci flat warped products with a quarter-symmetric connection, J. Geom., 107, 627-634, (2016).

[25] Q. Qu, Y. Wang, Multiply warped products with a quarter-symmetric connection, Journal of Mathematical Analysis and Applications, 431(2), 955-987, (2015).

[26] A. A. Shaikh, K. K. Baishya, On Φ-symmetric LP-Sasakian manifolds, Yokohama Mathematical Journal, 52 , 97-112, (2006).

[27] B. G. Schmidt, Conditions on a connection to be a metric connection, Commun. Math. Phys., 29, 55-59, (1973).

[28] M. M. Tripathi, A new connection in a Riemannian manifold, Int. Electron. J. Geom., 1 , 15-24, (2006).

Department of Mathematics, Faculty of Arts and Sciences, Kahramanmaras Sutcu Imam University, Kahramanmaras, TURKEY
    Email address: oguzbaha@gmail.com

THE INVESTIGATION OF DYNAMICS OF A DEFORMED TENT FAMILY

DAMLA AYDOĞDU AND MUSTAFA SALTAN

0000-0001-9801-6374 and 0000-0002-3252-3012

ABSTRACT

Tent map is one of the most important examples of dynamical systems. In this paper, we first define a deformed Tent map on $[0,1]$ by using the construction of the Tent map. Then, we express this map in binary system. Thus, we easily compute the periodic points of this map and investigate whether it is chaotic in the sense of Devaney not. Moreover, we define deformed Tent family and give bifurcation diagram of this family.

References

[1] J. Banks, V. Dragan, Smale's Horseshoe Map Via Ternary Numbers, SIAM, 36(2), 265-271, (1994).

[2] M. Barnsley, Fractals Everywhere, Academic Press, San Diego, CA, USA, (1988).

[3] A. Crannell, The Role of Transitivity in Devaney's Definition of Chaos, The American Mathematical Monthly 102(9), 788-793, (1995).

[4] R.L. Devaney, An Introduction to Chaotic Dynamical Systems, Addison-Wesley Publishing Company, California, USA, (1989).

[5] D. Gulick, Encounters with Chaos and Fractals, Academic Press, Boston, (2012).

Department of Mathematics, Faculty of Science, Eskişehir, Turkey
Email address: damlaozturk61d@gmail.com

Department of Mathematics, Faculty of Science, Eskişehir, Turkey
Email address: mustafasaltan@eskisehir.edu.tr

(ψ, φ)-CONTRACTION ON Δ-SYMMETRIC QUASI-METRIC SPACE

ALİ ÖZTÜRK

0000-0001-6014-9112

ABSTRACT

In this paper, in the setting of Δ-symmetric quasi-metric spaces, we introduce the notion of (ψ, φ)-contraction and we prove a fixed point theorem for (ψ, φ)-contractive mappings.

References

[1] P.D. Proinov, Fixed point theorems for generalized contractive mappings in metric spaces, J. Fixed Point Theory Appl., 22(1), (2020).

[2] B. Alqahtani, A. Fulga, E. Karapinar, Fixed point results on Δ-symmetric quasi-metric space via simulation function with an application to Ulam stability, Mathematics, 6(10), 208, (2018).

[3] E. Karapinar, Roldán-López-de-Hierro, Antonio-Francisco, B. Samet, Matkowski theorems in the context of quasi-metric spaces and consequences on G-metric spaces. An. Stiint. Univ. Ovidius Constanta Ser. Mat. 24(1), 309-333, (2016).

[4] S. Banach, Sur les opérations dans les ensembles abstraits et leur application aux équations intégrales, Fundamenta Mathematicae, 3, 133–181, (1922).

[5] D. W. Boyd, J. S. W. Wong, On nonlinear contractions. Proc. Amer. Math. Soc. 20, 458-464, (1969).

[6] A. El-S. Ahmed, A. Fulga, The Górnicki-Proinov type contraction on quasi-metric spaces. AIMS Math. 6(8), 8815–8834, (2021).

Department of Mathematics, Bolu Abant İzzet Baysal University, 14030, Bolu, Turkey.

Email address: ozturkali@ibu.edu.tr

t−LOWER LEVEL SET AND t−UPPER LEVET SET OF AN INTUITIONISTIC FUZZY SET

ÜMİT DENİZ

0000-0002-9248-2769

ABSTRACT

In this paper we give the definitions of t-lower level set $(L_t(A))$ and t-upper level set $(U_t(A))$ of an Intuitionistic fuzzy set.[1] A t-lower level set is defined by giving a lower boundry on $\mu_A(x) + \nu_A(x)$. A t-upper level set is defined by giving an upper boundry on $\mu_A(x) + \nu_A(x)$. If A is an Intuitionistic fuzzy set of X then $L_t(A)$ and $U_t(A)$ are subsets of X.

In this paper we give some theorems by using t-lower level sets and t-upper level sets and prove them.

References

[1] K.T. Atanassov. Intuitionistic Fuzzy Sets, VII ITKR.s Session, Sofia, June, (1983).

[2] L.A. Zadeh, Fuzzy Sets, Information and Control, 8, 338-353, (1965).

[3] G. Çuvalcıoğlu. Some Properties of Controlled Set Theory, Notes on Intuitionistic Fuzzy Set, 20(2), 37-42, (2014).

[4] F. Tuğrul, M. Çitil, A New Perspective on Evaluation System in Education with Intuitionistic Fuzzy Logic and PROMETHEE Algorithm, Journal of Universal Mathematics, 4(1), 13-24, (2021).

[5] P. K. Sharma, (α, β)-Cut of Intuitionistic Fuzzy Groups, International Mathematical Forum, V.6, 53, 2605-2614, (2011).

[6] G, Cuvalcıoğlu, S. Tarsuslu, New Intuitionistic Fuzzy Level Sets, IFSCOM2016 Proceeding Book, No 1, 73-77 (2016), ISBN:978-975-6900-54-3.

Department of Mathematics, Faculty of Art and Science, Rize, Turkey
Email address: umit.deniz@erdogan.edu.tr

ON THE EVOLUTION OF A PLANE CURVE USING HYPERBOLICAL KINEMATICS

GÜL TUĞ

0000-0001-9453-3809

ABSTRACT

The biological growth of some crustacean bodies is quite complicated issue. One needs to use the local geometry on a generating curve to describe the kinematics of the biological growth. Since there are several complex bodies in nature, it must be chosen a convenient geometry to understand the background mathematics of the growth process. In this paper, we investigate that kind of a biological growth of the surfaces called "accretive growth" by using the hyperbolical kinematics. In the Lorentzian g-plane $\mathbb{R}^{1,1}_{a_1,a_2}$, rotations occur on a hyperbola. Therefore, we obtain surfaces constructed by the evolution of a generating curve trough a hyperbolical growth described by the attached frame, locally. Furthermore, we give some examples and visualizations to support the theoretical results with the help of a symbolic programming language.

REFERENCES

[1] A. Erlich, D. Moulton, A. Goriely, R. Chirat Morphomechanics and Developmental Constraints in the Evolution of Ammonites Shell Form, Journal of Experimental Zoology Part B: Molecular and Developmental Evolution, 326(7), 437-450, (2016).

[2] Ø. Hammer, H.Bucher, Models for the morphogenesis of the molluscan shell, An international Journal of Palaentology and Stratigraphy, 38(2), 111-122, (2005).

[3] C. Illert, Formulation and solution of the classical problem, II Tubular three dimensional surfaces, Nuovo Cimento, 11, 761-780, (1989).

[4] D. Moulton, A. Goriely Surface growth kinematics via local curve evolution. Journal of Mathematical Biology, 68(1-2), 81-108, (2014).

---

[5] H. Şimşek, M. Özdemir Generaing hyperbolical rotation matrix for a given hyperboloid. Linear Algebra and its Applications, 496, 221-245, (2016).

[6] G. Tuğ, Z. Özdemir, İ., Gök, FN.Ekmekci Accretive Darboux Growth along a Space Curve. Applied Mathematics and Computation, 316, (2018).

[7] G. Tuğ , Z. Özdemir Elliptical kinematics of the accretive surface growth, Turk J Math 46, 728–745, (2022).

[8] A.R. Tarrida, Affine Maps, Euclidean Motions and Quadrics, Springer, 411, (2011).

Department of Mathematics, Karadeniz Technical University, Trabzon, Turkey
Email address: gguner@ktu.edu.tr

APPROXIMATION IN A VARIABLE BOUNDED INTERVAL

GUREL BOZMA AND NAZMIYE GONUL BILGIN

0000-0002-0916-5894 and 0000-0001-6300-6889

ABSTRACT

In this paper, the important approach features of a Kantorovich-type modified operator on a mobile range will be examined. Approximation results will be given practically with numerical calculations and graphics.

References

[1] P.N. Agrawal, M. Goyal, A. Kajla, q-Bernstein-Schurer-Kantorovich type operators. Bollettino dell'Unione Matematica Italiana, 8(3), 169-180, (2015).

[2] M. Mursaleen, F. Khan, A. Khan, A. Kilicman, Some approximation results for generalized Kantorovich-type operators. Journal of Inequalities and Applications, 2013(1), 1-14 (2013).

[3] A. Indrea, A. Indrea, A New Class of Kantorovich-Type Operators. Constructive Mathematical Analysis, 3(3), 116-124, (2020).

[4] B.I. Vasian, S. L. Garoiu, C. M. Păcurar, On New Classes of Stancu-Kantorovich-Type Operators. Mathematics, 9(11), 1235, (2021).

[5] D. Barbosu. Kantorovich-Stancu type operators. J. Inequal. Pure Appl. Math, 5(3), 6, (2004).

[6] M. Dhamija, N. Deo, Approximation by generalized positive linear Kantorovich operators. Filomat, 31(14), 4353-4368, (2017).

(1) Department of Mathematics, Faculty of Art and Science, Zonguldak, Turkey
Email address, 1: `g.bozma@fbe.karaelmas.edu.tr`

(2) Department of Mathematics, Faculty of Art and Science, Zonguldak, Turkey
Email address, 2: `nazmiyegonul@beun.edu.tr`

―――――――

LEONARDO OCTONIONS

HAYRULLAH ÖZİMAMOĞLU

0000-0001-7844-1840

ABSTRACT

In this paper, we introduce a new class of octonions. We define the Leonardo octonions. Then, we obtain some algebraic properties of the Leonardo octonions such as the generating function, Binet formula, some summation formulas, Catalan's identity, Cassini's identity and d'Ocagne's identity.

References

[1] Y. Alp, E. G. Koçer, Some properties of Leonardo numbers, Konuralp Journal of Mathematics, 9(1), 183-189, (2021).

[2] P. Catarino, A. Borges, On Leonardo numbers, Acta Mathematica Universitatis Comenianae, 89(1), 75-86, (2019).

[3] O. Keçilioğlu, I. Akkus, The Fibonacci octonions, Adv. Appl. Clifford Algebras, 25(1), 151-158, (2015).

[4] T. Koshy, Fibonacci and Lucas numbers with applications, John Wiley and Sons, (2001).

[5] R. Serôdio, On octonionic polynomials, Adv. Appl. Clifford Algebras, 17(2), 245-258, (2007).

[6] Y. Tian, Matrix representations of octonions and their applications, Adv. Appl. Clifford Algebras, 10(1), 61-90, (2000).

[7] S. Vajda, Fibonacci and Lucas numbers and the golden section: theory and applications, Halsted Press, (1989).

Department of Mathematics, Faculty of Arts and Sciences, Nevşehİr Hacı Bektaş Velİ University, Nevşehİr, 50300, Turkey
Email address: h.ozimamoglu@nevsehir.edu.tr

―――――――

ON A NEW FAMILY OF THE GENERALIZED GAUSS K-PELL-LUCAS NUMBERS AND THEIR POLYNOMIALS

HAYRULLAH ÖZİMAMOĞLU AND AHMET KAYA

0000-0001-7844-1840 and 0000-0001-5109-8130

ABSTRACT

In this paper, we generalize the known Gauss Pell-Lucas numbers, and call such numbers as the generalized Gauss k-Pell-Lucas numbers. We obtain relations between the family of the generalized Gauss k-Pell-Lucas numbers and the known Gauss Pell-Lucas numbers. We generalize the known Gauss Pell-Lucas polynomials, and call such polynomials as the generalized Gauss k-Pell-Lucas polynomials. We obtain relations between the family of the generalized Gauss k-Pell-Lucas polynomials and the known Gauss Pell-Lucas polynomials. In addition, we present the new generalizations of these numbers and polynomials in matrix form. Then, we get Cassini's identities for these numbers and polynomials.

References

[1] A. Aşcı, E. Gürel, Gaussian Jacobsthal and Gaussian Jacobsthal Lucas Numbers, Ars Combinatoria, 111, 53-63, (2013).

[2] A. Aşcı, E. Gürel, Gaussian Jacobsthal and Gaussian Jacobsthal Lucas Polynomials, Notes on Number Theory and Discrete Mathematics, 19(1), 25-36, (2013).

[3] G. Berzsenyi, Gaussian Fibonacci numbers, Fibonacci Quarterly, 15(3), 233-236, (1977).

[4] S. Halıcı, S. Öz, On Gaussian Pell polynomials and their some properties, Palestine Journal of Mathematics, 7(1), 251-256, (2018).

[5] S. Halıcı, S. Öz, On Some Gaussian Pell and Pell-Lucas numbers, Ordu Univ. J. Sci. Tech., 6(1), 8-18, (2016).

[6] A. F. Horadam, Complex Fibonacci numbers and Fibonacci quaternions, Amer. Math. Monthly, 70, 289-291, (1963).

[7] J. H. Jordan, Gaussian Fibonacci and Lucas numbers, Fibonacci Quarterly, 3(4), 315-318, (1965).

[8] M. Mikkawy, T. Sogabe, A new family of k-Fibonacci numbers, Appl. Math. Comput. Tech., 215, 4456-4461, (2010).

[9] E. Özkan, M. Taştan, A new families of Gauss k-Jacobsthal numbers and Gauss k-Jacobsthal-Lucas numbers and their polynomials, Journal of Science and Arts, 20(4), 893-908, (2020).

[10] E. Özkan, M. Taştan, On a new family of Gauss k-Lucas numbers and their polynomials, Asian-European Journal of Mathematics, 14(06), 2150101, (2021).

[11] E. Özkan, M. Taştan, On Gauss Fibonacci polynomials, on Gauss Lucas polynomials and their applications, Communications in Algebra, 48(3), 952-960, (2020).

[12] S. Taş, A new family of k-Gaussian Fibonacci numbers, Journal of Balıkesır University Institute of Science and Technology, 21(1), 184-189, (2019).

[13] M. Taştan, E. Özkan, On the Gauss k-Fibonacci polynomials, Electronic Journal of Mathematical Analysis and Applications, 9(1), 124-130, (2021).

[14] T. Yağmur, Gaussian Pell-Lucas Polynomials, Communications in Mathematics and Applications, 10(4), 673-679, (2019).

Department of Mathematics, Faculty of Arts and Sciences, Nevşehİr Hacı Bektaş Velİ University, Nevşehİr, 50300, Turkey
   Email address: h.ozimamoglu@nevsehir.edu.tr

Department of Mathematics, Faculty of Arts and Sciences, Nevşehİr Hacı Bektaş Velİ University, Nevşehİr, 50300, Turkey
   Email address: ahmetkaya@nevsehir.edu.tr

INITIAL AND PRODUCT SINGLE-VALUED NEUTROSOPHIC PROXIMITY STRUCTURES

SAMED ÖZKAN

0000-0003-3063-6168

ABSTRACT

In this paper, we introduce the notion of single-valued neutrosophic proximity spaces which is a generalization of fuzzy proximity spaces [2] and intuitionistic fuzzy proximity spaces [5] and investigate some of their properties. Then, we show that a single-valued neutrosophic proximity on a set X induced a single-valued neutrosophic topology on X. Moreover, we prove the existence of initial single-valued neutrosophic proximity structure and define the product of single-valued neutrosophic proximity spaces.

References

[1] A.A. Salama, S.A. Alblowi. Neutrosophic Set and Neutrosophic Topological Spaces. IOSR Journal of Mathematics, 3(4), 31-35, (2012).

[2] A.K. Katsaras, Fuzzy Proximity Spaces, Analysis and Applications, 68(1), 100-110 (1979).

[3] H. Wang, F. Smarandache, Y.Q. Zhang, R. Sunderraman, Single Valued Neutrosophic Sets, Multispace and Multistructure, 4, 410-413 (2010).

[4] S.A. Naimpally, B.D. Warrack, Proximity Spaces, Cambridge University Press, (1970).

[5] S.J. Lee, E.P. Lee, Intuitionistic Fuzzy Proximity Spaces, International Journal of Mathematics and Mathematical Sciences, 49, 2617-2628, (2004).

[6] S. Özkan, On Single-Valued Neutrosophic Proximity Spaces, Fuzzy Information and Engineering, 10(4), 452-466 (2018).

Department of Mathematics, Nevşehir Hacı Bektaş Veli University, Nevşehir, Turkey
Email address: ozkans@nevsehir.edu.tr

HAUSDORFFNESS IN $\mathcal{L}$-PREORDERED SPACES

SAMED ÖZKAN

0000-0003-3063-6168

ABSTRACT

In this paper, we study the category of quantale-valued preordered spaces. We characterize explicitly each of $\overline{T_0}$, T_0, T_1, pre-$\overline{T_2}$, $\overline{T_2}$ and NT_2 quantale-valued preordered spaces. Furthermore, we examine how these characterization are related to each other and show that the full subcategory $\mathbf{T_i}(\mathbf{pre\text{-}T_2}(\mathcal{L}\text{-}\mathbf{Prord}))$ $(i = 0, 1, 2)$ of $\mathbf{pre\text{-}T_2}(\mathcal{L}\text{-}\mathbf{Prord})$, and the full subcategory $\mathbf{T_i}(\mathcal{L}\text{-}\mathbf{Prord})$ $(i = 1, 2)$ of $\mathcal{L}\text{-}\mathbf{Prord}$ are isomorphic.

References

[1] D. Hofmann, G.J. Seal, W. Tholen, Monoidal Topology: A Categorical Approach to Order, Metric, and Topology. Cambridge University Press, (2014).

[2] J. Adamek, H. Herrlich, G.E. Strecker, Abstract and Concrete Categories, Pure and Applied Mathematics, John Wiley & Sons, New York, (1990).

[3] J.T. Denniston, A. Melton, S.E. Rodabaugh, S.A. Solovyov, Lattice-valued preordered sets as lattice-valued topological systems. Fuzzy Sets and Systems, 259, 89-110, (2015).

[4] M. Baran, Separation properties, Indian J. Pure Appl. Math., 23, 333-341, (1991).

[5] M. Baran, H. Altındiş. T_2 objects in topological categories, Acta Mathematica Hungarica, 71(1-2), 41-48, (1996).

[6] M. Baran, J. Al-Safar. Quotient-reflective and bireflective subcategories of the category of preordered sets, Topology and its Applications, 158(15), 2076-2084, (2011).

[7] S. Özkan, M. Qasim. Zero-Dimensionality and Hausdorffness in Quantale-Valued Preordered Spaces, Filomat, (in press).

Department of Mathematics, Nevşehir Hacı Bektaş Veli University, Nevşehir, Turkey
Email address: ozkans@nevsehir.edu.tr

AN INVESTIGATION ON THE LASOTA-WAZEWSKA MODEL WITH A PIECEWISE CONSTANT ARGUMENT

GIZEM S. OZTEPE

0000-0002-8170-7029

ABSTRACT

This paper is devoted to investigate the asymptotic stability of the equilibrium point of the Lasota-Wazewska model with a piecewise constant argument and it is proved that this point is an attractor. It is also shown that every oscillatory solution of the corresponding difference equation has semi-cycles of length at least two.

References

[1] G.S. Oztepe, An investigation on the Lasota-Wazewska model with a piecewise constant argument, Hacettepe Journal of Math. and Stat., 50(5), 1500-1508, (2021).

[2] M. Wazewska-Czyzewska, A. Lasota, Mathematical problems of the dynamics of the red blood cells system, (Polish) Math. Stos. III, 6, 23-40, (1976).

[3] J. Wiener, Generalized Solution of Functional Differential Equations, World Scientific, Singapore, (1993).

[4] S. Xiao, Delay effect in the Lasota–Wazewska model with multiple time-varying delay. Int. J. Biomath., 11, 1850013, (2018).

Ankara University, Department of Mathematics, Faculty of Sciences, Ankara, TURKEY
Email address: gseyhan@ankara.edu.tr

DETECTION OF THE BIFURCATION OF CHEN'S CHAOTIC ATTRACTOR

GIZEM S. OZTEPE

0000-0002-8170-7029

ABSTRACT

The investigation of bifurcations of a Chen's system is the main aim of this paper. Especially we focus on Hopf bifurcation and after obtaining the Hopf bifurcation point in terms of system parameters, the normal form of this bifurcation is obtained by using an effective method called the multiple scales method. The obtained results are also confirmed numerically.

References

[1] S. R. Choudhury, D. Mandragona, A Chaotic Chemical Reactor With and Without Delay: Bifurcations, Competitive Modes, And Amplitude Death, Internat. J. Bifur. Chaos Appl. Sci. Engrg. 29(2), 1950019, 15p. (2019).

[2] S.R. Choudhury, G. S. Oztepe, Bifurcations and Dynamics in Modified Two Population Neuronal Network Models, J. Discontin. Nonlinearity Complex, 10 (02), 237-257, (2021).

[3] C. Li, G. Chen, A Note on Hopf bifurcation in Chen's system, Int. J. Bifurcat. Chaos, 13(6), 1609-1615, (2003).

Ankara University, Department of Mathematics, Faculty of Sciences, Ankara, TURKEY
Email address: gseyhan@ankara.edu.tr

ON DISCONTINUITY PROBLEM VIA SIMULATION FUNCTIONS

NIHAL TAŞ AND NIHAL ÖZGÜR

0000-0002-4535-4019 and 0000-0002-8152-1830

ABSTRACT

Metric fixed-point theory has been extensively studied with various perspectives. One of them is to generalize the used metric space such as S-metric and b-metric spaces. Another approach is to solve the raised open problems such as the Rhoades' discontinuity problem. We combine these two approaches and consider the set of simulation functions to present new solutions to the Rhoades' discontinuity problem on the existence of a self-mapping which has a fixed point but is not continuous at the fixed point on an S-metric and a b-metric space.

References

[1] I.A. Bakhtin, The Contraction Principle in Quasimetric Spaces. Func. An., Ulianowsk, Gos. Ped. Ins., 30, 26-37, (1989).

[2] R.K. Bisht, R.P. Pant, A Remark on Discontinuity at Fixed Point. Journal of Mathematical Analysis and Applications, 445(2), 1239-1242, (2017).

[3] E. Karapınar, F. Khojasteh, An Approach to Best Proximity Points Results via Simulation Functions, Journal of Fixed Point Theory and Applications. 19(3), 1983-1995, (2017).

[4] F. Khojasteh, S. Shukla, S. Radenović, A New Approach to the Study of Fixed Point Theory for Simulation Functions. Filomat, 29(6), 1189-1194, (2015).

[5] B.E. Rhoades, Contractive Definitions and Continuity. Contemporary Mathematics. 72, 233-245, (1988).

[6] A.F. Roldán-López-de-Hierro, E. Karapınar, C. Roldán-López-de-Hierro, J. Martínez-Moreno, Coincidence Point Theorems on Metric Spaces via Simulation Functions, Journal of Computational and Applied Mathematics, 275, 345-355, (2015).

---

[7] S. Sedghi, N. Shobe, A. Aliouche, A Generalization of Fixed Point Theorems in S-Metric Spaces, Matematicki Vesnik, 64(3), 258-266, (2012).

[8] S. Sedghi, N.V. Dung, Fixed Point Theorems on S-Metric Spaces, Matematicki Vesnik, 66(1), 113-124, (2014).

Department of Mathematics, Faculty of Arts and Sciences, Balikesir, Turkey
Email address: nihaltas@balikesir.edu.tr

Department of Mathematics, Faculty of Arts and Sciences, Balikesir, Turkey
Email address: nihal@balikesir.edu.tr

FIXED-FIGURE PROBLEM ON S_b-METRIC SPACES

NIHAL TAŞ AND HÜLYA AYTIMUR

0000-0002-4535-4019 and 0000-0003-4420-9861

ABSTRACT

Recently, fixed-figure problem has been studied as a geometric generalization of fixed-point theory on metric and generalized metric spaces. In this talk, we investigate new solutions to this problem modifying some known contractive condition on S_b-metric spaces. Also, we support our results with necessary examples.

References

[1] G.Z. Erçınar, Some Geometric Properties of Fixed Points, Ph.D. Thesis, Eskişehir Osmangazi University, (2020).

[2] N.Y. Özgür, N. Taş, Some Fixed-Circle Theorems on Metric Spaces, Bulletin of the Malaysian Mathematical Sciences Society, 42(4), 1433-1449, (2019).

[3] N. Özgür, N. Taş, Geometric Properties of Fixed Points and Simulation Functions, arXiv:2102.05417.

[4] S. Sedghi, A. Gholidahneh, T. Došenović, J. Esfahani, S. Radenović, Common Fixed Point of Four Maps in S_b-Metric Spaces, Journal of Linear and Topological Algebra, 5(2), 93-104, (2016).

[5] N. Taş, N. Özgür, New Fixed-Figure Results on Metric Spaces, Fixed Point Theory and Fractional Calculus - Recent Advances and Applications, 33-62, (2022).

Department of Mathematics, Faculty of Arts and Sciences, Balikesir, Turkey
Email address: nihaltas@balikesir.edu.tr

Department of Mathematics, Faculty of Arts and Sciences, Balikesir, Turkey
Email address: hulya.aytimur@balikesir.edu.tr

ALTERNATIVE PLANES AND THE CURVES ON THEM

AYKUT HAS AND BEYHAN YILMAZ

0000-0003-0658-9365 and 0000-0002-5091-3487

ABSTRACT

In this study, the planes formed by Frenet elements are defined with a U vector chosen different from T, N and B, which are the elements of the Frenet frame, and the curves on these planes are also characterized. As it is known, the planes formed by Frenet elements between themselves have been defined and investigated many times. In this present article, the planes formed by an arbitrary chosen vector U with T, N and B are defined and the curves lying in this plane are characterized.

REFERENCES

[1] B.Y. Chen, When does the position vector of a space curve always lie in its rectifying plane, The American Mathematical Monthly, 110, 147-152, (2003).

[2] K. Ilarslan, E. Nesovic, M. Petrovic-Torgasev, Some characterizations of rectifying curves in the Minkowski 3- space, Novi Sad Journal of Mathematic, 33(2), 23-32, (2003).

[3] S. Cambie, W. Goemans, I. Van Den Bussche, Rectifying curves in n-dimensional Euclidean space, Turk. J. Math., 40, 210-223, (2016).

[4] H. Öztekin H, A.O. Öğrenmiş, Normal and rectifying curves in Pseudo-Galilean space G3 1 and their characterizations, J Math. Comput. Sci., 2, 91-100, (2012).

[5] D.J. Struik, Lectures on Classical Diferential Geometry, Dover Publications, (1988).

DEPARTMENT OF MATHEMATICS, FACULTY OF SCIENCE, KAHRAMANMARAS, TURKEY
Email address: ahas@ksu.edu.tr

DEPARTMENT OF MATHEMATICS, FACULTY OF SCIENCE, KAHRAMANMARAS, TURKEY
Email address: beyhanyilmaz@ksu.edu.tr

ON SOMBOR AND SOMBOR-TYPE INDICES

SEDA OĞUZ ÜNAL

0000-0003-1338-1466

ABSTRACT

The so-called Sombor index was invented in 2021 ([4]), and soon became very popular, with around a hundred published papers. One of the reasons why the Sombor index has become so popular is that this index is related to geometry, unlike other vertex-degree based indices. The Nirmala and Banhatti-Sombor indices are variants of (and motivated by) the original Sombor index (see [5, 6]).

In [3] the authors invented a new graph related to monogenic semigroups inspired by zero divisor graphs. There are many studies concerning monogenic semigroup graphs were published by Akgüneş et al.(see for example [1, 2]).

We connected the theory of Sombor index and two Sombor-type indices with semigroup theory. In this talk we will give exact formulas of Sombor, Nirmala and Banhatti-Sombor indices over the monogenic semigroup graph. Pertinent algorithms are designed and examples are given to support to the main theorems ([7, 8, 9]).

References

[1] N. Akgüneş, B. Çağan, On the Dot Product of Graphs over Monogenic Semigroups, Applied Mathematics and Computation, 322, 1-5, (2018).

[2] N. Akgüneş, A Further Note on the Graph of Monogenic semigroups, Konuralp Journal of Mathematics, 6, 49-53, (2018).

[3] K.C. Das, N. Akgüneş, A.S. Çevik, On a Graph of Monogenic Semigroup, J. Ineq. Appl., 44, (2013).

[4] I. Gutman, Geometric Approach to Degree-Based Topological Indices: Sombor Indices, 86, 11-16, (2021).

[5] V.R. Kulli, On Banhatti-Sombor Indices, International Journal of Applied Chemistry, 8, 21-25, (2021).

---

[6] V.R. Kulli, Nirmala Index, International Journal of Mathematics Trends and Technology, 67, 8-12, (2021).

[7] S. Oğuz Ünal, An Application of Sombor Index over a Special Class of Semigroup Graph, Journal of Mathematics, #3273117 (2021).

[8] S. Oğuz Ünal, Nirmala Index over a Graph of a Monogenic Semigroups, Bull. Int. Math. Virtual Inst., 12, 119-124, (2022).

[9] S. Oğuz Ünal, Banhatti-Sombor Index over a Graph of a Special Class of Semigroup, 10, 40-43, (2022).

DEPARTMENT OF SECONDARY SCHOOL SCIENCE AND MATHEMATICS EDUCATION, FACULTY OF EDUCATION, SIVAS, TURKEY
    Email address: sdaoguz@gmail.com

A COMMON FIXED POINT THEOREM OF COMPATIBLE MAPPINGS CONCERNING F^*-CONTRACTION IN MODULAR METRIC SPACES

KÜBRA ÖZKAN

0000-0002-8014-1713

ABSTRACT

In 2008, Chistyakov introduced the notion of modular metric spaces, which has a physical interpretation [1] and he gave the fundamental properties of modular metric spaces [2]. In this study, the existence and uniqueness of common fixed points of compatible mappings satisfying F^*-contraction are proved in the modular metric spaces. Moreover, some corollaries related to the main theorem are given.

REFERENCES

[1] V. V. Chistyakov, Modular metric spaces generated by F-modulars, Folia Mathematica, 14, 3-25, (2008).

[2] V. V. Chistyakov, Modular metric spaces I basic concepts, Nonlinear Analysis, 72, 1-14, (2010).

[3] G. Jungck, Compatible mappings and common fixed points, International Journal of Mathematics and Mathematical Sciences, 9(4), 771-779, (1986).

[4] S. Muralisankar, A. Santhi, Common fixed point theorems for F-contraction mappings with an application, The Journal of Analysis, 27(4), 1109-1121, (2019).

[5] B. Wardowski, Fixed point theory of a new type of contractive mappings in complete metric spaces, Fixed Point Theory and Applications, 2012, Article ID 94, (2012).

[6] H. Piri, P. Kumam, Wardowski type fixed point theorems in complete metric spaces, Fixed Point Theory and Applications, 45, 1-12, (2016).

Manisa Celal Bayar University, Department of Mathematics, Manisa, TURKEY
Email address: kubra.ozkan@hotmail.com

EXISTENCE OF STABLE NONLINEAR SPLINES

MICHAEL J. JOHNSON

0000-0003-0478-866X

ABSTRACT

Given **interpolation points** $P_1, P_2, \ldots, P_n$ in the plane, an **interpolating curve** is a smooth curve that passes sequentially through the given points. Historically, interpolating curves were drawn with the aid of a (draftsman's) spline, which is naively modeled as an interpolating curve whose bending energy, $\frac{1}{2} \int_C \kappa(s)^2 \, ds$, is minimal. (In the above line integral over the interpolating curve C, s denotes arclength and κ denotes curvature.) Surprisingly, as pointed out by Birkhoff and de Boor (General Motors, 1964), if the interpolation points do not lie sequentially along a line, then no interpolating curve with minimal bending energy exists, because one can always describe a (very long and rounded) interpolating curve with arbitrarily small bending energy. Instead, they propose seeking an interpolating curve whose bending energy is minimal among all *nearby* interpolating curves. Such interpolating curves are called **stable nonlinear splines**. Stable nonlinear splines do not always exist, but it is known (Lee & Forsythe, Brunett) that when they exist, they are curature continuous. However, the prickly issue of existence has never been adequately resolved, despite noteworthy efforts of Fisher, Jerome, Golomb and Linnér. Prior to our contributions, the only general existence proof for stable nonlinear splines was found in Golomb's unpublished technical report (1978), which proves existence when the interpolation points are sufficiently close to being collinear. In this talk, I will describe joint work with Albert Borbély and Hakim Johnson, that culminates in a broad existence proof for stable nonlinear splines.

References

[1] A. Borbely, M.J. Johnson, Elastic splines I: existence, Constr. Approx., 40, 189-218, (2014).

[2] M.J. Johnson, H.S. Johnson. A constructive framework for minimal energy planar curves, Appl. Math. Comp., 276, 172-181, (2016).

[3] A. Borbely, M.J. Johnson, Elastic splines II: unicity of optimal s-curves and curvature continuity, Constr. Approx., 49, 525-554, (2019).

[4] A. Borbely, M.J. Johnson, Elastic splines III: existence of stable nonlinear splines, J. Approx. Theory, 251(C), (2020).

DEPARTMENT OF MATHEMATICS, FACULTY OF SCIENCE, KUWAIT CITY, KUWAIT
Email address: yohnson1963@hotmail.com

QUASI-ELASTIC CUBIC SPLINE INTERPOLATION OF PLANAR DATA

MARIAM DEKHIL

0000-0002-1663-0272

ABSTRACT

The problem of finding a fair curve that pass sequentially through (i.e., **interpolates**) a given list $P_1, P_2, \ldots, P_n$ of points in the plane is a fundamental problem in Computer Aided Geometric Design (CAGD). First described at General Motors (1964), the **stable nonlinear spline** is an interpolating curve whose *bending energy* is minimal when compared to nearby interpolating curves. It is intended to model the draftsman's spline; however, a satisfactory existence proof eluded researchers until 2020 when A. Borbély and M. Johnson published the first broad existence proof [1]. Their approach reduced an infinite dimensional nonlinear optimization problem into a uniquely solvable infinite dimensional geometric Hermite interpolation problem–the **inner problem**, coupled with an n-dimensional nonlinear optimization problem–the **outer problem**. The inner problem is illustrated in the figure below, and it was found by M. Johnson and H. Johnson that the solution
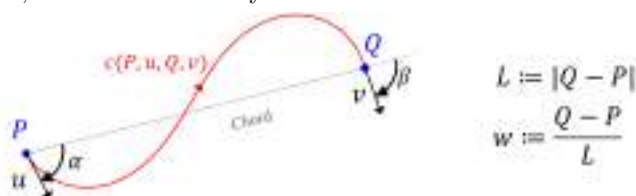
of the original inner problem (involving implicitly defined segments of rectangular elastica) could be *surgically* replaced with an explicit parametric cubic, namely

$$c(t; P, u, Q, v) := P + L[t(1-t)^2 u + t^2(t-1)v + t^2(3-2t)w], \ 0 \le t \le 1.$$

Thus was born an interpolation method, called **quasi-elastic cubic splines**, that has many theoretical similarities with stable nonlinear splines. In my talk, I plan to explain what has so far been proved about quasi-elastic cubic splines and then discuss new results that have been obtained when the interpolation points are equispaced and are consistent with a convex interpolating curve.

References

[1] A. Borbely, M.J. Johnson. Elastic splines III: existence of stable nonlinear splines, J. Approx. Theory, 251,(C), (2020).

Department of Mathematics, Faculty of Science, Kuwait University, Kuwait

Email address: m.dekhil97@gmail.com, mariam.dekhil@grad.ku.edu.kw

POSITION CONTROL OF THE QUADCOPTER WITH PID CONTROLLER

OZAN POLAT AND AZIZ SEZGIN

0000-0001-9004-3896 and 0000-0001-6861-5309

ABSTRACT

In this study, efficient control system was designed for position control of the quadcopter in six degrees of freedom. The main goal was to get the quadcopter to desired position in the xyz plane. After selecting the physical model, the mathematical model of the system was derived. All external disturbances like drag force or wind gust were ignored in this model. From the mathematical model it is known that there are four inputs to the quadcopter system which are angular velocities of the motors, therefore this system is underactuated. Proportional-Integral-Derivative (PID) control strategy was used to stabilize the quadcopter. Necessary pitch and roll angles were found and control inputs were calculated with PID controller. Finally, angular velocities and current values which were needed to supply to each motor were determined. According to the results, it was observed that the control algorithm became successful, quadcopter was able to reach the desired location in xyz plane with a small overshoot.

References

[1] V. Praveen, A. Pillai, Modeling and Simulation of Quadcopter using PID Controller, International Journal of Circuit Theory and Applications, (2016).

[2] E. Bozkurt, B. Dandıl, F. Ata, Dört Rotorlu İnsansız Hava Aracının Kayan Kipli Denetleyici ve Geri Adımlamalı Denetleyici ile Yönelim ve Yükseklik Denetimi, Fırat Üniversitesi Müh.Bil.Dergisi, (2020).

[3] E. Suiçmez, A. Kutay, Dört Rotorlu Bir İnsansız Hava Aracının Geri Adımlama Yöntemi ile Yol Takibi Kontrolü, Havacılık ve Uzay Teknolojileri Dergisi, (2014).

[4] Romero L., Pozo D., Rosales J., Quadcopter stabilization by using PID controllers, (2014).

---

[5] S. Zouaoui, E. Mohamed, B. Kouider, Easy Tracking of UAV Using PID Controller, Periodica Polytechnica Transportation Engineering, (2018).

[6] L. Cedro, K. Wieczorkowski, Optimizing PID controller gains to model the performance of a quadcopter, 13th International Scientific Conference on Sustainable, Modern and Safe Transport, (2019).

[7] Z. He, Z. Long, A Simple Attitude Control of Quadrotor Helicopter Based on Ziegler-Nichols Rules for Tuning PD Parameters, Hindawi Publishing Corporation The Scientific World Journal, (2014).

[8] C. Sabo, K. Cohen, Fuzzy Logic Unmanned Air Vehicle Motion Planning, Hindawi Publishing Corporation, (2012).

[9] A. Prayitno , V. Indrawati, I. Trusulaw, Comparison of PID and Fuzzy Controller for Position Control of AR.Drone, International Conference on Electrical Engineering, Computer Science and Informatics, (2017)

[10] M. Rahimi, S. Hajighasemi, D. Sanaei, Designing and Simulation for Vertical Moving Control of UAV System using PID, LQR and Fuzzy logic, International Journal of Electrical and Computer Engineering (IJECE), (2014).

[11] A. Reizenstein, Position and Trajectory Control of a Quadcopter Using PID and LQ Controllers, Department of Electrical Engineering, Linköping University, (2017).

[12] D. Li, Fuzzy PID Controller to control the attitude of Quadrotor UAV, Gyancity Journal of Engineering and Technology, (2020)

[13] T. Jiinec , Stabilization and Control of Unmanned Quadcopter, Luleå University of Technology Department of Computer Science, Electrical and Space Engineering, (2011).

[14] S. Bouabdallah, P. Murrieri, R. Siegwart, Design and Control of an Indoor Micro quadrotor, (2002).

[15] https://andrew.gibiansky.com/blog/physics/quadcopter-dynamics/

[16] X. Lin, Y. Wang, Y. Liu, Neutral-network based robust terminal sliding-mode control of quadrotor, School of Information and Control Engineering, Qingdao University of Technology,Shandong, China, (2019).
.

Istanbul University Cerrahpasa, Faculty of Mechanical Engineering, Istanbul, Turkey
Email address: `ozan.polat@ogr.iuc.edu.tr`

Istanbul University Cerrahpasa, Faculty of Mechanical Engineering, Istanbul, Turkey
Email address: `asezgin@iuc.edu.tr`

A NOTE ON OVER–PARAMETRIZED LINEAR MODELS

Nesrİn Güler and Melek Erİş Büyükkaya

0000-0003-3233-5377 and 0000-0002-6207-5687

ABSTRACT

In this paper, we consider a general linear model and its over–parametrized linear models. We investigate the relation between these two models by considering the best linear unbiased predictors (BLUPs) of joint unknown vectors. We give the concepts and definitions on predictability and BLUPs of the general vector of unknown vectors under considered models. We next derive some results on the comparison of covariance matrices of BLUPs under given these models by using formulas in matrix algebra such as rank and inertia of block matrices and elementary matrix operations. For the subjects related to the results obtained in this paper, please see the following references [1]-[4].

References

[1] I. S. Alalouf, G. P. H. Styan, Characterizations of estimability in the general linear model. Ann. Stat., 7, 194–200, (1979).

[2] S. Gan, Y. Sun, Y. Tian, Equivalence of predictors under real and over–parameterized linear models, Commun. Statist. Theory and Methods, 46 (11), 5368-5383, (2017).

[3] S. J. Haslett, S. Puntanen, Effect of adding regressors on the equality of the BLUEs under two linear models, Journal of Statistical Planning and Inference, 140, 104-110, (2010).

[4] Y. Tian, Matrix rank and inertia formulas in the analysis of general linear models, Open Math., 15 (1), 126-150, (2017).

Sakarya university, Department of Econometrics, Sakarya, Turkey
Email address: nesring@sakarya.edu.tr

Karadeniz Technical University, Department of Statistics and Computer Sciences, Trabzon, Turkey
Email address: melekeris@ktu.edu.tr

ON BASIC WEITZENBÖCK DERIVATIONS OF FREE METABELIAN LIE ALGEBRAS OF LOW RANK

ANDRE DUSHIMIRIMANA

0000-0002-7486-2557

ABSTRACT

Let L_n be the free metabelian Lie algebra of rank n. In this talk, we study the generators of the algebra $L_n^{\delta_n}$ of constants of L_n basic Weitzenböck derivations δ_n for $n \leq 5$.

References

[1] V. Drensky, C.K. Gupta, Constants of Weitzenböck derivations and invariants of unipotent transformations acting on relatively free algebras, J. Algebra, 292, 393-428, (2005).

[2] R. Weitzenböck, Uber die Invarianten von linearen Gruppen, Acta Math., 58, 231-293, (1932).

Department of Mathematics, Çukurova University, Adana, Turkey
Email address: duandosh@yahoo.fr

SOME NEW FIXED-CIRCLE THEOREMS ON METRIC SPACES

ELIF KAPLAN

0000-0002-7620-3387

ABSTRACT

This work presents some new existence theorems for fixed-circles of self-mappings on metric spaces. To do this, we obtain new conditions using the Caristi type contractive condition. Also, we confirm our results by illustrative examples.

References

[1] N.Y. Özgür, N. Taş, New fixed-circle results related to Fc-contractive and Fc-expanding mappings on metric spaces, arXiv preprint arXiv:2101.10770, (2021).

[2] N. Mlaiki, U. Çelik, N. Taş, N.Y. Özgür, A. Mukheimer, Wardowski type contractions and the fixed-circle problem on S-metric spaces, J. Math., Art. ID 9127486, 9, (2018).

[3] N. Mlaiki, N.Y. Özgür, N. Taş, New fixed-point theorems on an S-metric space via simulation functions, Mathematics,7, 583 (2019).

[4] N. Mlaiki, N. Taş, N.Y. Özgür, On the fixed-circle problem and Khan type contractions, Axioms, 7(4), 80 (2018).

[5] N.Y. Özgür, N. Taş, U. Çelik, New fixed-circle results on S-metric spaces, Bulletin of Mathematical Analysis and Applications, 9(2), 10-23, (2017).

[6] N.Y. Özgür, N. Taş, Some fixed-circle theorems on metric spaces, Bulletin of the Malaysian Mathematical Sciences Society, 42(4), 1433-1449, (2019).

[7] N.Y. Özgür, N. Taş, Fixed circle problem on S-metric spaces with a geometric viewpoint, Facta Universitatis. Series:Mathematics and Informatics, 34(3), 459-472, (2019).

[8] N.Y. Özgür, N. Taş, Some fixed-circle theorems and discontinuity at fixed circle. In AIP Conference Proceedings, 1926 (1), (2018).

[9] N.Y. Özgür, N. Taş, On the geometry of fixed points of self-mappings on S-metric spaces, Communications Faculty of Sciences University of Ankara Series A1 Mathematics and Statistics,

69(2), 1184-1192, (2020).

[10] H.N. Saleh, S. Sessa, W.M. Alfaqih, M. Imdad, N. Mlaiki, Fixed circle and fixed disc results for new types of Θc-contractive mappings in metric spaces, Symmetry, 12(11), 1825, (2020).

[11] N. Taş, N.Y. Özgür, N. Mlaiki, New types of FC-contractions and the fixed-circle problem. Mathematics, 6(10), 188, (2018).

[12] N. Taş, Suzuki-Berinde type fixed-point and fixed-circle results on S-metric spaces, Journal of Linear and Topological Algebra, 7(3), 233-244, (2018).

[13] N. Taş,Various types of fixed-point theorems on S-metric spaces, J. BAUN Inst. Sci. Technol, 20(2), 211-223, (2018).

[14] A. Tomar, M. Joshi, , S.K. Padaliya, Fixed point to fixed circle and activation function in partial metric space, Journal of Applied Analysis, (2021).

[15] U. Çelik, N.Y. Özgür, On the fixed-circle problem, Facta Universitatis, Series: Mathematics and Informatics, 35(5), 1273-1290, (2020).

[16] J. Caristi, Fixed point theorems for mappings satisfying inwardness conditions. Trans. Am. Math. Soc. 215, 241–251 (1976).

DEPARTMENT OF MATHEMATICS, FACULTY OF SCIENCE AND ARTS, SAMSUN, TURKEY
Email address: elifaydinkaplan@gmail.com

TRAJECTORY TRACKING VIA BACKSTEPPING CONTROLLER WITH PID OR SMC FOR MOBILE ROBOTS

SINAN YIGIT AND AZIZ SEZGIN

0000-0002-4417-8586 and 0000-0001-6861-5309

ABSTRACT

Mobile robot concept is one of the most commonly used nonholonomic system for industrial and academic autonomous applications. There are many types of mobile robot design concepts and control strategies which have been continuously developed by researchers.In this study, two wheeled differential drive mobile robot (DDMR) is used for trajectory tracking study under different conditions.Reference trajectory, dynamic and kinematic motion models of DDMR are defined as mathematical expressions in computer software.For tracking the reference trajectory, error between current pose and reference pose was decreased by Sliding Mode Controller (SMC) and Proportional–Integral–Derivative controller (PID) with Kinematic Based Backstepping Controller (KBBC) respectively. A reference path which consists of sinusoidal and linear parts tracked by both controller combinations in first simulation to examine controller tracking performances. In order to examine and compare; responsiveness, stability and robustness of the controllers, an additional mass vertically added to the mobile robot body which affects motion dynamics of DDMR during trajectory tracking application. All results and discussions comparatively stated at the end of the study with related error figures and evaluations.

References

[1] M., Mohd Saiful Azimi, et al., Multi-objective path planner for an agricultural mobile robot in a virtual greenhouse environment, Electronics in agriculture, 157, 488-499, (2019).

[2] L., Hang, A. V. Savkin, An algorithm for safe navigation of mobile robots by a sensor network in dynamic cluttered industrial environments, Robotics and Computer-Integrated Manufacturing, 54, 65-82 ,(2018).

[3] D., Quang-Vinh, et al., Modelling and scheduling autonomous mobile robot for a real-world application, IFAC Proceedings, 46(9), 2098-2103, (2013).

Key words and phrases. Differential drive mobile robot, PID control, Sliding mode control, Kinematic based backstepping control, Trajectory tracking.

[4] D. Pazderski, Application of transverse functions to control differentially driven wheeled robots using velocity fields, Bulletin of the Polish Academy of Sciences. Technical Sciences, 64(4), (2016).

[5] P. Panahandeh, et al., A kinematic Lyapunov-based controller to posture stabilization of wheeled mobile robots, Mechanical Systems and Signal Processing, 134, (2019).

[6] T. Hellström, Kinematics equations for differential drive and articulated steering, Department of Computing Science, Umeå University, (2011).

[7] A., Leopoldo, et al., Duality-based nonlinear quadratic control: Application to mobile robot trajectory-following, IEEE Transactions on Control Systems Technology, 23(4), 1494-1504, (2015).

[8] H. Taheri, X. Z. Chun, Omnidirectional mobile robots, mechanisms and navigation approaches, Mechanism and Machine Theory, 153, (2020).

[9] F.Demirbaş, M.KALYONCU, Differential drive mobile robot trajectory tracking with using pid and kinematic based backstepping controller, Selçuk Üniversitesi Mühendislik, Bilim ve Teknoloji Dergisi, 5(1), 1-15, (2017).

DEPARTMENT OF MECHANICAL ENGINEERING İSTANBUL UNIVERSITY - CERRAHPASA ISTANBUL, TURKEY
  Email address: sinanyigit07@gmail.com

DEPARTMENT OF MECHANICAL ENGINEERING-İSTANBUL UNIVERSITY - CERRAHPASA ISTANBUL, TURKEY
  Email address: asezgin@iuc.edu.tr

ON THE STABILITY RESULT FOR INTEGRAL-TYPE MAPPING USING A THREE-STEP ITERATIVE ALGORITHM

SAMET MALDAR AND VATAN KARAKAYA

0000-0002-2083-899X and 0000-0003-4637-3139

ABSTRACT

The fixed point theory is an important research area in various disciplines. Moreover, this theory has wide theoretical and application areas in mathematics. In this work, the convergence of an iteration method under integral type conditions for a given mapping class has been shown. In addition, by using the definition of stability given by Harder and Hicks, it has been shown that this iteration method is stable under integral type conditions.

References

[1] A.M. Harder, T.L. Hicks. Stability results for fixed point iteration procedures. Math. Jpn. 33, 693-706, (1988).

[2] A. Branciari, A fixed point theorem for mappings satisfying a general contractive condition of integral type, International Journal of Mathematics and Mathematical Sciences, 29(9), 531-536, (2002).

[3] V. Karakaya, K. Dogan,F. Gursoy, M. Erturk, Fixed point of a new three-step iteration algorithm under contractive-like operators over normed spaces, In Abstract and Applied Analysis, 2013, 1-9, (2013).

[4] M. A. Maldar. English title: Investigation of Fixed Point Results Under Various Fixed Point Mappings, PhD Thesis (in Turkish), Yildiz Technical University, (2016).

Department of Mathematics, Aksaray University, Aksaray, Turkey
Email address: mmaldar@aksaray.edu.tr

Department of Mathematical Engineering, Yildiz Technical University, Istanbul, Turkey
Email address: vkkaya@yahoo.com

ON PERFECTNESS OF FUZZY GRAPH

SREENANDA RAUT AND MADHUMANGAL PAL

0000-0001-7560-2258 and 0000-0002-6709-836X

ABSTRACT

Perfect graph has gained a lot of importance since its first use by Berge in the early 1960s. This article embarked a comprehensive study on perfect fuzzy graphs to obtain the fuzzy analog of the famous weak and strong perfect graph theorems following due classification of fuzzy graphs in terms of perfectness. It has been shown that unlike crisp case, for fuzzy graphs there exists one and only one perfect fuzzy graph theorem satisfying both the conditions of strong and weak perfect graph theorems. A detailed study on perfectness of different types of fuzzy graphs has been carried out comparing the results with that obtained on crisp graphs. It has been shown through illustrative examples how the perfectness of a fuzzy graph and that of its underlying crisp graph is independent of each other. Finally, the use of perfect fuzzy graph on application grounds have been evaluated by using it in analyzing how a huge percentage of population in a city is unknowingly living under big threat due exposure to electromagnetic radiation emitted from cell-phone towers.

References

[1] S. Ali, S. Mathew, J. Mordeson, Hamiltonian fuzzy graphs with application to human trafficking, Information Sciences, (2020).

[2] K.T. Atanassov, Intuitionistic Fuzzy Sets, Studies in fuzziness and soft computing. Springer, (1999).

[3] P. Ballen, Perfect graphs and the perfect graph theorems, http://www.cis.upenn.edu/ pballen/brinkmann.pdf

[4] C. Berge, Färbung von Graphen, deren sämtliche beziehungsweise deren ungerade Kreise starr sind, Wissenschaftliche Zeitschrift der Martin-Luther-Universität Halle-Wittenberg, Mathematisch-naturwissenschaftliche Reihe (in German), 10, 114, (1961).

---

[5] C. Berge, Perfect graphs, Six Papers on Graph Theory, Calcutta: Indian Statistical Institute, 1–21, (1963).

[6] M. Chudnovsky, N. Robertson, P. Seymour, R.Thomas, The strong perfect graph theorem, Annals of Mathematics, 164 (1): 51–229.

[7] W.L. Craine, Characterizations of fuzzy interval graphs, Fuzzy Sets and Systems, 68, 181-193, (1994).

[8] D. Dubois, H. Prade, Fuzzy Sets and Systems, Theory and Applications, Academic Press, New York, (1980).

[9] P.C. Gilmore, A.J. Hoffman, A characterization of comparability graphs and of interval Graphs, Canad. J. Math.,16, 539-548, (1964).

[10] M.C. Golumbic, Algorithmic Graph Theory and Perfect Graphs, Academic Press, New York, (1980).

[11] A. Kishore, M.S. Sunitha, Chromatic number of fuzzy graphs, Annals of Fuzzy Mathematics and Informatics, 7(4), 543-551, (2014).

[12] L. Lovasz, Normal hypergraphs and the perfect graph conjecture, Discrete Mathematics, 2(3), 253–267,(1972).

[13] L. Lovasz, A characterization of perfect graphs. Journal of Combinatorial Theory, Series B, 13(2), 95–98, (1972).

[14] [12] M.L.N. McAllister, Fuzzy intersection graphs, Computers and Mathematics with Applications, 15(10), 871-886, (1988).

[15] J.N. Mordeson, P.S. Nair, Fuzzy Graphs and Fuzzy Hypergraphs, Springer, Berlin, (2000).

[16] P.S. Nair, S.C.Cheng, Cliques and fuzzy cliques in fuzzy graphs, Joint 9th IFSA World Congress and 20th NAFIPS International Conference, Vancouver, Canada, 2277-2280, (2001).

[17] P. Nair, Perfect and precisely perfect fuzzy graphs, Annual Conference of the North American Fuzzy Information Processing Society - NAFIPS, 1-4, (2008).

[18] M. Pal, Intersection graphs: An introduction, Annals of Pure and Applied Mathematics, 4(1), 43-91, (2013).

[19] M.Pal, S.Samanta, G. Ghorai, Modern trends in fuzzy graph theory, Springer, (2020).

[20] T. Pramanik, S. Samanta, M. Pal, Interval-valued fuzzy planar graph, International Journal of Machine Learning and Cybernetics, (2014).

[21] S. Raut, M. Pal, G. Ghorai, Fuzzy permutation garph and its complements, Journal of Intelligent and Fuzzy Systems, 35, 2199-2213, (2018).

[22] S. Raut, M. Pal, Artif Intell Rev., Springer, Netherlands, (2019).

[23] A. Rosenfeld, Fuzzy graphs, (1975).

[24] S. Samanta, T. Pramanik, M. Pal, Fuzzy colouring of fuzzy graphs, Afrika Matematika, 27, 37-50, (2015).

[25] S. Samanta, M. Pal, Fuzzy Planar Graphs, IEEE Transactions on Fuzzy Systems,, 23. 1936-1942, (2015).

[26] F. Sun, X. Wang, X. Qu, Cliques and clique covers in fuzzy graphs, Journal of Intelligent and Fuzzy Systems, 31, 1245-1256, (2016).

[27] M.S. Sunitha, A.V. Kumar, Complemnets of fuzzy graphs, Indian J Pure Appl Math,33, 1451–1464, (2002).

[28] L.A.Zadeh, Fuzzy sets, Information and Control, 8,338-353, (1965).

DEPARTMENT OF APPLIED MATHEMATICS WITH OCEANOLOGY AND COMPUTER PROGRAMMING, VIDYASAGAR UNIVERSITY, INDIA
  Email address: sreen61087@gmail.com

DEPARTMENT OF APPLIED MATHEMATICS WITH OCEANOLOGY AND COMPUTER PROGRAMMING, VIDYASAGAR UNIVERSITY, INDIA
  Email address: mmpalvu@gmail.com

MAIN EIGENVALUES IN CHAIN GRAPHS

AISHA SALIM

0000-0002-5980-1078

ABSTRACT

In this paper, we study main eigenvalues of connected chain graphs along with their corresponding eigenvectors. We provide tight upper and lower bounds on the number of main eigenvalues a chain graph can have, and characterize different types of chain graphs that satisfy these bounds. This characterization allows us to construct chain graph with k main eigenvalues for any natural number k. We also make a connection between spectral properties of a special type of antibidiagonal matrices and spectral properties of chain graphs.

References

[1] A. Alazemi, M. Anđelić, A.Salim, On main eigenvalues of chain graphs. Computational and Applied Mathematics volume, 40(268), (2021).

[2] F. Bell, D. Cvetković, P. Rowlinson, S. Simić, Graphs for which the least eigenvalue is minimal, ii. Linear Algebra and its Applications, 429(8), 2168-2179, (2008).

[3] A. Bhattacharya, S. Friedland, U. Peled, On the first eigenvalue of bipartite graphs, The Electronic Journal of Combinatorics, 15, (2008).

[4] D .Cvetković, The generating function for variations with restrictions and paths of the graph and self-complementary graphs, Publikacije Elektrotehničkog fakulteta. Serija Matematika i fizika, (320-328), 27-34 , (1970).

[5] D .Cvetković, P. Rowlinson, S .Simić, An introduction to the theory of graph spectra, Cambridge (2010).

[6] E.M. Hagos, Some results on graph spectr, Linear Algebra and its Applications, 356(1), 103-168, (2002).

[7] O. Holtz, The inverse eigenvalue problem for symmetric anti-bidiagonal matrices, Linear Algebra and its Applications, 408, 268-274, (2005).

---

[8] X. Huang, Q. Huang, L. Lu, Construction of graphs with exactly k main eigenvalues, Linear Algebra and its Applications, 486, 204-218, (2015).

[9] P. Rowlinson, The main eigenvalues of a graph: a survey, Applicable analysis and discrete mathematics, (1), 445-471, (2007).

[10] P. Rózsa, On periodic continuants, Linear Algebra and its Applications, 2(2), 267-274 ,(1969).

DEPARTMENT OF MATHEMATICS, FACULTY OF SCIENCE, KUWAIT CITY, KUWAIT
Email address: `aisha.salim@grad.ku.edu.kw`

1-WELL-COVERED GRAPHS CONTAINING A LARGE CLIQUE

ZAKIR DENIZ

0000-0002-0701-0397

ABSTRACT

A graph is *well-covered* if its all maximal independent sets have the same size. If a graph is well-covered and it remains well-covered upon removal of any vertex, then it is called 1-*well-covered* graph, and those graphs without isolated vertices are also known as $\mathbf{W}_2$ graphs. We show that if the removal of two disjoint maximum independent sets from a graph $G \in \mathbf{W}_2$ leaves a clique of size at least 3, then G has a clique of size $n/3$. Using this result, we develop a complete characterization of these graphs, which is based on eleven graph families.

References

[1] C. Berge, Some common properties for regularizable graphs, edge-critical graphs and b-graphs, Graph theory and algorithms, 108-123, (1981).

[2] B. A. Hartnell, Characterization of the 1-well-covered graphs with no 4-cycles, Graph Theory in Paris, 219-224, (206).

[3] V. Levit, E. Mandrescu, 1-well-covered graphs revisited, European Journal of Combinatorics, 80, 261-272, (2019).

[4] J. Staples, On some subclasses of well-covered graphs, Journal of Graph Theory, 3(2), 197-204, (1979).

Duzce University, Department of Mathematics, 81620, Duzce, Turkey
Email address: zakirdeniz@duzce.edu.tr

INVESTIGATING THE RELATION BETWEEN CRITERIA AND ALTERNATIVES USING THE INTUITIONISTIC FUZZY PROMETHEE METHOD

UMUT ESEN, FERIDE TUĞRUL, AND MEHMET ÇITIL

0000-0001-9697-8502,0000-0001-7690-8080 and 0000-0003-3899-3434

ABSTRACT

Multi-criteria decision making methods have facilitated the work of decision makers in many application areas. When many multi-criteria decision making methods which are PROMETHEE, TOPSIS, ELECTRE, etc. have been expressed with intuitionistic fuzzy sets, offering a new perspective to decision makers. The aim of this study is to create a decision mechanism that observes the change in the order of alternatives as the criteria change. In this study; were utilized the intuitionistic fuzzy-based multi criteria decision making methods to observe the relation between the criteria and alternatives.

References

[1] K. T. Atanassov, Intuitionistic Fuzzy Sets, VII ITKR Session, Sofia, 20-23 June (1983), (Deposed in Centr. Sci.-Techn. Library of the Bulg. Acad. of Sci., 1697/84) (in Bulgarian). Reprinted: Int. J. Bioautomation, 20(S1), 1-6, (2016).

[2] M. Behzadian, R.B. Kazemzadeh, A. Albadvi, M. Aghdasi, PROMETHEE: A comprehensive literature review on methodologies and applications, European Journal of Operational Research, 200, 198-215, (2010).

[3] J.P. Brans, L'ing'eni'erie de la decision; Elaboration d'instruments d'aide a lad'ecision. Lam'ethode PROMETHEE, in: R. Nadeau, M. Landry, ed., L'aide a la d'ecision: Nature, Instruments et Perspectives d'Avenir, Qu'ebec, Canada. Presses de l'Universit'e Laval, 183-213, (1982).

[4] H. Liao, Z.S. Xu. Multi-Criteria Decision Making with Intuitionistic Fuzzy PROMETHEE. Journal of Intelligent Fuzzy Systems, 27, 1703-1717, (2014).

[5] F. Tuğrul, M. Çitil. A New Perspective on Evaluation System in Education with Intuitionistic Fuzzy Logic and PROMETHEE Algorithm, Journal of Universal Mathematics, 4(1), 13-24,

(2021).

[6] P. Vincke, J.P. Brans, A preference ranking organization method, The PROMETHEE method
for Multiple Criteria Decision Making, Management Science, 31, 647–656, (1985).

Department of Mathematics, Kahramanmaraş Sütcü İmam University, Kahramanmaraş,
Turkey
    Email address: umutesen123@gmail.com, feridetugrul@gmail.com, citil@ksu.edu.tr

AN INNOVATIVE APPLICATION ON SUPERMARKET SELECTION THROUGH USING INTUITIONISTIC FUZZY TOPSIS METHOD

FERIDE TUĞRUL

0000-0001-7690-8080

ABSTRACT

Multi-criteria decision making methods have recently attracted the attention of researchers and have had a large share in multidisciplinary fields. In this study, using the intuitionistic fuzzy TOPSIS method, supermarket chains were evaluated in the consumer context. Consumers' opinions were expressed using linguistic data. The reason why the intuitionistic fuzzy TOPSIS method is preferred; it is the ability of consumers to express their opinions easily, to take into account the undecided situations.

References

[1] K. T. Atanassov, Intuitionistic Fuzzy Sets, VII ITKR Session, Sofia, 20-23 June (1983), (Deposed in Centr. Sci.-Techn. Library of the Bulg. Acad. of Sci., 1697/84) (in Bulgarian). Reprinted: Int. J. Bioautomation 20(S1), 1-6, (2016).

[2] F.E. Boran, S. Genç, M. Kurt, D. Akay, A Multi-Criteria Intuitionistic Fuzzy Group Decision Making For Supplier Selection With TOPSIS Method, Expert Systems with Applications, 36(8), 11363-11368, (2009).

[3] G. Çuvalcıoğlu, Some Properties of Controlled Set Theory, Notes on Intuitionistic Fuzzy Sets, 20(2), 37-42, (2014).

[4] B.D. Rouyendegh, Developing an Integrated ANP and Intuitionistic Fuzzy TOPSIS Model For Supplier Selection, Journal of Testing and Evaluation, 43(3), 664–672, (2015).

Department of Mathematics, Kahramanmaraş Sütcü İmam University, Kahramanmaraş, Turkey
  Email address: feridetugrul@gmail.com

EVALUATION AND APPLICATIONS THROUGH THE USE OF MULTI-CRITERIA DECISION MAKING METHODS

FERIDE TUĞRUL AND MEHMET ÇITIL

0000-0001-7690-8080 and 0000-0003-3899-3434

ABSTRACT

One of the most used methods of multi-criteria decision making is the PROMETHEE method. While reconstructing with intuitionistic fuzzy sets, this method provides convenience to decision makers because it also makes sense of the degree of hesitation. In this study, a guiding application of the intuitionistic fuzzy PROMETHEE method, which is used in many application areas and gives the most stable result, in the field of selection of transportation services has been made.

REFERENCES

[1] K.T. Atanassov, Intuitionistic Fuzzy Sets, VII ITKR Session, Sofia, 20-23 June (1983), (Deposed in Centr. Sci.-Techn. Library of the Bulg. Acad. of Sci., 1697/84) (in Bulgarian). Reprinted: Int. J. Bioautomation 20(S1), 1-6, (2016).

[2] J.P. Brans, L'ing'eni'erie de la decision; Elaboration d'instruments d'aide a lad'ecision. Lam'ethode PROMETHEE, in: R. Nadeau, M. Landry, ed., L'aide a la d'ecision: Nature, Instruments et Perspectives d'Avenir, Qu'ebec, Canada. Presses de l'Universit'e Laval, 183-213, (1982).

[3] G. Çuvalcıoğlu, Some Properties of Controlled Set Theory, Notes on Intuitionistic Fuzzy Set, 20(2), 37-42, (2014).

[4] H. Liao, Z.S. Xu, Multi-Criteria Decision Making with Intuitionistic Fuzzy PROMETHEE. Journal of Intelligent Fuzzy Systems, 27, 1703-1717, (2014).

Department of Mathematics, Kahramanmaraş Sütcü İmam University, Kahramanmaraş, Turkey
Email address: feridetugrul@gmail.com, citil@ksu.edu.tr

SOME CURVATURE CONDITIONS OF KENMOTSU MANIFOLDS ADMITTING GENERALIZED TANAKA-WEBSTER CONNECTION

MUSTAFA YILDIRIM AND R. ÇINAR KAYA

0000-0002-7885-1492 and 0000-0002-4517-9791

ABSTRACT

The aim of this study is to examine some curvature conditions of Kenmotsu manifolds with generalized Tanaka-Webster connection. Using the Q tensor whose trace is the well-known Z-tensor, we prove the conditions $\xi - Q^*$ flat, $\phi - Q^*$ flat Kenmotsu manifolds admitting Tanaka-Webster connection and obtain some important results.

REFERENCES

[1] D.E. Blair, Contact manifolds in Riemannian geometry, Lecture Notes in Mathematics, Springer-Verlag, Berlin, (1976).

[2] K. Kenmotsu, A class of almost contact Riemannian manifolds, Tohoku Math. J., 24, 93-103, (1972).

[3] C.A. Mantica, Y.J. Suh, Pseudo $Q-$symmetric Riemannian manifolds, Int. J. Geom. Methods Mod. Phys., 10, 1-25, (2013).

[4] H. Özturk, , N. Aktan,, C. Murathan, On $\alpha-$Kenmotsu manifolds satisfying certain conditions, Applied sciences, 12, 115-126, (2010).

[5] G. Pitis, Geometry of Kenmotsu Manifolds: Publishing House of Transilvania University of Braşov, Braşov, (2007).

[6] D.L. Kıran Kumar, H.G .Nagaraja, D. Kumari, Concircular curvature tensor of Kenmotsu manifold admitting generalized Tanaka-Webster connection, J. Math. Comput. Sci., 9(4), 447-462, (2019).

[7] K. Yano, M. Kon, Structures on manifolds, Series in pure Mathematics, 3. World Scientific Publishing Co., Springer, (1984).

Aksaray university, Mathematics, Aksaray, Turkey
Email address: mustafayldrm24@gmail.com

Aksaray university, Mathematics, Aksaray, Turkey
Email address: ramazancinarkaya42@gmail.com

ON THE HADAMARD'S TYPE INEQUALITIES FOR EXPONENTIAL TYPE CO-ORDINATED CONVEX FUNCTIONS VIA FRACTIONAL INTEGRALS

FIRAS CUMAOĞLU, ABDULLAH AKKURT, AND HÜSEYIN YILDIRIM

0000-0001-9984-2467, 0000-0001-5644-1276 and 0000-0001-8855-9260

ABSTRACT

In this article, we introduce a new definition, which is called exponential type co-ordinated convexity. Using this definition, we have obtained some new fractional integral inequalities of the Hermite-Hadamard type. Our results generalize some of the existing studies in the literature.

Let us now consider a bidemensional interval $\Delta =: [a,b] \times [c,d]$ in $\mathbb{R}^2$ with $a < b$ and $c < d$. A function $f : \Delta \to \mathbb{R}$ will be called exponential type co-ordinated convex on Δ, for all $t, s \in [0,1]$ and $(x,y), (u,w) \in \Delta$, if the following inequality holds;

$$
\begin{aligned}
f\left(tx + (1-t)y, su + (1-s)w\right) \leq\ & (e^t - 1)(e^s - 1)f(x,u) \\
& + (e^{1-t} - 1)(e^s - 1)f(y,u) \\
& + (e^t - 1)(e^{1-s} - 1)f(x,w) \\
& + (e^{1-t} - 1)(e^{1-s} - 1)f(y,w).
\end{aligned}
$$

References

[1] M. Kadakal, İ. İşcan, Exponential type convexity and some related inequalities, J. Inequal. Appl., 1-9, (2020).

[2] S.S. Dragomir, On Hadamard's inequality for convex functions on the co-ordinates in a rectangle from the plane, Taiwanese J. Math., 4, 775-788, (2001).

[3] S.S. Dragomir, C.E.M. Pearce, Selected Topics on Hermite–Hadamard Inequalities and Applications, RGMIA Monographs, Victoria University, (2000).

[4] M.A. Latif, S.S.Dragomir, On some new inequalities for differentiable co-ordinated convex functions, J. Inequal. Appl., 1 (December), 1-13, (2012).

[5] S.G. Samko, A.A. Kilbas, O.I. Marichev, Fractional Integrals and Derivatives, Theory and Applications, Gordon and Breach, Yverdon et alibi, (1993).

[6] M.Z. Sarikaya, On the Hermite–Hadamard-type inequalities for co-ordinated convex function via fractional integrals, Integr. Transf. Spec. Funct., 25, 134-147, (2014).

DEPARTMENT OF MATHEMATICS, FACULTY OF SCIENCE AND ARTS, UNIVERSITY OF KAHRAMANMARAŞ SÜTÇÜ İMAM, 46100, KAHRAMANMARAŞ, TURKEY.
    Email address: firaselhaci1997@gmail.com

DEPARTMENT OF MATHEMATICS, FACULTY OF SCIENCE AND ARTS, UNIVERSITY OF KAHRAMANMARAŞ SÜTÇÜ İMAM, 46100, KAHRAMANMARAŞ, TURKEY.
    Email address: abdullahmat@gmail.com

DEPARTMENT OF MATHEMATICS, FACULTY OF SCIENCE AND ARTS, UNIVERSITY OF KAHRAMANMARAŞ SÜTÇÜ İMAM, 46100, KAHRAMANMARAŞ, TURKEY.
    Email address: hyildir@ksu.edu.tr

ON HERMITE-HADAMARD TYPE INEQUALITIES FOR CO-ORDINATED CONVEX FUNCTIONS VIA PROPORTIONAL FRACTIONAL INTEGRALS

ALI MUHAMMEDOĞLU, ABDULLAH AKKURT, AND HÜSEYIN YILDIRIM

0000-0001-6858-3466, 0000-0001-5644-1276 and 0000-0001-8855-9260

ABSTRACT

In this paper, we define proportional fractional integrals for continuous functions of two variables. Then, we prove the Hermite-Hadamard type inequalities for co-ordinated convex functions by using proportional fractional integrals. Many results obtained in this paper provide significant extensions of other related results given in the literature. Finally, we give some examples of our results.

References

[1] F. Jarad, T. Abdeljawad, S. Rashid, et al. More properties of the proportional fractional integrals and derivatives of a function with respect to another function, Adv. Differ Equ., 303 (2020).

[2] S.S. Dragomir, On Hadamard's inequality for convex functions on the co-ordinates in a rectangle from the plane, Taiwanese J. Math., 4, 775-788, (2001).

[3] S.S. Dragomir, C.E.M. Pearce, Selected Topics on Hermite-Hadamard Inequalities and Applications, RGMIA Monographs, Victoria University, (2000).

[4] M.A. Latif, S.S. Dragomir, On some new inequalities for differentiable co-ordinated convex functions, J. Inequal. Appl., 1 (December), 1-13, (2012).

[5] S.G. Samko, A.A. Kilbas, O.I. Marichev, Fractional Integrals and Derivatives, Theory and Applications, Gordon and Breach, Yverdon et alibi, (1993).

[6] M.Z. Sarikaya, On the Hermite–Hadamard-type inequalities for co-ordinated convex function via fractional integrals, Integr. Transf. Spec. Funct., 25, 134-147 (2014).

[7] M.Z. Sarikaya, Some inequalities for differentiable co-ordinated convex mappings, Asian-Eur. J. Math., 8, (2015).

[8] M.Z. Sarikaya, E. Set, M.E .Ozdemir, S.S. Dragomir, New some Hadamard's type inequalities for co-ordinated convex functions, Tamsui Oxford J. Inf. Math. Sci., 28, 137-152, (2012).

Department of Mathematics, Faculty of Science and Arts, University of Kahramanmaraş Sütçü İmam, 46100, Kahramanmaraş, Turkey.
  Email address: `alidna1992f@gmail.com`

Department of Mathematics, Faculty of Science and Arts, University of Kahramanmaraş Sütçü İmam, 46100, Kahramanmaraş, Turkey.
  Email address: `abdullahmat@gmail.com`

Department of Mathematics, Faculty of Science and Arts, University of Kahramanmaraş Sütçü İmam, 46100, Kahramanmaraş, Turkey.
  Email address: `hyildir@ksu.edu.tr`

NUMERICAL RANGES OF OPERATORS ON SOME SPACES

BÜŞRANUR ŞERAN AND ELIF DEMIR

0000-0001-6515-9301 and 0000-0001-5973-9115

ABSTRACT

Let $T \in B(H)$ be a bounded operator on a real or complex Hilbert space. Then we define its numerical range as

$$W(T) := \{<Tx, x>: x \in H, \|x\| = 1\}.$$

In this study, we will discuss the numerical range of operators on Hilbert space. We will characterize the numerical range and numerical radius of linear operators such as self-adjoint operators, normal operators, unitary operators and commuting operators.

References

[1] K. Havasréti, Numerical Ranges of Operators, Budapest, (2021).

[2] K. E. Gustafson, D. K. M. Rao, Numerical Range, The Field of Values of Linear Operators and Matrices, Springer-Verlag, New York, (1996).

[3] K. Mandal, A. Bhanja, S. Bag, K. Paul, On the Numerical Range of Operators on Some Special Banach Spaces, India, (2020).

Department of Mathematics, Faculty of Arts and Sciences, Istanbul, Turkey
Email address: busranur.seran@std.yildiz.edu.tr

Department of Mathematics, Faculty of Arts and Sciences, Istanbul, Turkey
Email address: edbilek@yildiz.edu.tr

ASYMPTOTIC REPRESENTATION OF SOLUTIONS OF THIRD-ORDER NONLINEAR IMPULSIVE DIFFERENTIAL EQUATIONS

SIBEL DOĞRU AKGÖL

0000-0003-3513-1046

ABSTRACT

In this work, we consider the third-order nonlinear impulsive differential equation of the form

$$(1) \quad \begin{cases} a(t)x''' + b(t)x'' + c(t)x' + d(t)x = f(t,x), & t \neq t_i, \quad i \in \mathbb{N}, \\ \Delta x' + a_i x' = f_i(x), & t = t_i, \\ \Delta x'' + b_i x' = g_i(x), & t = t_i. \end{cases}$$

We find sufficient conditions for existence of solutions of equation (1) satisfying an asymptotic representation. The main innovative aspect here is the use of principal and non-principal solutions of a related second-order homogeneous equation.

References

[1] S. Doğru Akgöl, A. Zafer, Prescribed asymptotic behavior of second-order impulsive differential equations via principal and nonprincipal solutions, J. Math. Anal. Appl., 503, 2, (2021).

[2] P. Hartman. Ordinary differential equations, SIAM, Philadelphia, 2002.

[3] W. Kelley, A. Peterson, The theory of differential equations: Classical and qualitative, Pearson Education, Inc., (2004).

Department of Mathematics, Faculty of Arts and Science, Ankara, Turkey
Email address: sibel.dogruakgol@atilim.edu.tr

RADON TRANSFORM OF FUZZY BASIS FUNCTIONS

ZEKERIYA USTAOGLU

0000-0001-7941-2507

ABSTRACT

Algebraic iterative methods on the inversion of Radon transform [1] are applied
to the discrete versions of the reconstruction problems. In the discretization pro-
cess, instead of the standard pixel basis functions, we consider the basis functions
defined via fuzzy basic functions [2], such as the triangular or the sinusoidal basic
functions, and we provide the evaluation of the Radon transform of thus defined
basis functions. We also give a numerical approximation procedure and some im-
plementations on the solution of reconstruction problem. The results are compared
with the ones obtained by some other existing inversion methods [3].

References

[1] J. Radon, Über die Bestimmung von Funktionen durch ihre Integralwerte längs gewisser
 Mannigfaltigkeiten, Ber. Verh. Sächs Akad. 69, 262-277, (1917).

[2] I. Perfilieva, Fuzzy transforms: Theory and applications, Fuzzy Sets and Systems, 157,
 993-1023, (2006).

[3] F. Natterer, The Mathematics of Computerized Tomography, Wiley, Teubner, Stuttgart,
 (1986).

Department of Mathematics, Faculty of Arts and Sciences, Zonguldak Bülent Ecevit
University, Zonguldak, Türkiye
 Email address: zekeriyaustaoglu@beun.edu.tr

ON THE SOLUTION OF AN INTEGRAL GEOMETRY PROBLEM OVER FAMILY OF PARABOLOIDS

ZEKERIYA USTAOGLU

0000-0001-7941-2507

ABSTRACT

The problems of integral geometry consist in determining a function by its given integrals of this function over a family of manifolds [1]. In this paper, we consider the problem of determining a function from the integrals of it over some families of circular paraboloids of which focal lengths and directions of symmetry axes are fixed, without any restriction on their vertices [2]. We obtain some inversion formulas with a method based on the Fourier transform and the solution of a first kind Volterra integral equation [3]. We also present an example on the numerical reconstruction of unknown function by using the obtained inversion formulas.

References

[1] I.M. Gelfand, S.G. Gindikin, M.I. Graev, Selected Topics in Integral Geometry, AMS, Providence, RI, (2003).

[2] A.L. Bukhgeim, On some problems of integral geometry, Siberian Mathematical Journal, 13, 23-29, (1972).

[3] A.D. Polyanin, A.V. Manzhirov, Handbook of Integral Equations, Chapman-Hall/CRC Press, Boca Raton and London (2008).

Department of Mathematics, Faculty of Arts and Sciences, Zonguldak Bülent Ecevit University, Zonguldak, Türkiye
    Email address: zekeriyaustaoglu@beun.edu.tr

ON A SOLVABLE THREE-DIMENSIONAL SYSTEMS OF DIFFERENCE EQUATIONS WITH CONSTANT COEFFICIENTS

İBRAHIM ERDEM AND YASIN YAZLIK

0000-0001-7954-2395 and 0000-0001-6369-540X

ABSTRACT

In this paper, we consider the following three-dimensional system of difference equations

$$x_n = \frac{x_{n-k}y_{n-l}}{bx_{n-k} + ay_{n-k-l}}, \ y_n = \frac{y_{n-k}z_{n-l}}{dy_{n-k} + cz_{n-k-l}}, \ z_n = \frac{z_{n-k}x_{n-l}}{fz_{n-k} + ex_{n-k-l}}, \ n \in \mathbb{N}_0,$$

where the parameters a, b, c, d, e, f and the initial values $x_{-i}, y_{-i}, z_{-i}, i \in \{1, 2, ..., k+l\}$, are real numbers, and solve the system of difference equations in closed form. Also, we determine the asymptotic behavior of solutions and the forbidden set of the initial values by using the obtained formulas.

References

[1] M. El-Dessoky , E. Elsayed, On a solution of system of three fractional difference equations, Journal of Computational Analysis and Applications 2015; 19(4), 760-769, (2015).

[2] E.M. El-Metwally, H.A. El-Metwally, Elsayed E.M. Global behavior of the solutions of some difference equations, Advances in Difference Equations, 28, 1-16, (2011)

[3] H. El-Metwally, Solutions form for some rational systems of difference equations, Discrete Dynamics in Nature and Society, 903593, (2013).

[4] Y. Yazlik, D.T. Tollu, Taskara N. On the solutions of a three-dimensional system of difference equations, Kuwait Journal of Science, 43(1), 95-111, (2016).

[5] M. Kara, Y. Yazlik, D.T. Tollu, Solvability of a system of higher order nonlinear difference equations, Hacettepe Journal of Mathematics and Statistics, 49(5), 1566-1593, (2020).

[6] M. Kara, Y. Yazlik, Solvability of a nonlinear three-dimensional system of difference equations with constant coefficients, Mathematica Slovaca, 71(5), 1133-1148, (2021).

---

[7] M. Kara, Y. Yazlik, On a solvable three-dimensional system of difference equations, Filomat, 34(4), 1167-1186, (2020).

Department of Mathematics, Faculty of Science and Art, Nevsehir, Turkey
   Email address: ibrahimerdem64@gmail.com

Department of Mathematics, Faculty of Science and Art, Nevsehir, Turkey
   Email address: yyazlik@nevsehir.edu.tr

ON THE STRUCTURE OF T-NORMS AND T-CONORMS ON BOUNDED LATTICES

GÜL DENIZ ÇAYLI

0000-0002-7918-9752

ABSTRACT

In this article, we first present some approaches for creating triangular norms in a bounded lattice $\mathbb{L}$ from triangular subnorms allowed to act in the subinterval of the lattice. Next, we develop a method for enhancing the triangular superconorm in the subinterval of $\mathbb{L}$ to triangular conorms on the bounded lattice $\mathbb{L}$. Furthermore, illustrative examples were supplied to help understand the newly added triangular norms and triangular conorms.

REFERENCES

[1] G. Birkhoff, Lattice Theory, American Mathematical Society Colloquium Publishers, Providence, RI (1967).

[2] G. D. Çaylı, On A New Class of T-norms and T-conorms on Bounded Lattices, Fuzzy Sets and Systems, 332, 129-143, (2018).

[3] G. D. Çaylı, On Generating of T-norms and T-conorms on Bounded Lattices, International Journal of Uncertainty, Fuzziness and Knowledge-Based Systems, 28, 807-835, (2020).

[4] Ü. Ertuğrul, F. Karaçal, R. Mesiar, Modified Ordinal Sums of Triangular Norms and Triangular Conorms on Bounded Lattices, International Journal of Intelligent Systems, 30, 807-817, (2015).

[5] W. Ji, Constructions of Uninorms on Bounded Lattices by means of T-subnorms and T-subconorms, Fuzzy Sets and Systems, 403, 38-55, (2021).

[6] J. Medina, Characterizing when An Ordinal Sum of Triangular Norms is A Triangular Norm on Bounded Lattices, Fuzzy Sets and Systems, 202, 75-88, (2012).

[7] S. Saminger, On Ordinal Sums of Triangular Norms on Bounded Lattices, Fuzzy Sets and Systems, 157, 1403-1416, (2006).

Department of Mathematics, Faculty of Science, Karadeniz Technical University, 61080 Trabzon, Turkey
  Email address: guldeniz.cayli@ktu.edu.tr

DISCRETIZATION AND STABILITY ANALYSIS OF A CONFORMABLE FRACTIONAL ORDER COVID-19 MODEL

GÜVEN KAYA

0000-0003-0411-5633

Abstract. This work aims to examine the complex behaviors of a conformable fractional order predator-prey model. For this purpose, two-dimensional discrete system of the model is created by using of a discretization process based on the use of piecewise constant arguments. Then, we use the Schur-Cohn criterion to obtain the necessary and sufficient conditions for the stability of the equilibrium points. Finally, numerical simulations are used to show that the analytical results are correct.

References

[1] H. Dai,Z. Zheng, Z., W. Wang, A new fractional wavelet transform, Communications in Nonlinear Science and Numerical Simulation, 44, 19-36, (2017).

[2] Zheng, Z., Dai, H. A new fractional equivalent linearization method for nonlinear stochastic dynamic analysis, Nonlinear Dynamics, 91(2), 1075-1084, (2018).

[3] A. Ortega, J.J. Rosales, J.M. Cruz-Duarte, M. Guia, Fractional model of the dielectric dispersion, Optik, 180, 754-759, (2019).

Department of Mathematics, Faculty of Arts and Sciences, Bingol University, Bingol,Turkey
Email address: gkaya@bingol.edu.tr

CHAOTIC OUTPUTS AND CHAOS CONTROL OF A DISCRETIZED MATHEMATICAL MODEL

GÜVEN KAYA

0000-0003-0411-5633

ABSTRACT

This study deals with the analysis of a model consisting of systems of differential equations with piecewise constant arguments. A discrete version of the system is obtained by using piecewise constant arguments. Using the Schur-Cohn criterion and a Lyapunov function, we obtain necessary and sufficient conditions for the positive equilibrium point to be locally asymptotic. Then, center manifold theorem and the bifurcation theory are used to examine the bifurcations that occur in the discrete dynamical system. Moreover, bifurcation occurring in the discrete system is controlled using the OGY method and exponential type chaos control strategy. Finally, all of these analytical results are confirmed with the help of numerical simulations.

References

[1] S. Kartal, Multiple bifurcations in an early brain tumor model with piecewise constant arguments. International Journal of Biomathematics, 11(04), 1850055, (2018).

[2] S.N. Elaydi, Discrete chaos: with applications in science and engineering. Chapman and Hall/CRC, (2007)

[3] E. Ott, C. Grebogi, J.A. Yorke, Erratum:Controlling chaos, Physical Review Letters,64(23), 2837, (1990).

[4] Q. Din, A novel chaos control strategy for discrete-time Brusselator models, J. Math. Chem., 56(10), 3045–3075, (2018).

Department of Mathematics, Faculty of Arts and Sciences, Bingol University, Bingol,Turkey
   Email address: gkaya@bingol.edu.tr

ON SPHERICAL INVERSIONS IN THREE DIMENSIONAL DD-SPACE

EMİNE ÇİÇEK AND ZEYNEP CAN

0000-0003-2656-5555 and 0000-0002-4856-1486

ABSTRACT

In this paper we introduce inversion with respect to a sphere in Disdyakis Dodecahedron space and we study on general properties and basic concepts of this transformation. Additionally investigate some properties such as cross ratio and harmonic conjugates and inverses of lines, planes and Disdyakis Dodecahedron spheres in $\mathbb{R}^3_{DD}$ under an inversion with respect to a Disdyakis Dodecahedron sphere.

References

[1] H. Minkowski. Gesammelte Abhandlungen, Chelsa Publishing Co. New York, (1967).

[2] B.C. Patterson, The origins of the Geometric Principle of Inversion, Isis, 19(1), 154-180, (1933).

[3] D. Blair, Inversion Theory and Conformal Mapping, Student Mathematical Library, American Mathematical Society, (2000).

[4] N. Childress, Inversion with respect to the central conics, Math. Mag., 38(3), (1965).

[5] J. Ramirez, Inversions in an ellipse, Forum Geom., 14, 107-115, (2014).

[6] J. Ramirez, G. Rubiano, A geometrical construction of inverse points with respect to an ellipse, Int. J. Math. Ed. Sci. Tech., 45(8), 1254-1259, (2014).

[7] A. Bayar, S. Ekmekçi, On circular inversions in taxicab plane, J. Adv. Res. Pure Math., 6, 33-39, (2014).

[8] J. A. Nickel, A Budget of inversion, Math. Comput. Modelling, 21, 87-93, (1995).

[9] Ö. Gelişgen, T. Ermiş, Properties of inversions in the alpha plane of some inversions, Forum Geometricorum, 19, 1-9, (2019).

---

[10] M. Özcan, R. Kaya, On the ratio of directed lengths in the taxicab plane and related properties, Missouri Journal of Mathematical Sciences, 14(2), 107 - 117, (2002).

[11] A. C. Thompson, Minkowski Geometry, Cambridge University Press, (1996).

DEPARTMENT OF MATHEMATICS, FACULTY OF SCIENCE AND LETTERS, AKSARAY, TÜRKİYE
Email address: cicekemine51@gmail.com

DEPARTMENT OF MATHEMATICS, FACULTY OF SCIENCE AND LETTERS, AKSARAY, TÜRKİYE
Email address: zeynepcan@aksaray.edu.tr

OPTICAL SOLITONS OF THE PERTURBED GERDJIKOV-IVANOV EQUATION WITH SPATIO-TEMPORAL DISPERSION AND ITS MODULATION INSTABILITY

KALTHAM K. AL-KALBANI, K. S. AL-GHAFRI, E. V. KRISHNAN, AND ANJAN BISWAS

0000-0001-9190-8484, 0000-0002-4392-0742, 0000-0002-0084-7290 and 0000-0002-8131-6044

ABSTRACT

In this paper, we focus on the investigating of the optical solitons to perturbed Gerdjikov–Ivanov (GI) equation in optical fibers. The complex form of perturbed GI equation is reduced to a nonlinear ordinary differential equation (ODE) bu Using traveling wave transformation. Different types of solutions such as bright, kink and singular optical soliton structures are obtained after solving the ODE analytically by applying the improved projective Riccati equations method. Furthermore, W-shaped, kink-dark and singular-kink waves are obtained under specific values for the physical parameters in the model. The existence conditions of all optical solitons are presented. In addition, the behaviors of some optical solitons are represented graphically in this paper by selecting suitable amounts for the physical parameters. Besides, the modulation instability of the perturbed GI equation is reported.

References

[1] C.H. Gu, Soliton theory and its applications, Springer-Verlag, Berlin,(1995).

[2] K.Lonngren, Soliton experiments in plasmas, Plasma Physics, 25(9), 943-982, (1983).

[3] M. Helal, Soliton solution of some nonlinear partial differential equations and its applications in fluid mechanics, Chaos, Solitons & Fractals, 13(9), 1917-1929, (2002).

[4] L. Mollenauer, J. Gordon, Solitons in optical fibers: fundamentals and applications, Elsevier, (2006).

[5] N. Doran, K. Blow, Solitons in optical communications, IEEE journal of quantum electronics, 19(12), 1883-1888, (1983).

[6] A. Hasegawa. Soliton-based optical communications: An overview, IEEE Journal of Selected Topics in Quantum Electronics, 6(6), 1161–1172, (2000).

[7] B. Malomed, Optical solitons and vortices in fractional media: A mini-review of recent results, In Photonics, Multidisciplinary Digital Publishing Institute, (2021).

[8] M. Arshad, A. Seadawy, D.Lu, W. Jun. Optical soliton solutions of unstable nonlinear schröodinger dynamical equation and stability analysis with applications, Optik, 157, 597-605, (2018).

[9] M. Ekici, A. Sonmezoglu, Q.Zhou, S. Moshokoa, M. Ullah, A. Arnous, A.Biswas, M. Belic, Analysis of optical solitons in nonlinear negative-indexed materials with anti-cubic nonlinearity, Optical and Quantum Electronics, 50(2), 1-10, (2018).

[10] W. Liu, Y. Zhang, H. Triki, M. Mirzazadeh, M. Ekici, Q. Zhou, A. Biswas, M. Belic, Interaction properties of solitonics in inhomogeneous optical fibers, Nonlinear Dynamics, 95(1), 557-563, (2019).

[11] K. Al-Ghafri, E. Krishnan, Optical solitons in metamaterials dominated by anti-cubic non-linearity and hamiltonian perturbations, International Journal of Applied and Computational Mathematics, 6(5), 1-20, (2020).

[12] K. Al-Ghafri, E. Krishnan, A. Biswas, W-shaped and other solitons in optical nanofibers, Results in Physics, 23, (2021).

[13] K. Al Kalbani, KS. Al-Ghafri, E. Krishnan, A. Biswas, Pure-cubic optical solitons by jacobi's elliptic function approach, Optik, 243, (2021).

[14] H. Susanto, B. Malomed, Embedded solitons in second-harmonic-generating lattices, Chaos, Solitons & Fractals, 142, (2021).

[15] L. Zeng, D. Mihalache, B.Malomed, X. Lu, Y. Cai, Q. Zhu,J. Li. Families of fundamental and multipole solitons in a cubic-quintic nonlinear lattice in fractional dimension. Chaos, Solitons & Fractals, 144, (2021).

[16] S. Arshed, Two reliable techniques for the soliton solutions of perturbed gerdjikov–ivanov equation, Optik, 164, 93-99, (2018).

[17] A. Biswas, R. Alqahtani, Chirp-free bright optical solitons for perturbed gerdjikov–ivanov equation by semi-inverse variational principl, Optik, 147:72-76, (2017).

[18] A. Biswas, M. Ekici, A. Sonmezoglu, F.B. Majid, H. Triki, Q. Zhou, S.P. Moshokoa, M. Belic, Optical soliton perturbation for gerdjikov-ivanov equation by extended trial equation method, Optik, 158, 747-752, (2018).

[19] S. Arshed, A. Biswas, M. Abdelaty, Q. Zhou, S.P. Moshokoa, M. Belic, Optical soliton perturbation for gerdjikov-ivanov equation via two analytical techniques, Chinese Journal of Physics, 56(6), 2879-2886, (2018).

[20] K. Hosseini, M. Mirzazadeh, M. Ilie, S. Radmehr, Dynamics of optical solitons in the perturbed gerdjikov-ivanov equation, Optik, 206, (2020).

[21] B. Ghanbari, D. Baleanu. New optical solutions of the fractional gerdjikov-ivanov equation with conformable derivative, Frontiers in Physics, 8, 167, (2020).

[22] J. Manafian, M. Lakestani. Optical soliton solutions for the gerdjikov–ivanov model via tan $(\phi/2)$-expansion method, Optik, 127(20), 9603-9620, (2016).

[23] N.Kadkhoda, H. Jafari, Analytical solutions of the gerdjikov-ivanov equation by using exp (- φ (ξ))-expansion method, Optik, 139, 72-76, (2017).

[24] A. Biswas, Y. Yıldırım, E. Yaşar, M.M. Babatin, Conservation laws for gerdjikov-ivanov equation in nonlinear fiber optics and pcf, Optik, 148, 209-214, (2017).

[25] H. Triki, R.T. Alqahtani, Q. Zhou, A. Biswas, New envelope solitons for gerdjikov-ivanov model in nonlinear fiber optics, Superlattices and Microstructures, 111, 326-334, (2017).

[26] A. Biswas, M. Ekici, A. Sonmezoglu, H.Triki, A.S. Alshomrani, Q. Zhou, S.P. Moshokoa, M. Belic, Optical solitons for gerdjikov-ivanov model by extended trial equation scheme. Optik, 157, 1241-1248, (2018).

[27] A.J.M. Jawad, A. Biswas, M. Abdelaty, Q. Zhou, S.P. Moshokoa, M. Belic, Chirped singular and combo optical solitons for gerdjikov-ivanov equation using three integration forms, Optik, 172, 144-149, (2018).

[28] A. Biswas, Y.Yildirim, E. Yasar, H. Triki, A.S. Alshomrani, M. Z. Ullah, Q. Zhou, S.P. Moshokoa, M. Belic, Solitons for perturbed gerdjikov–ivanov equation in optical fibers and pcf by extended kudryashov's method, Optical and Quantum Electronics, 50(3), 1-13, (2018).

[29] A. Biswas, Y.Yildirim, E. Yasar, H. Triki, A.S. Alshomrani, M. Z. Ullah, Q. Zhou, S.P. Moshokoa, M. Belic, Optical soliton perturbation with full nonlinearity for gerdjikov–ivanov equation by trial equation method, Optik, 157, 1214-1218, (2018).

[30] A. Biswas, Y.Yildirim, E. Yasar, H. Triki, A.S. Alshomrani, M. Z. Ullah, Q. Zhou, S.P. Moshokoa, M. Belic, Optical soliton perturbation with gerdjikov–ivanov equation by modified simple equation method, Optik, 157, 1235-1240, (2018).

[31] L. Kaur, A.M. Wazwaz, Optical solitons for perturbed gerdjikov–ivanov equation, Optik, 174, 447-451, (2018).

[32] E. Yaşar, Y. Yıldırım, E. Yaşar, New optical solitons of space-time conformable fractional perturbed gerdjikov-ivanov equation by sine-gordon equation method, Results in Physics, 9, 1666-1672, (2018).

DEPARTMENT OF MATHEMATICS, SULTAN QABOOS UNIVERSITY, P.O.BOX 36, AL-KHOD 123, MUSCAT, OMAN
Email address: s109970@student.squ.edu.om

UNIVERSITY OF TECHNOLOGY AND APPLIED SCIENCES, P.O. BOX 14, IBRI 516, OMAN
Email address: khalil.ibr@cas.edu.om

DEPARTMENT OF MATHEMATICS, SULTAN QABOOS UNIVERSITY, P.O.BOX 36, AL-KHOD 123, MUSCAT, OMAN
Email address: krish@squ.edu.om

DEPARTMENT OF PHYSICS, CHEMISTRY AND MATHEMATICS, ALABAMA A&M UNIVERSITY, NORMAL, AL 35762-4900, USA, MATHEMATICAL MODELING AND APPLIED COMPUTATION (MMAC) RESEARCH GROUP, DEPARTMENT OF MATHEMATICS, KING ABDULAZIZ UNIVERSITY, JEDDAH-21589, SAUDI ARABIA, DEPARTMENT OF APPLIED MATHEMATICS, NATIONAL RESEARCH NUCLEAR UNIVERSITY, 31 KASHIRSKOE HWY, MOSCOW-115409, RUSSIAN FEDERATION, DEPARTMENT OF MATHEMATICS AND APPLIED MATHEMATICS, SEFAKO MAKGATHO HEALTH SCIENCES UNIVERSITY, MEDUNSA-0204, PRETORIA, SOUTH AFRICA
Email address: biswas.anjan@gmail.com

COMPLEXITY ANALYSIS OF AN EPIDEMIC MODEL WITH INDIRECT TRANSMISSION

FATIHA NAJM, R. YAFIA, M. A. AZIZ ALAOUI, AND A. AGHRICHE

0000-0001-8438-5793, 0000-0002-9824-9036 and 0000-0001-5198-4597 and 0000-0003-2226-8430

ABSTRACT

We propose an new epidemic model which describes the dynamics of spreading diseases by two modes of transmission : direct and indirect. The model is given by a system of ordinary differential equations with two delays, the first describes the latendy period and the second describes the time needed for a susceptible individual to become infective by indirect contact. Our aim is to analyse mathematically this model, we compute the basic reproduction number and study the asymptotic behaviours, global stability, bifurcation and determine the most sensitive parameters. Numerical simulations are carried out to illustrate the theoretical part.

References

[1] B. Alnseba, B. Chahrazed, M. Pierre, A model for ovine brucellosis incorporating direct and indirect transmission, J. Biol. Dyn., 4, 2-11, (2010).

[2] C.T. Codeço, Endemic and epidemic dynamics of cholera: the role of the aquatic reservoir, BMC Infect. Dis., 1(1), (2001).

[3] M.J. Corbel, Brucellosis in Humans and Animals, World Health Organization, (2006).

[4] S.F. Dowell, Seasonal variation in host susceptibility and cycles of certain infectious diseases, Emerg. Infect. Dis. 7 (2001) 369–374.

[5] M.C. Eisenberga, Z.S. Shuai, J.H. Tien, P. van den Driessche, A cholera model in a patchy environment with water and human movement, Math. Biosci., 246, 105–112, (2013).

[6] H. Guo, M.Y. Li, Z. Shuai, Global stability of the endemic equilibrium of multigroup SIR epidemic models, Can. Appl. Math. Q., 14, 259–284, (2006).

Department of Mathematics Faculty of Sciences, Ibn Tofail University, Campus Universitaire, Kenitra, Morocco.

Email address: `fatiha.najm@uit.ac.ma`

Department of Mathematics Faculty of Sciences, Ibn Tofail University, Campus Universitaire, Kenitra, Morocco.

Email address: `radouane.yafia@uit.ac.ma`

Normandie Univ, France; ULH, LMAH, F-76600 Le Havre; FR-CNRS-3335, ISCN, 25 rue Ph. Lebon, 76600 Le Havre, France.

Email address: `aziz.alaoui@univ-lehavre.fr`

Department of Mathematics and Computer Science National School of Applied Sciences Sultan Moulay Slimane University Beni Amir, B.P. 8106 25000 Khouribga, Morocco

Email address: `a.aghriche@usms.ma`

THE LAPLACE TRANSFORM FOR QUANTUM CALCULUS ON FINITE INTERVALS

MEHMET ÇAĞRI YILMAZER, SERTAC GOKTAS, EMRAH YILMAZ, AND MIKAIL ET

0000-0001-9784-838X, 0000-0001-7842-6309, 0000-0002-7822-9193 and 0000-0001-8292-7819

ABSTRACT

Quantum calculus is the present name for the investigation of calculus without limits. In recent times, it attracts a lot of attention in mathematics that models quantum computing. $q-$calculus appeared as a link between mathematics and physics. It has a lot of applications in many areas such as number theory, combinatorics, orthogonal polynomials, hypergeometric functions, quantum, mechanics, and relativity theories [1, 6, 9]. $q-$exponential and $q-$trigonometric functions are improved in [7]. Ahmad et.al. [2] gave a study of second-order $q-$difference equations with boundary conditions. Yu and Wang [12] proved existence of solutions for nonlinear second-order $q-$difference equations with first-order $q-$derivatives. Alp and Sarıkaya [5] defined features of quantum integral($q-$integral).

q_k-calculus is a much more general form of quantum calculus. Tariboon and Ntouyas [10] initiated the study of quantum calculus on finite intervals and defined q_k-derivative and q_k-integral of any function. They defined q_k-derivative of a function $f : [t_k, t_{k+1}] \to \mathbb{R}$ and its essential properties such as derivative of a sum, a product or a quotient of two functions. Furthermore, they defined q_k-integral and demonstrated its fundamental properties [11].

In this study, we present q_k-Laplace transform by q_k-integral on quantum integral. We give some properties of q_k-Laplace transform. The q_k-Laplace transforms of some common functions are calculated.

The papers [3, 4, 8] to which the present study is related.

References

[1] B. Ahmad, Boundary-value problems for nonlinear third-order $q-$difference equations, Electronic Journal of Differential Equations, 94(1), 1-7, (2011).

[2] B. Ahmad, A. Alsaedi, S.K. Ntouyas, A study of second-order $q-$difference equations with boundary conditions, Advances in difference equations, 2012(1), 1-10, (2012).

[3] B. Ahmad, A. Alsaedi, S.K. Ntouyas, J. Tariboon, F. Alzahrani, Nonlocal boundary value problems for impulsive fractional q_k-difference equations, Advances in Difference Equations, 2016(1), 1-16, (2016).

[4] B. Ahmad, S.K. Ntouyas, J. Tariboon, Quantum calculus: New concepts, impulsive IVPs and BVPs, inequalities, New York: World Scientific, (2016).

[5] N. Alp, M.Z. Sarıkaya, A new definition and properties of quantum integral which calls $\overline{q}-$integral, Konuralp Journal of Mathematics, 5(2), 146-159, (2017).

[6] M. Bohner and T. Hudson, Euler-type boundary value problems in quantum calculus, International Journal of Applied Mathematics and Statistics, 9(J07), 19-23 (2007).

[7] J.L. Cieśliński, Improved $q-$exponential and $q-$trigonometric functions, Applied Mathematics Letters, 24(12), 2110-2114, (2011).

[8] R. Diaz, C. Teruel, q_k-Generalized Gamma and Beta Functions, Journal of Nonlinear Mathematical Physics, 12(1), 118-134, (2005).

[9] V. Kac, P. Cheung, Quantum calculus, New York: Springer, (2002).

[10] J. Tariboon, S.K. Ntouyas, Quantum calculus on finite intervals and applications to impulsive difference equations, Advances in Difference Equations, 2013(1), 1-19, (2013).

[11] J. Tariboon, S.K. Ntouyas, Quantum integral inequalities on finite intervals, Journal of Inequalities and Applications, 2014, 121, (2014).

[12] C. Yu, J. Wang, Existence of solutions for nonlinear second-order $q-$difference equations with first-order $q-$derivatives, Advances in Difference Equations, 2013(1), 1-11, (2013).

Department of Mathematics, Faculty of Science, Firat University, 23119, Elazig, Turkey
    Email address: mcagriyilmazer@gmail.com

Department of Mathematics, Faculty of Science and Letters, Mersin University, 33343, Mersin, TURKEY
    Email address: srtcgoktas@gmail.com

Department of Mathematics, Faculty of Science, Firat University, 23119, Elazig, Turkey
    Email address: emrah231983@gmail.com

Department of Mathematics, Faculty of Science, Firat University, 23119, Elazig, Turkey
    Email address: mikailet68@gmail.com

THE CONFORMABLE LAPLACE TRANSFORM ON TIME SCALES AND ITS SOME APPLICATIONS

GÖZDE ÖZLÜ, ASLI ÖNER, AND SERTAC GOKTAS

0000-0002-4521-4040 , 0000-0002-4799-9574 and 0000-0001-7842-6309

ABSTRACT

In the classical case, Laplace transform is a valuable tool to solve linear differential equations, and it plays a crucial role in mathematics and engineering. Detailed information on the general structure of the Laplace transform in the classical situation can be found in Schiff's study [8].

Laplace transform on time scale was firstly considered to unify continuous Laplace transform and discrete $\mathcal{Z}$-transform in [7]. For arbitrary time scales, Laplace transform was investigated by Bohner and Peterson [6]. The various forms of Laplace transform on time scale were studied in detail by many authors in literature [3–5].

The conformable Laplace transform, which helps us to solve some important problems and fractional differential equations were introduced by Abdeljawad [1](see also [9]). On the other hand, conformable dynamic equations on time scales are introduced in the book [2]. Here, some solution methods of these equations are examined. Conformable Laplace transform used in one of these methods is introduced for the solutions of the initial value problems established with these equations.

In this study, we consider again the conformable Laplace transform on time scales. We prove some properties of its and apply them to a few initial value problems. Moreover, we compare them with the classical Laplace transform and the conformable Laplace transform.

References

[1] T. Abdeljawad, On conformable fractional calculus, Journal of Computational and Applied Mathematics, 279, 57–66, (2015).

[2] D.R. Anderson, S.G. Georgiev, Conformable Dynamic Equations on Time Scales, Chapman and Hall/CRC., (2020).

[3] M. Bohner, G.Sh. Guseinov, The convolution on time scales, Abstract and Applied Analysis, 1-24, (2007).

[4] M. Bohner, G.Sh. Guseinov, B. Karpuz, Properties of the Laplace transform on time scales with arbitrary graininess, Integral Transforms and Special Functions, 22(11), 785-800, (2011).

[5] M. Bohner, G.Sh. Guseinov, A. Peterson, Further properties of the Laplace transform on time scales with arbitrary graininess, Integral Transforms and Special Functions, 24(4), 289-301, (2013).

[6] M. Bohner, A. Peterson, Laplace transform and $\mathcal{Z}-$transform: Unification and Extension, Methods and Applications of Analysis, 9(1), 151-158, (2002).

[7] S. Hilger, Special functions, Laplace and Fourier transform on measure chains, Dynamic Systems and Applications, 8(3-4), 471-488, (1999).

[8] J.L. Schiff, The Laplace transform: theory and applications (Undergraduate Texts in Mathematics Springer), New York: Springer, (1999).

[9] J. Younis, B. Ahmed, M. AlJazzazi, R. Al Hejaj, H. Aydi, Existence and Uniqueness Study of the Conformable Laplace Transform, Journal of Mathematics, Article ID 4554065, 1-7, (2022).

Department of Mathematics, Faculty of Science and Letters, Mersin University, 33343, Mersin, TURKEY
    Email address: gozdeozlu@outlook.com

Department of Mathematics, Faculty of Science and Letters, Mersin University, 33343, Mersin, TURKEY
    Email address: aslioner98@gmail.com

Department of Mathematics, Faculty of Science and Letters, Mersin University, 33343, Mersin, TURKEY
    Email address: srtcgoktas@gmail.com

ON FAITHFUL REPRESENTATIONS OF Q-DEFORMED TAVIS-CUMMINGS MODEL

LATIF A-M. HANNA , ABDULLAH ALAZEMI, AND ANWAR AL-DHAFEERI

0000-0001-8227-7123, 0000-0001-9383-3121 and 0000-0003-4079-3642

ABSTRACT

Consider the q-deformed Lie algebra, $t_q : [K_+, K_-]_q = rK_0, [K_0, K_+]_q = sK_+, [K_-, K_0]_q = sK_-, [K_*, K_+]_q = tK_+, [K_-, K_*]_q = tK_-$ and $[K_0, K_*]_q = (1 - q)K_0K_*$, where $r, s, t \in \mathbb{R} - \{0\}$, subject to the physical properties: K_0 and K_* are real diagonal operators, and $K_- = K_+^\dagger$, ($\dagger$ is for Hermitian conjugation), whose Hamiltonian is $H = \omega_1 K_0 + (\omega_1 + \omega_2) K_* + \lambda(T) \left(K_- e^{i\phi} + K_+ e^{-i\phi}\right)$ (λ is a time-dependent coupling parameter). The q-deformed Lie algebra, t_q is introduced as a generalized model of the Tavis-Cummings model cite: Tavis and cite: TavisAbdullhalBashir, namely: $[K_1, K_2] = K_3, [K_3, K_1] = 2K_1, [K_3, K_2] = -2K_2, [K_4, K_1] = -K_1, [K_4, K_2] = K_2$ and $[K_3, K_4] = 0$, subject to the physical properties K_3 and K_4 are real diagonal operators and $K_2 = K_1^\dagger$, whose Hamiltonian is $H = \omega_1 K_3 + (\omega_1 + \omega_2) K_4 + \lambda(T) \left(K_2 e^{i\phi} + K_1 e^{-i\phi}\right)$.

Faithful matrix representations of least degree of t_q are discussed and conditions are given to guarantee the existence of the faithful representations. The Tavis-Cummings model is itself an extension of the model of the double quantized harmonic oscillator generated by K_+, K_- and K_0.

REFERENCES

[1] A. Algin, A comparative study on q-deformed Fermion oscillators, Int. J. Theor. Phys., 50, 1554-1568, (2011) .

[2] S. Steinberg, Applications of the Lie algebraic formulas of Baker, Campbell, Hausdorff, and Zassenhaus to the calculation of explicit solutions of partial differential equations, J. Differential Equations, 26(3), 404-434, (1997) .

[3] S. Steinberg, Lie series, Lie transformations, and their applications, Lie Methods in Optics, J.S. Mondragón and K.B. Wolf, (eds.), Lecture Notes in Phys., Springer (250) 45-103, (1986).

[4] J. C. Spreeuw and J. P. Woerdman "Optical Atoms", Progress in Optics, 31, 263-319, (1993).

[5] L. A-M. Hanna, On the classification of the Lie algebras ", Linear Algebra and its Applications, 370, 251-256, (2003).

[6] Latif Hanna, Rania Alharbey, Sebawe Abdalla, Shoukry Hassan, Algebraic Method of Solution of Schrödinger's Equation of a Quantum Model, WSEAS Transactions on Mathematics, 19(43), 421-429, 2020.

[7] L. A-M. Hanna, M. E. Khalifa, S. S. Hassan, On representations of Lie algebras for quantized Hamiltonians, Linear Algebra Appl. 266, 69-79, 1997.

[8] L. A-M. Hanna, S.S. Hassan, On matrix representations of deformed Lie algebras, Int. J. Theol. Phys., Group Th. and Nonlinear Opt., 13 (2010), 137-143.

[9] L. A-M. Hanna, On faithful matrix representations of q-deformed Lie algebra for coupled quantized oscillators, International Journal of Applied Mathematics, IJAM, Vol. 33 (6), 1083-1098, (2020).

[10] A. B. Klimov, J.L. Romero, An algebraic solution of Lindblad-type master equation, J. Opt. B: Quantum Semiclass. Opt., 5, S316-S321, (2003) .

[11] L.A-M. Hanna, On representations of Lie algebras of a generalized Tavis-Cummings model, J. Appl. Math., 1,55-64, (2003).

[12] L. A-M. Hanna, A deformed Tavis-Cummings model and its matrix representation, JP J. of Algebra, Number Theory and Applications, 35, 49-65, (2014).

[13] V.P. Karassiov, New Lie-algebraic structures in nonlinear problems of quantum optics and laser physics, J. of Soviet Laser Research, 13, 188-195, (1992).

[14] V.P. Karassiov, G-invariant polynomial extensions of Lie algebras in quantum many-body physics, J. Phys. A: Math. Gen., 27 153-165, (1994).

[15] W. S. Chung, H. Hassanabadi, q-deformed quantum mechanics based on the q-addition, Advanced Science News, Fortschr. Phys. 1800111 , WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim (2019).

[16] P. Narayana Swamy, Interpolating statistics and q-deformed oscillator algebras, Intern. J. of Modern Physics, B, 20, 697-713, (2006).

[17] Tavis, F.W. Cummings, Exact solution for an N-molecule-radiation-field Hamiltonian, Phys. Rev., 170, 379-384, (1968).

[18] M.A. Bashir, M.S. Abdalla, The most general solution for the wave equation of the transformed Tavis-Cummings model, Phys. Lett. A, 204, 21-25, (1995).

Department of Mathematics, Faculty of Science, Kuwait City, Kuwait
Email address: latif.hanna@ku.edu.kw

Department of Mathematics, Faculty of Science, Kuwait City, Kuwait
Email address: abdullah.alazemi@ku.edu.kw

Department of Mathematics, Faculty of Science, Kuwait City, Kuwait
Email address: anwar.aldhafeeri@grad.ku.edu.kw

THE QUANTITATIVE CHARACTERISTICS OF THE LIMIT ORDER BOOK

DRAGANA RADOJIČIĆ

0000-0001-7850-2623

ABSTRACT

The propose of this research is to describe the behavior present in the market, and dynamics of the limit order book. This research is based on real market data from the Nasdaq Stock Market (second largest exchange in the world). Firstly, relevant features are extracted from the database, and further, their informativeness is studied. Since there are millions on the stock market events in just one day, the limit order book produces a huge database. The proposed system of data reconstruction and transformation of order book databases during which characteristics of interest are extracted are presented in [4]. In order to proceed further with research, the paper [5] presents a framework for data processing of the LOBSTER database. New methods for feature selection from the book limited orders are presented in [6], and it has been found that the performance of the Long-term memory neural networks model is improved when we choose characteristics using these proposed methods. In [7] by applying Fourier transforms new characteristics are extracted from the stock exchange database. In this research, the statistical properties of the limit order book which are crucial for understanding the dynamics of the order book are studied.

References

[1] D. Radojičić, S .Kredatus, An approach for processing data from NASDAQ stock exchange database, In Proceedings of the 10th International Conference on Information Society and Technology, Society for Information Systems and Computer Networks, (2020).

[2] D. Radojičić, N. Radojičić, S. Kredatus, A multicriteria optimization approach for the stock market feature selection, Computer Science and Information Systems, 18(3), 749-69, (2021).

[3] D. Radojičić D, S .Kredatus, The impact of stock market price fourier transform analysis on the gated recurrent unit classifier model, Expert Systems with Applications, 30, 159, (2020).

[4] D. Radojičić, S. Kredatus, T. Rheinländer, An approach to reconstruction of data set via supervised and unsupervised learning, In 2018 IEEE 18th International Symposium on Computational Intelligence and Informatics (CINTI), (2018).

University of Belgrade, Faculty of Economics, Serbia
Email address: dragana.radojicic@ekof.bg.ac.rs

ON TOPOLOGICAL INDICES OF LINE GRAPH OF SUBDIVISION GRAPH OF SEMIGROUP GRAPHS

YAŞAR NACAROĞLU AND NIHAT AKGÜNEŞ

0000-0001-7179-0490 and 0000-0001-7891-2905

ABSTRACT

In algebraic graph theory, The zero divisor graph is defined in the zero divisors of commutative rings. Its vertices are the zero divisors of the ring. Here, two vertices like x and y adjacent if and only if $x.y = 0$. For the first time, the concept of zero divisor graph was introduced by Beck [1] and many studies have been carried out until today. Das et al.[4] defined the concept of zero-divisor graph on monogenic semi-groups and examined the properties of this special algebraic graph. Recently, Akgunes et al. [5] examined the parametric properties of line graph of monogenic semi-group graphs. In this study, we examined some topological indices on the line graphs of the subdivision graphs of this special algebraic graph..

References

[1] I. Beck, Coloring of commutative rings, Journal of Algebra, 116(1), 208–226, (1988).

[2] D. F. Anderson, A. Badawi, On the zero-divisor graph of a ring, Communications in Algebra, 36(8) 3073–3092, (2008).

[3] D. F. Anderson, P. S. Livingston, The zero-divisor graph of a commutative ring, Journal of Algebra, 217(2), 434–447, (1999).

[4] K. C. Das, N. Akgunes, A. S. Cevik, On a graph of monogenic semigroup, Journal of Inequalities and Application, 44(13), (2013).

[5] N. Akgunes, Y. Nacaroglu, S. Pak, Line Graphs of Monogenic Semigroup Graphs, Journal of Mathematics, 2021, (2021).

[6] G. Su, L. Xu, Topological indices of the line graph of subdivision graphs and their Schur-bounds, Applied Mathematics and Computation, 253, 395–401, (2015).

Department of Mathematics, Kahramanmaras Sutcu Imam University, Kahramanmaraş, Türkiye

Email address: yasarnacaroglu@ksu.edu.tr

Department of Mathematics and Computer Sciences, Necmettin Erbakan University, Konya, Türkiye

Email address: nakgunes@erbakan.edu.tr

SOME GEOMETRIC PROPERTIES OF CONFORMAL BI-SLANT RIEMANNIAN MAPS

ŞENER YANAN

0000-0003-1600-6522

ABSTRACT

In this study, conformal bi-slant Riemannian maps from a Kaehler manifold to a Riemannian manifold are defined. On total manifolds, their geometric properties are examined.

References

[1] B. Şahin, Riemannian Submersions, Riemannian Maps in Hermitian Geometry, and Their Applications, Academic Press, Elsevier, (2017).

[2] B. Şahin, Ş. Yanan, Conformal Riemannian maps from almost Hermitian manifolds. Turkish Journal of Mathematics, 42(5), 2436-2451, (2018).

[3] B. Şahin, Ş. Yanan, Conformal semi-invariant Riemannian maps from almost Hermitian manifolds. Filomat, 33(4), 1125-134, (2019).

[4] Ş. Yanan, Conformal generic Riemannian maps from almost Hermitian manifolds. Turkish Journal of Science, 6(2), 76-88, (2021).

[5] Ş. Yanan, Conformal hemi-slant Riemannian maps. Fundamentals of Contemporary Mathematical Sciences, 3(1), 57-74, (2022).

[6] Ş. Yanan, Conformal semi-slant Riemannian maps from almost Hermitian manifolds onto Riemannian manifolds. Filomat, 36(5), (2022).

[7] Ş. Yanan, B. Şahin, Conformal slant Riemannian maps. International Journal of Maps in Mathematics, 5(1), 78-100, (2022).

[8] K. Yano, M. Kon, Structures on Manifolds, World Scientific, (1984).

Department of Mathematics, Faculty of Arts and Science, Adiyaman, Turkey
Email address: syanan@adiyaman.edu.tr

A NEW GENERALIZATION OF THE PADOVAN SEQUENCE

ORHAN DİŞKAYA AND HAMZA MENKEN

0000-0001-5698-7834 and 0000-0003-1194-3162

ABSTRACT

Integers number sequences in mathematics are one of the subjects with the most application area. The Fibonacci number sequence has applications in many branches of science such as nature, anatomy, botany, zoology, art, music, analysis, physics, astronomy, chemistry, biology and computers. Since the positive real root of the Fibonacci number sequence gives the golden ratio, it has many applications. Many scientists deal with Fibonacci sequence and its generalizations in recent years. Some of these generalizations are number sequences such as Lucas, Pell, and Jacobthal [4, 5, 6]. In this study, the Padovan numbers sequence, which has a third-order characteristic equation, and some of its generalizations are examined.
The Padovan sequence $\{P_n\}$ is defined by the third order recurrence

$$P_{n+3} = P_{n+1} + P_n$$

with the initial conditions $P_0 = 1$, $P_1 = 0$ and $P_2 = 1$.
Feinberg [2] defined Tribonacci numbers. Hoggatt and Bicknell [3] gave Tribonacci poliynomials. Vieira and Alves [9] expressed Sequences of Tridovan and their identities.
The Tridovan sequence $\{TP_n\}$ is defined by the forth order recurrence

$$TP_{n+4} = TP_{n+2} + TP_{n+1} + TP_n$$

with the initial conditions $TP_{-1} = 0$, $TP_0 = 1$, $TP_1 = 0$ and $TP_2 = 1$. G. P. Dresden and Z. Du have defined of the k-bonacci sequence in [1]. In [7, 8], Fibonacci polynomials of order k, multinomial expansions and probability are handled by the authors. we also generalized to padovan numbers by making use of [7].
In the present work, we consider more general form of the Padovan sequence. For new generalization of the Padovan sequence, we derive the Binet-like formulas, the generating functions and the exponential generating functions and we examine and its relationship with Fibonacci numbers. Also, we obtain its matrices.

References

[1] G. P. Dresden, Z. Du, A simplified Binet formula for k-generalized Fibonacci numbers, J. Integer Seq., 17, 14-47, (2014).

[2] M. Feinberg, Fibonacci-Tribonacci, The Fibonacci Q., 3, 71-74, (1963).

[3] V. E. Hoggatt, M. Bicknell, Generalized Fibonacci polynomials, Fibonacci Q. 11, 457-465, (1973).

[4] T. Koshy, Pell and Pell-Lucas numbers with applications, Springer, New York, (2014).

[5] T. Koshy, Fibonacci and Lucas Numbers with Applications, Volume 1, John Wiley & Sons, New Jersey, (2018).

[6] T. Koshy, Fibonacci and Lucas Numbers with Applications, Volume 2, John Wiley & Sons, New Jersey, (2019).

[7] A. N. Philippou, C. Georghiou, G. N. Philippou, Fibonacci polynominals of order k, multinomial expansions and probability, Int. J. Math. Math. Sci., 6, 545-550, (1983).

[8] A. N. Philippou, A note on the Fibonacci sequence of order K and the multinomial coefficients, Fibonacci Q., 21, 82-86, (1983).

[9] R. P. M. Vieira, F. R. V. Alves, Sequences of Tridovan and their identities, Notes Number Theory Discrete Math., 25, 185-197, (2019).

Department of Mathematics, Science and Letters Faculty, Mersin University, Turkey
Email address: orhandiskaya@mersin.edu.tr

Department of Mathematics, Science and Letters Faculty, Mersin University, Turkey
Email address: hmenken@mersin.edu.tr

GENERALIZED URYSOHN SPACES

KÜBRA ERKUL AND AYHAN ERCIYES

0000-0002-2571-9244 and 0000-0002-0942-5182

ABSTRACT

A subset A of X is said to be semi-open if there exists an open set U in X such that $U \subset A \subset \overline{U}$. The notion of semi-open set was defined by N. Levine in 1963. S.M.N Maheshawari and R. Prasad defined the semi-separation axioms in 1975, denoted as semi-T_0, semi-T_1, and semi-T_2 which based on the semi-open set concept. In 1982, C. Dorsett worked on semi-regular and semi-normal spaces, giving their heritability and equivalence over a continuous function. In 1978, S. G. Crossley showed that strong Hausdorff and Urysohn properties are semi-topological properties. Semi-Urysohn spaces was described by M.P. Bhamini in 1983. In 1996, T. Noiri and J. Umehara showed the relationship between θ-irreducible spaces and semi-Urysohn spaces.

A is pre-open if and only if $A \subset (\overline{A})^o$. Pre-open set was described by A. S. Mashhour in 1982 and obtained its various properties. In 1990, A. Kar and P. Bhattacharyya defined separation axioms using pre-open sets, denoted as pre-T_0, pre-T_1, and pre-T_2 axioms. In 1996, M. Pal and P. Bhattacharyya obtained pre-Urysohn spaces using pre-open sets. In 1999, R. Paul and P. Bhattacharyya worked on pre-Urysohn spaces. They determined the relationships between Pre-Urysohn spaces and Urysohn and other known spaces.

The aim of this study is to determine the hereditary, multiplicative properties of semi-Urysohn and pre-Urysohn spaces, which are the generalizations of the known Urysohn spaces between the above-mentioned semi-Hausdorff, semi-T_3, pre-Hausdorff, pre-T_3 to investigate their relationship with known spaces.

References

[1] S.P. Arya, M.P. Bhamini, Some generalizations of TD-spaces, Mat. Vesnik, 6, 221-230 (1982).

[2] P. Bhattacharyya, A note on preopen sets, North Bengal Univ. Rev., 7(l), 46-52, (1992).

---

[3] S.G.Crossley, A note on seml-topological properties, Ibld. 72,409-414 (1978).

[4] C. Dorsett, S-Normal, S-regular spaces, Societatea de Științe Matematice din România, 26,231-235 (1982).

[5] N. Levine, Semi-open sets and semi-continuity in topological spaces, Amer. Math. Monthly, 70, 36-41, (1963).

[6] A. Kar and P. Bhattacharyya, Some weak separation axioms, Bull. Cal Math. Soc., 82, 415-422, (1990).

[7] S.N. Maheshwary, R.Prasad, Some new separation axioms, Ann. Soc. Scl.Bruxelles, 89, 395-402, (1975).

[8] A.S.Mashhour, I.A.Hasanein, S.N.El-Deeb, A note on precontinuity and semicontinuity, Indian J.Pure Appl., 13(10), 1119-1123, (1982).

[9] A.S. Mashhour, M.E. Abd El-Monsef, S.N. El-Deeb, On pre-continuous and weakprecontinuous mappings, Proc. Math. and Phys. Soc. Egypt, 51, 47-53 (1982).

[10] T. Noiri, J. Umehara, Properties of θ-irreducible spaces, Acta Math. Hungar., 72, 61-66, (1996).

[11] R. Paul, P. Bhattacharyya, Properties of quasi-precontinuous functions, Indian J. Pure Appl. Math. 27, 475-486, (1996).

Department of Mathematics, Faculty of Science and Letters, Aksaray, Türkiye
Email address: kubraerkul06@gmail.com

Department of Mathematics, Faculty of Science and Letters, Aksaray, Türkiye
Email address: ayhanerciyes@aksaray.edu.tr

MOORE-PENROSE INVERSE OF THE SIGNLESS LAPLACIAN OF BIPARTITE GRAPHS

OSAMA ALHALABI, ABDULLA ALAZEMI, AND MILICA ANĐELIĆ

0000-0001-5953-3790, 0000-0001-9383-3121 and 0000-0002-3348-1141

ABSTRACT

In this paper we provide a relation between the Moore-Penrose inverse of Laplacian and signless Laplacian matrices of a bipartite graph. As a consequence we obtain combinatorial formulae for the Moore-Penrose inverse of signless Laplacians of bipartite graphs. We also obtain a combinatorial formula for the Moore-Penrose inverse of an incidence matrix of any graph. In this way we answer some of open problems raised in [R. Hessert, S. Mallik, Moore-Penrose inverses of the signless Laplacian and edge-Laplacian of graphs, Discrete Math. 344 (2021) #112451].

References

[1] A. Azimi, R.B. Bapat, Moore-Penrose inverse of the incidence matrix of a distance-regular graph, Linear Algebra Appl., 551, 92-103, (2018).

[2] A. Azimi, R.B. Bapat, E. Estaji, Moore-Penrose inverse of the incidence matrix of graphs with complete and cyclic blocks, Discrete Math., 342, 10-17, (2019)

[3] R.B. Bapat, K.P.S. Rao Bhaskara, K. M. Prasad, Generalized inverses over integral domains, Linear Algebra Appl., 140, 181-196, (1990).

[4] R.B. Bapat, Moore-Penrose inverse of the incidence matrix of a tree, Linear Multilinear Algebra,42, 159-167, (1997).

[5] A. Ben-Israel, T.N.E. Greville, Generalized Inverse: Theory and Applications, 2nd Edition, Springer, New York, (2003).

[6] D. Cvetkovi´c, P. Rowlinson, S. Simi´c, An Introduction to the Theory of Graph Spectra, Cambridge University Press, New York, (2010).

---

[7] K.H. Monfared, S. Mallik, An analog of Matrix Tree Theorem for signless Laplacians, Linear Algebra Appl., 560, 43-55, (2019).

[8] R. Hessert, S. Mallik, Moore-Penrose inverses of the signless Laplacian and edge-Laplacian of graphs, Discrete Math., 344, (2021).

[9] R. Hessert, S. Mallik, The inverse of the incidence matrix of a unicyclic graph, Linear Multilinear Algebra, (2022).

[10] Y. Ijiri, On the generalized inverse of an incidence matrix, J. Soc. Appl. Math., 13(3), 827-836, (1965).

COLLEGE OF GRADUATE STUDIES, KUWAIT UNIVERSITY, SAFAT 13060, KUWAIT
Email address: osama.alhalabi@grad.ku.edu.kw

DEPARTMENT OF MATHEMATICS, FACULTY OF KUWAIT UNIVERSITY, SAFAT 13060, KUWAIT
Email address: abdullah.alazemi@ku.edu.kw

DEPARTMENT OF MATHEMATICS, FACULTY OF KUWAIT UNIVERSITY, SAFAT 13060, KUWAIT
Email address: milica.andelic@ku.edu.kw

ON THE GEOMETRY OF GCR-LIGHTLIKE SUBMANIFOLDS OF SEMI-RIEMANNIAN PRODUCT MANIFOLDS

NERGIZ (ÖNEN) POYRAZ AND EROL YAŞAR

0000-0002-8110-712X and 0000-0001-8716-0901

ABSTRACT

In this paper, we research geometry of GCR-lightlike submanifolds of semi-Riemannian product manifolds. We obtain some results for such submanifolds.

References

[1] K. L. Duggal, A. Bejancu, Lightlike submanifolds of semi-Riemannian manifolds and applications, Kluwer Academic Publishers, Dordrecht, (1996).

[2] K.L. Duggal, B. Şahin, Generalized Cauchy-Riemann lightlike submanifolds of kaehler manifolds, Acta Math. Hung., 112(1-2), 107-130 (2006).

[3] K.L. Duggal, B. Şahin, Generalized Cauchy-Riemann lightlike submanifolds of indefinite Sasakian manifolds, Acta Math. Hung., 122(1-2), 45-58 (2009).

[4] K.L. Duggal, B. Şahin, Differential geometry of lightlike submanifolds, Birkhäuser, Basel, (2010).

[5] Kumar, S., Kumar, R. and Nagaich, R. K., GCR-lightlike submanifolds of a semi-Riemannian product manifold, Bull. Korean Math. Soc., 51(3), 883-899 (2014).

[6] D. N. Kupeli, Singular Semi-Riemannian Geometry, Kluwer, Dordrecht, 366 (1996).

[7] N. (Önen) POYRAZ, A study on GCR-lightlike submanifolds of semi-Riemannian product manifolds, Journal of Universal Mathematics, 4(1), 25-33, (2021).

[8] X. Senlin, N. Yilong, Submanifolds of product Riemannian manifold, Acta Mathematica Scientia, 20(2), 213-218 (2000).

DEPARTMENT OF MATHEMATICS, FACULTY OF ARTS AND SCIENCES, ADANA, TURKEY
Email address: nonen@cu.edu.tr

DEPARTMENT OF MATHEMATICS, FACULTY OF ARTS AND SCIENCES, MERSIN, TURKEY
Email address: yerol@mersin.edu.tr

SOME INEQUALITIES FOR SCREEN HOMOTHETIC LIGHTLIKE HYPERSURFACES OF A GRW SPACETIME

NERGIZ (ÖNEN) POYRAZ

0000-0002-8110-712X

ABSTRACT

In this paper, we some inequalities involving the Ricci curvature and the scalar curvature on screen homothetic lightlike hypersurfaces of a GRW spacetime. Moreover, the equality cases are considered and we show that M is a totally geodesic or a totally umbilical in case of equalities.

References

[1] C. Atindogbe, K. L. Duggal, Conformal screen on lightlike hypersurfaces, Int. J. Pure Appl. Math., 11(4), 421-442, (2004).

[2] C. L. Bejan, K. L. Duggal, Global lightlike manifolds and harmonicity, Kodai Math. J., 28(1), 131-145, (2005).

[3] B.Y. Chen, Some pinching and classification theorems for minimal submanifolds, Archiv der Mathematik, 60(6), 568-578, (1993).

[4] B.Y. Chen, Mean curvature and shape operator of isometric immersion in real space forms, Glasg. Math. J., 38, 87-97 (1996).

[5] K. L. Duggal, A. Bejancu, Lightlike Submanifolds of Semi-Riemannian Manifolds and Applications, Kluwer Academic Publishers, Dordrecht, (1996).

[6] K. L. Duggal, B. Şahin, Differential Geometry of Lightlike Submanifolds, Birkhäuser, Basel, (2010).

[7] T. H. Kang, On lightlike hypersurfaces of a GRW spacetime, Bull. Korean Math. Soc., 49(4), 863-874 (2012).

Department of Mathematics, Faculty of Arts and Sciences, Adana, Turkey
Email address: nonen@cu.edu.tr

THE EFFECT OF SOCIO-DEMOGRAPHIC CHARACTERISTICS ON PATIENT SATISFACTION

SEMRA KONCA

0000-0001-6343-5448

ABSTRACT

The aim of this study is to examine the effects of socio-demographic variables such as gender, age, marital status, social security, educational status, institution of employment, monthly income, frequency of admission to hospital, and place of residence on patient satisfaction of outpatients who were examined in Bitlis State Hospital. The methods used in the study are independent sample t test, ANOVA and Kruskal Wallis H test.

References

[1] E. Ostertagova, O. Ostertag, Methodology and application of one-way ANOVA, American Journal of Mechanical Engineering, 1(7), 256-261, (2013).

[2] T.V. Hecke, Power study of anova versus Kruskal-Wallis test, Journal of Statistics and Management Systems, 15(2-3), (2012).

[3] T.K. Kim, T test as a parametric statistic, Korean Journal of Anesthesiology, 68(6), 540-546, (2015).

Graduate School of Education, Bitlis Eren University Bitlis, Turkey
Email address: smraknc@gmail.com

A NEW 2-NORM

ŞÜKRAN KONCA AND MOCHAMMAD IDRIS

0000-0003-4019-958X and 0000-0003-2565-5903

ABSTRACT

In this work, we define a new 2-norm on a normed space with dimension ≥ 2, investigate its relationship with Gähler's 2-norm [Lineare 2-normierte Räume, Math. Nachr.] and examine under which conditions the equivalence of these 2-norms can be satisfied. We also derive an alternative norm from this new 2-norm and explore its relation with the usual norm on this space.

References

[1] S. Gähler, Lineare 2-normierte Räume, Mathematische Nachrichten, 28, 1-43, (1963).

[2] S. Gähler, Uber 2-Banach Räume, Mathematische Nachrichten, 42, 335-347, (1969).

[3] T.R. Kristianto, R.A. Wibawa-Kusumah, H. Gunawan, Equivalence relations of n-norms on a vector space, Matematicki Vesnik, 65(4), 488-493, (2013).

İzmİr Bakirçay University, Faculty of Engineering and Architecture, Department of Fundamental Sciences/Mathematics, 35665, İzmir, Turkey.
   Email address: `sukran.konca@bakircay.edu.tr`

Department of Mathematics, Faculty of Mathematics and Natural Sciences, Universitas Lambung Mangkurat, Banjarbaru-Kalimantan Selatan, 70714, Indonesia
   Email address: `moch.idris@ulm.ac.id`

SIEVE METHOD TOWARD THE SOLUTION OF THE GOLDBACH CONJECTURE

AHMAD R. NOROUZI

0000-0003-1189-1200

ABSTRACT

Goldbach's conjecture is one of the oldest problems in the Number theory field. This problem states that for any even number greater than 2, at least one prime binary can be found in which the sum of primes is equal to the initial even number. Here in this paper, a potential solution is proposed which employs the sieve method to eliminate unacceptable binaries. And as the result, it proves that for even numbers greater than 2810, at least one pair of primes remains in which the sum of prime numbers is equal to the initial even number.

REFERENCES

[1] Y. Wang, *The* Goldbach Conjecture, vol. 4. World scientific, (2002).

[2] H. A. Helfgott, The ternary Goldbach conjecture is true, arXiv Prepr. arXiv1312.7748, (2013).

[3] H. A. Helfgott, Major arcs for Goldbach's problem, arXiv Prepr. arXiv1305.2897, (2013).

[4] H. A. Helfgott, "Minor arcs for Goldbach's problem," *arXiv Prepr. arXiv1205.5252*, (2012).

[5] T. O. e Silva, Goldbach conjecture verification, last updated April, (2012).

SCHOOL OF NATURAL SCIENCES, UNIVERSITY OF TASMANIA, HOBART, AUSTRALIA
E-mail address: a.norouzi@utas.edu.au

EDUCATION OF GEOMETRY IN PRIMARY SCHOOLS IN TURKEY IN THE BEGINNING OF THE 20TH CENTURY

H. ALHUSSEIN and B. ÇELİK

0000-0002-9812-2211 and 0000-0001-7234-8063

ABSTRACT

In this study, it will be discussed on the subjects in a small book that explains how geometry lessons should be taught by teachers in primary schools during the transition period from the Ottoman Empire to the Republic of Turkey. This small book, titled "Mekatib'i İbtidaiyede Hendesenin Usul'ü Tedrisi", was published by the Ministry of Education of the Republic of Turkey in 1920 in line with the decisions taken by the Grand National Assembly of Turkey.

REFERENCES

[1] M. Değirmendere, M. A. Kuyucaklızâde ve Matematiğe Dair "Nihâyetü'l-Elbâb fî Tercemeti Hulâsati'l- Hisâb" Adlı Eseri (Metin ve Değerlendirme), T.C. Uludağ Üniversitesi Sosyal Bilimler Enstitüsü İslam Tarihi ve Sanatları Anabilim Dalı İslam Tarihi Bilim Dalı Yüksek Lisans Tezi, Bursa, (2009).
[2] Komisyon, Mekâtib İbtidaiyede Hendesenin Usul'ü Tedrisi, Türkiye Büyük Millet Meclisi Hükümeti Maarif Vekâleti Neşriyatından, Adet (Sayı):7, Matbaa-ı Âmira, İstanbul, (H:1339, M:1920)
[3] M. N. Özön, Osmanlıca Türkçe Sözlük, İnkılâp ve Aka Kitabevi, 6.Baskı, İstanbul, (1979).
[4] https://www.kamusiturki.com , (Erişim tarihi: 6 Nisan 2022).
[5] https://www.osmanlicaturkce.com, (Erişim tarihi: 6 Nisan 2022).
[6] https://www.osmanlicasozlukler.com, (Erişim tarihi: 6 Nisan 2022).

BURSA ULUDAĞ UNIV. GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES, BURSA, TÜRKİYE
E-mail address: t.hasanalhusseın@gmail.com

DEPARTMENT OF MATHEMATICS FACULTY OF ARTS AND SCIENCE, BURSA, TÜRKİYE
E-mail address: basri@uludag.edu.tr

IMPROVED WEIGHED AGGREGATION OPERATORS ON PYTHAGOREAN FUZZY SETS

ALİ KÖSEOĞLU and RIDVAN ŞAHİN

0000-0002-2131-7141, 0000-0001-7434-4269

ABSTRACT

Pythagorean fuzzy sets (PyFSs) are very useful tools for problems involving uncertain information. The aggregation operators of this set play an important role in dealing with such data. However, current averaging operators have some drawbacks that cause indeterminate results. In this paper, we propose the improved Pythagorean fuzzy weighted averaging (IPyFWA) operator of PyFSs.

REFERENCES

[1] K.T. Atanassov, Intuitionistic Fuzzy Sets, Fuzzy Sets and Systems, 20(1), 87–96, (1986).
[2] R.R. Yager, A.M. Abbasov, Pythagorean membership grades, complex numbers and decision making, Int. J. Intell. Syst., 28 (5), 436–452, (2013).
[3] H. Garg, A new generalized Pythagorean fuzzy information aggregation using Einstein operations and its application to decision making, Int. J. Intell. Syst., 31 (9), 886–920, (2016).
[4] X.Y. Zou, S.M. Chen, K.Y. Fan, Multiple attribute decision making using improved intuitionistic fuzzy weighted geometric operators of intuitionistic fuzzy values, Inf. Sci., (2020).
[5] T. K. Paul, M. Pal, & C. Jana, Multi-attribute decision making method using advanced Pythagorean fuzzy weighted geometric operator and their applications for real estate company selection, Heliyon, 7(6), e07340, (2021).
[6] X. Peng, Y. Yang, Some results for Pythagorean fuzzy sets, Int. J. Intell. Syst., 30 (11), 1133–1160.9, (2015).
[7] R. A. Krohling, A. G. Pacheco & A. L. Siviero, IF-TODIM: An intuitionistic fuzzy TODIM to multi-criteria decision making, Knowledge-Based Systems, *53*, 142-146, (2013).

RECEP TAYYIP ERDOGAN UNIVERSITY, FACULTY OF ARTS AND SCIENCES, DEPARTMENT OF MATHEMATICS, RIZE, TURKEY
E-mail address: ali.koseoglu@erdogan.edu.tr

GUMUSHANE UNIVERSITY, ENGINEERING AND NATURAL SCIENCES FACULTY, DEPARTMENT OF MATHEMATICAL ENGINEERING, GÜMÜŞHANE, TURKEY
E-*mail address:* math.ridone@gmail.com

INTUITIONISTIC MULTIPLICATIVE SET APPROACH FOR GREEN SUPPLIER SELECTION PROBLEM USING TODIM METHOD

Ali KÖSEOĞLU

0000-0002-2131-7141

ABSTRACT

Production and supply chain can be considered as the fundamentals of economic cycle for all countries. As a result of climate crisis in the world and the disasters it brought, the use of green products has become inevitable. With the restrictions imposed by some governments, suppliers have started to canalize their productions to environmental goods and the selection of most appropriate green supplier become a strategic decision. However, classical methods remain incapable to making these decisions due to the uncertain information contained in real life problems. Intuitionistic multiplicative information is a good choice dealing with these uncertainties in this kind of problems. Therefore, in this work, green supplier selection problem is discussed using TODIM method with intuitionistic multiplicative sets.

REFERENCES

[1] L. A. Zadeh, Fuzzy sets, Inf. Control, vol. 8, no. 3, pp. 338–353, 1965, Accessed: [Online], Available: https://www.sciencedirect.com/science/article/pii/S001999586590241X, Nov. 18, (2019).
[2] K. T. Atanassov, Intuitionistic fuzzy sets, Fuzzy Sets Syst., vol. 20, no. 1, pp. 87–96, (1986).
[3] M. Xia, Z. Xu, and H. Liao, Preference relations based on intuitionistic multiplicative information, *I*EEE Trans. Fuzzy Syst., vol. 21, no. 1, pp. 113–133, doi: 10.1109/TFUZZ.2012.2202907, (2013).
[4] L. F. A. M. Gomes and M. M. P. P. Lima, Todim: Basic and application to multicriteria ranking of projects with environmental impacts, Found. Comput. Decis. Sci., vol. 16, no. 4, pp. 113–127, (1991).

RECEP TAYYIP ERDOGAN UNIVERSITY, FACULTY OF ARTS AND SCIENCES, DEPARTMENT OF MATHEMATICS, RIZE, TURKEY

E-mail address: ali.koseoglu@erdogan.edu.tr

A TILING APPROACH TO FIBONACCI p-NUMBERS

YASEMIN TAŞYURDU and BERKE CENGİZ

0000-0002-9011-8269 and 0000-0001-8372-3332

ABSTRACT

In this paper, we introduce tiling representations of Fibonacci p-numbers, which are generalizations of the well-known Fibonacci and Narayana numbers, and generalized in the distance sense. We obtain Fibonacci p-numbers count the number of distinct ways to tile a $1 \times n$ board using various $1 \times r$, r-ominoes from $r = 1$ up to $r = p$. Moreover, the product identities and sum formulas of these numbers with special subscripts are given by tiling interpretations that allow the derivation of their properties.

REFERENCES

[1] A.P. Stakhov, Introduction into Algorithmic Measurement Theory, Soviet Radio: Moskow, Russia, (1977).
[2] R.C. Brigham, R.M. Caron, P.Z. Chinn, R.P. Grimaldi, A tiling scheme for the Fibonacci numbers, J. Recreational Math. 28(1), 10–17, (1996-97).
[3] A.T. Benjamin, J.J. Quinn, The Fibonacci Numbers Exposed More Discretely, Math. Magazine, 33, 182–192, (2002).
[4] A.T. Benjamin, J.J. Quinn, Proofs That Really Count: The Art of Combinatorial Proof, Mathematical Association of America, (2003).
[5] A. Stakhov, B. Rozin, Theory of Binet formulas for Fibonacci and Lucas p-numbers, Chaos, Solitons & Fractals, 27(5), 1163–1177, (2006).

DEPARTMENT OF MATHEMATICS, FACULTY OF ARTS AND SCIENCES, ERZINCAN BİNALİ YILDIRIM UNIVERSITY, 24100 ERZINCAN, TURKEY
E-mail address: ytasyurdu@erzincan.edu.tr

GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES, ERZİNCAN BİNALİ YILDIRIM UNİVERSITY, DEPARTMENT OF MATHEMATICS, 24100 ERZINCAN, TURKEY
E-mail address: brkcng06@gmail.com

ON FIBONACCI (k, p)-NUMBERS AND THEIR INTERPRETATIONS

YASEMİN TAŞYURDU and BERKE CENGİZ

0000-0002-9011-8269 and 0000-0001-8372-3332

ABSTRACT

In this paper, we define a generalization of Fibonacci numbers, which generalizes both well-know Fibonacci, Jacobsthal, Narayana numbers and Fibonacci p-numbers generalized in the distance sense, according to a new parameter k. Tiling and combinatorial interpretations of generalized Fibonacci numbers are presented, and explicit formulas that allow us to calculate the nth number are given. Also generating functions and some properties of these numbers are obtained.

REFERANSLAR

[1] A.F. Horadam, A generalized Fibonacci sequence, American Mathematical Monthly, 68(5), 455-459, (1961).

[2] A.P. Stakhov, Introduction into Algorithmic Measurement Theory, Soviet Radio: Moskow, Russia, (1977).

[3] R.C. Brigham, R.M. Caron, P.Z. Chinn, R.P. Grimaldi, A tiling scheme for the Fibonacci numbers, J. Recreational Math., 28(1), 10–17, (1996-97).

[4] A.T. Benjamin, J.J. Quinn, Proofs That Really Count: The Art of Combinatorial Proof, Mathematical Association of America, (2003).

[5] A. Stakhov, B. Rozin, Theory of Binet formulas for Fibonacci and Lucas p-numbers, Chaos, Solitons & Fractals, 27(5), 1163–1177, (2006).

[6] S. Falcon, A. Plaza, A. On the Fibonacci k-numbers, Chaos, Solitons & Fractals, 32(5), 1615-1624, (2007).

[7] Y. Taşyurdu, N. Cobanoğlu, Z. Dilmen, On the a new Family of k-Fibonacci numbers, Erzincan University Journal of Science and Technology, 9(1), 95-101, (2016).

DEPARTMENT OF MATHEMATICS, FACULTY OF ARTS AND SCIENCES, ERZINCAN BİNALİ YILDIRIM UNIVERSITY, 24100 ERZINCAN, TURKEY
E-mail address: ytasyurdu@erzincan.edu.tr

GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES, ERZİNCAN BİNALİ YILDIRIM UNİVERSITY, DEPARTMENT OF MATHEMATICS, 24100 ERZINCAN, TURKEY
E-mail address: brkcng06@gmail.com

AN APPROACH TO CONTINUITY AND CONVERGENCE IN IDEAL TOPOLOGICAL SPACES

BURCU BACAKSIZ, and H. FULYA AKIZ

0000-0002-5101-0124 and 0000-0002-8547-2175

ABSTRACT

In [1], S Kasahara defined an operation $\gamma : \tau \rightarrow P(X)$ as a function from τ to the power set of X such that $V \subseteq V$, for each $V \in \tau$, where $V \gamma$ denotes the value of γ at V. In [3], Hussain introduced and explore generalized open sets namely γ-pre-open and γ-b-open sets in topological spaces. In [3], Granados used the notions of b-open and b-I-open sets to introduce the idea of b-I-convergence which we will denoted by b-I-convergence and give the relations between b-I-sequential and b-I-sequentially. In 1966, Kuratowski [4] studied and applied the concept of ideals of topological spaces. In this paper, we introduce the notions of γ-b-I-continuity and γ-b-I-convergence in ideal topological spaces and give some properties.

REFERENCES

[1] S. Kasahara, Operation-Compact Spaces, Math. Japon. 24,97-105, (1979).
[2] S. Hussain, On Generalized Open Sets, Hacettepe Journal of Mathematics and Statistics 47(6) ,1438-1446, (2018).
[3] C. Granados, A new notion of convergence on ideal topological spaces, Vol.7(2): 250-256, (2020).
[4] K. Kuratowski, Topology Vols 1 and 2, Academic Press, (1966).

YOZGAT BOZOK UNIVERSITY, FACULTY OF ART AND SCIENCE, YOZGAT, TURKEY
E-mail address: brcblgn17@gmail.com

YOZGAT BOZOK UNIVERSITY, FACULTY OF ART AND SCIENCE, YOZGAT, TURKEY
E-mail address: fulya.gencel@yobu.edu.tr

ON NEW TYPE OF EXPONENTIAL

TOPOLOGICAL INDICES

Büşra AYDIN, Nihat AKGÜNEŞ
0000-0002-8736-0409, 0000-0001-7891-2905

ABSTRACT

New graph invariants, named exponential Zagreb indices, are introduced for more than one type of Zagreb index. After that, in terms of exponential Zagreb indices, lists on equality results over special graphs are presented as well as some new bounds on unicyclic, acyclic, and general graphs are obtained.

References

[1] N. Akgüneş and B. Çağan, On the dot product of graphs over monogenic semigroups, Applied Mathematics and Computation, 322, 1-5, (2018).

[2] R. Cruz and J. Rada, The path and the star as extremal values of vertex-degree-based topological indices among trees, MATCH Communications in Mathematical and in Computer Chemistry, 82, 715-732, (2019).

[3] I. Gutman and K. C. Das, The first Zagreb index after 30 years, MATCH Communications in Mathematical and in Computer Chemistry, 50, 83-92, (2004).

[4] I. Gutman and N. Trinajstic, Graph Theory and Molecular Orbitals, Total π-electron energy of alternant hydrocarbons, Chemical Physics Letters, 17(4), 535-538, (1972).

[5] F. Harary, Graph Theory, Reading, Addison-Wesley, Boston, MA, USA, 1994.

[6] J. Rada, Exponential vertex-degree-based topological indices and discrimination, MATCH Communications in Mathematical and in Computer Chemistry, 82, 29-41, (2019).

DEPARTMENT OF MATHEMATICS-COMPUTER SCIENCES, NECMETTIN ERBAKAN UNIVERSITY, KONYA 42090, TURKEY
Email Address: bsrcgn@gmail.com

DEPARTMENT OF MATHEMATICS-COMPUTER SCIENCES, NECMETTIN ERBAKAN UNIVERSITY, KONYA 42090, TURKEY
Email Address: nakgunes@erbakan.edu.tr

NUMERICAL SOLUTION OF FRACTIONAL PANTOGRAPH VOLTERRA INTEGRO-DIFFERENTIAL EQUATIONS VIA BERNSTEIN POLYNOMIALS

ELÇİN GÖKMEN

0000-0003-1208-1875

ABSTRACT

In this paper, we propose a method based on orthogonal bases functions including Bernstein polynomials to solve fractional Volterra integro-differential equations with pantograph delay. By employing the procedure with the collocation points, the main problem is reduced into a system of algebraic equations. We also investigate error estimation of the method. Some problems are solved to verify the applicability and validity of the technique. The numerical results are compared with those obtained by some known methods in literature.

REFERENCES

[1] Y. Yang, Y. Huang, Spectral-Collocation Methods for Fractional Pantograph Delay-Integrodifferential Equations, Advances in Mathematical Physics, Article ID 821327, (2013).
[2] S. Behera, S. Saha Ray, An efficient numerical method based on Euler wavelets for solving fractional order pantograph Volterra delay-integro-differential equations, Journal of Computational and Applied Mathematics. 406, 113825, (2022).
[3] H. Jafari, N.A. Tuan, R.M. Ganji, A new numerical scheme for solving pantograph type nonlinear fractional integro-differential equations, Journal of King Saud University – Science, 33, 101185, (2021).
[4] E. Gökmen, A computational approach with residual error analysis for the fractional-order biological populationmodel, Journal of Taibah University for Science, 15(1), 218-225, (2021).

MUĞLA SITKI KOÇMAN UNIVERSITY, FACULTY OF SCIENCE, DEPARTMENT OF MATHEMATICS, MUĞLA, TURKEY
E-mail address: egokmen@mu.edu.tr

SOME RESULTS ON THE COMBINATION OF ALGEBRAIC STRUCTURES

ESRA KIRMIZI ÇETİNALP

0000-0002-3754-8622

ABSTRACT

There is a long history of combining combinatorial structures in the context of infinite groups. One example is a new algebraic construction, one obtains by combining the properties of two different structures. By obtaining such new structure, it becomes possible to include of related structures. In this work, by taking finite k-monoids, we consider *n-generalized Schützenberger* and *iterated bicrossed* product from the point of Combinatorial Group Theory. Then we define a new algebraic construction of these products. We give to be a monoid of this new product, then we obtain a presentation for arbitrary monoids. Additionally, we give the necessary and sufficient conditions for the regularity of this product.

REFERENCES

[1] A. L. Agore and G. Militaru, Crossed product of groups, applications, Arab. J. Sci. Eng., 33, 1-17 (2008).
[2] A. Emin, F. Ateş, S. İkikardeş and İ.N. Cangül, A new monoid construction under crossed products, J. Inequal. Appl., 244, (2013).
[3] J.M. Howie, N. Ruskuc, Constructions and presentations for monoids, Communication in Algebra ,22, 6209-6224 (1994).

Department of Mathematics,Karamanoğlu Mehmetbey University, Merkez, Karaman, Turkey
E-mail address: esrakirmizicetinalp@gmail.com

EXAMINATION OF CLASSIFIER AND ORDERER SCALED VARIABLES

ESRA YAVUZ[1], MUSTAFA ŞAHİN[2]

0000-0002-5589-297X, 0000-0003-3622-4543

ABSTRACT

In the study, information is given about which scale the data will be handled and which statistical relationship measures will be applied to the data in line with this scale when starting the researchers' methods and studies. For this purpose, a total of 14 tests consisting of statistical relationship measures tests were included in the analysis. 7 of these tests constitute classifier scale variables and 7 of them constitute ordinal scale variables. In this study, first of all, statistical terms and descriptive statistics were defined, and then, statistical measurement tests, which consisted of classifier and ordinal scaled variables, were defined in detail.

REFERENCES

[1] F. Akdeniz, Olasılık ve İstatistik, Baki Kitapevi, Adana, 546s, (1998).
[2] R. Alpar, Uygulamalı Çok Değişkenli İstatistiksel Yöntemlere Giriş I., Spor Kitap Evi, Ankara, 340s, (1997).
[3] JW Dixon, JF Massey, Introduction to Statistical Analysis, McGraw-Hill, United States, 636s, (1969).
[4] DG. Kleınbaum, LL. Kupper, A. Nizam, Applied Regression Analysis and Multivariable Methods, ITP Company, United States of America,798s, (1998).
[5] L. Ott, An Introduction to Statistical Methods and Data Analysis, Pws-Kent, United States of America, 1033s , (1988).
[6] D. J. Sheskin, Parametric and Nonparametric Statistical Procedures, CRC Press New York, 1193s, (2004).
[7] C. H. Thode, Testing for Normality, Marcel Dekker Inc., New York, 368s, (2001).

ŞIRNAK UNİVERSİTY, CİZRE VOCATİONAL SCHOOL, DEPARTMENT OF ACCOUNTİNG AND TAX, 73200, CİZRE, ŞIRNAK, TURKEY
e- mail: yavuz7346@gmail.com

KAHRAMANMARAS SÜTÇÜ IMAM UNİVERSİTY, FACULTY OF AGRİCULTURE, DEPARTMENT OF AGRİCULTURAL BİOTECHNOLOGY, 46100, KAHRAMANMARAŞ, TURKEY
e-mail: ms66@ksu.edu.tr

INVESTIGATION OF PARAMETRIC, NON-PARAMETRIC AND SEMIPARAMETRIC METHODS IN REGRESSION ANALYSIS

ESRA YAVUZ[1], MUSTAFA ŞAHİN[2]

0000-0002-5589-297X, 0000-0003-3622-4543

ABSTRACT

Regression analysis is known as statistical methods applied to model and analyze the relationship between variables. Regression method can be examined as parametric, non-parametric and semiparametric regression methods.

The parametric regression method assumes that the dependent variable is in a linear relationship with the independent variables and that the shape of the relationship is known. If these assumptions are not met, non-parametric regression methods are applied. However, these methods cause difficulties especially in the interpretation part due to the problem of multidimensionality when there is more than one independent variable. Thus, when there is more than one independent variable, some of the independent variables may be in a linear relationship with the dependent variable, while the other part may be in a nonlinear relationship. Thus, in order to model these relationships, semiparametric regression methods, which are the additive combination of parametric and non-parametric regression methods, are used.

In this study, parametric regression method, definition of non-parametric regression method and assumption conditions are given. It has been shown that the semiparametric regression method can be applied in cases where these assumptions are not met. Thus, in the study, regression methods were examined in three different parts, and parametric, non-parametric and semiparametric regression methods were examined theoretically.

REFERENCES

[1] G. Aneiros-Pérez, P. Vieu, Nonparametric time series prediction: A semi-functional partial linear modeling, J. Multivariate Anal, 99(5), 834-857, (2008).
[2] M. Aytaç, Applied non-parametric statistical tests, Uludag University Press, Bursa, Turkey, (1991).
[3] J. Begun, W. Hall, W. Huang & J. Wellner, Information and asymptotic efficiency in parametric-nonparametric models, Annals of Stat, 11, 432-452, (1983).
[4] M. Çitil & F. Tuğrul, Some New Equalities On the Intutionistic Fuzzy Modal Operators, Sakarya University Journal of Science, 22(6), (2018).
[5] J. Harezlak, D. Ruppert & M. P. Wand, Semiparametric regression with R, New York, Springer (2018).
[6] L. Keele, Semiparametric Regression For The Social Sciences, Chichester: John Wiley & Sons, (2008).
[7] R. Li & H. Liang, Variable selection in semiparametric regression modeling, *Annals of statistics*, 36(1), 261, (2008).
[8] D. Ruppert, M. P. Wand & R. J. Carroll, Semiparametric regression, (12), Cambridge university press, (2003).
[9] A. Yatchew, Semiparametric regression for the applied econometrician, Cambridge University Pres, Cambridge, UK, 213, (2003).
[10] E. Yavuz & M. Şahin, Semiparametric Regression Models and Applicability in Agriculture, Black Sea Journal of Agriculture, 9-10, (2022).
[11] Z. Zhongyi & W. Baocheng, Dianostic and influence analysis for semiparametric nonlinear regression models, Acta Math Appl Sinica, 24(4), 568-581, (2001).

ŞIRNAK UNİVERSİTY, CİZRE VOCATİONAL SCHOOL, DEPARTMENT OF ACCOUNTİNG AND TAX, 73200, CİZRE, ŞIRNAK, TURKEY
e- mail: yavuz7346@gmail.com

KAHRAMANMARAS SÜTÇÜ IMAM UNİVERSİTY, FACULTY OF AGRİCULTURE, DEPARTMENT OF AGRİCULTURAL BİOTECHNOLOGY, 46100, KAHRAMANMARAŞ, TURKEY
e-mail: ms66@ksu.edu.tr

SURFACE PENCIL WITH A COMMON TIMELIKE ADJOINT CURVE

FATMA GÜLER

0000-0002-5107-8436

ABSTRACT

We showed that the adjoint curve of a spacelike curve with timelike binormal is the timelike curve. We obtain some relationships between a Frenet curve and its adjoint curve in Minkowski 3-space. For the timelike adjoint curve of a given spacelike curve with timelike binormal, we obtain conditions on surfaces that possess this curve as a common asymptotic, geodesic or curvature line in Minkowski 3-space. We also give examples confirming our theory.

REFERENCES

[1] G. J. Wang, K. Tang, C. L. Tai, Parametric representantion of a surface pencil with a common spatial geodesic, Computer Aided Design, 36: 447-459, (2004).
[2] E. Bayram, F. Güler, and E. Kasap, Parametric representation of a surface pencil with a common asymptotic curve, Computer- Aided Design, 44(7), 637-643, (2012).
[3] F. Güler, E. Bayram and E. Kasap, Offset surface pencil with a common asymptotic curve, International Journal of Geometric Methods in Modern Physics, 15.11, 1850195, (2018).
[4] E. Bayram, Surface pencil with a common adjoint curve, Turkish Journal of Mathematics, 44(5), 1649-1659, (2020).
[5] S. K. Nurkan, I. A. Güven and M. K. Karacan, Characterizations of Adjoint Curves in Euclidean 3- Space, Proceedings of the National Academy of Sciences, India Section A: Physical Sciences, 1-7, (2018).

DEPARTMENT OF MATHEMATICS, FACULTY OF SCIENCE AND LETTERS, SAMSUN, TURKEY
E-mail address: f.guler@omu.edu.tr

.

RULED SURFACES WITH THE Q-PARALLEL BASE CURVE

FATMA GÜLER

0000-0002-5107-8436

ABSTRACT

In this study, the ruled surfaces are investigated whose base curve is q parallel curve. Their developability and minimality and the conditions for the q base curve to be special curve on the ruled surface are investigated. The ruled surfaces are illustrated with examples.

REFERENCES

[1] M. Dede, C. Ekici, & H. Tozak, Directional tubular surfaces, International Journal of Algebra, 9(12), 527-535, (2015).
[2] M. T. Aldossary, &M. A. Gazwani, Motion of Parallel Curves and Surfaces in Euclidean 3-Space R3, Geometry-math-journal.ro, (2020).
[3]L. Richard Bishop, There is more than one way to frame a curve, American Mathematical Monthly : 246-251, (1975).
[4] A. Yazla, & M. T. Sariaydin, On Surfaces Constructed by Evolution According to Quasi Frame, Facta Universitatis, Series: Mathematics and Informatics, 605-619, (2020).

DEPARTMENT OF MATHEMATICS, FACULTY OF SCIENCE AND LETTERS, SAMSUN, TURKEY
E-mail address: f.guler@omu.edu.tr

A NEW METHOD FOR SOLVING THE CONFORMABLE TIME-FRACTIONAL JAULENT-MIODEK EQUATIONS

HALIL ANAC

0000-0002-1316-3947

ABSTRACT

The conformable time-fractional Jaulent-Miodek equations by the new methods, called conformable fractional q-Elzaki homotopy analysis transform method and conformable fractional Elzaki decomposition method are analyzed. The graphs of the numerical solutions of these equations are plotted. It is observed that the numerical simulations verify the suggested methods are effective and reliable.

REFERENCES

[1] M. Shrinath, A. Bhadane, New conformable fractional ELZAKI transformation, Theory and applications, Malaya Journal of Matematik (MJM), (1), 619-625, (2019).

[2] M. Atraoui, M. Bouaouid, On the existence of mild solutions for nonlocal differential equations of the second order with conformable fractional derivative, Advances in Difference Equations, (1), 1-11, (2021).

[3] T. Abdeljawad, On conformable fractional calculus, Journal of computational and Applied Mathematics, 279, 57-66, (2015).

[4] V. Ala, U. Demirbilek, K. R. Mamedov, Exact solutions of a conformable fractional equation via Improved Bernoulli Sub-Equation Function Method, 9th International Eurasian Conference on Mathematical Sciences and Applications, Skopje, Macedonia, 2020.

[5] R. Khalil, M. Al Horani, A. Yousef, and M. Sababheh, A new definition of fractional derivative, Journal of Computational and Applied Mathematics, 264, 65-70, (2014)

TORUL VOCATIONAL SCHOOL, GUMUSHANE UNIVERSITY, GUMUSHANE, TURKEY
E-mail Address: halilanac0638@gmail.com

REPRESENTATION THEOREM OF CONTROLLED SETS

GÖKHAN ÇUVALCIOĞLU, DİLARA GÜNDOĞDU, CANSU ALTINCI

0000-0001-5451-3336, 0000-0003-4146-8737, 0000-0003-0675-9555

ABSTRACT

After the concept of Intuitionistic Fuzzy Set has been made, the algebraic structures of intuitionistic fuzzy sets and representation theorems for different many valued set theories were introduced by many researchers. In this study, controlled sets, which are a special type of intuitionistic fuzzy sets, are defined and the relationship between level sets of controlled sets are given. Finally, the representation theorem for controlled sets is given.

REFERENCES

[1] K.T. Atanassov, Intuitionistic Fuzzy Sets, VII ITKR's Session, Sofia, June, (1983).

[2] L.A. Zadeh, Fuzzy Sets, Information and Control, 8, 338-353, (1965).

[3] G. Çuvalcıoğlu, Some Properties of Controlled Set Theory, Notes on Intuitionistic Fuzzy Set, 20(2), 37-42, (2014).

[4] D.A. Ralescu, A Generalization of the Representation Theorem, Fuzzy Sets and Systems, 51, 309-311, (1992).

DEPARTMENT OF MATHEMATICS, MERSIN UNIVERSITY, MERSIN, TURKEY
E-mail address: gcuvalcioglu@mersin.edu.tr
DEPARTMENT OF MATHEMATICS, MERSIN UNIVERSITY, MERSIN, TURKEY
E-mail address: dilaragundogdu8@gmail.com
DEPARTMENT OF MATHEMATICS, MERSIN UNIVERSITY, MERSIN, TURKEY
E-mail address: cansu.altinci01@gmail.com

KEYFRAME EXTRACTION USING LINEAR ROTATION INVARIANT COORDINATES

HASAN MUTLU AND UFUK CELIKCAN

0000-0001-8686-6988, 0000-0001-6421-185X

ABSTRACT

Today, with the improvements in processing power of video cards, SOC hardware, and smartphones, the use of 3D motion data have expanded considerably beyond video games. At the same time, with these developments, the use of computer animation also increased along with the rapid progress in areas such as augmented reality, virtual reality, and video editing software. Keyframe extraction is a widely applied remedy for issues faced with 3D motion capture -based computer animation. In this paper, we propose a novel keyframe extraction method. In this method, firstly the skeletal motion is represented in linear rotation invariant (LRI) coordinates. Afterwards, by applying dimension reduction using PCA, the dimensions covering 95% of the data are automatically selected and the summary data is thus acquired. Then, by applying K-means classification, the summary data is divided into clusters and a keyframe is extracted from each cluster using the cosine similarity measure. To validate the results of our proposed method, we conducted an online user study. The results of the study show that 45% of the participants preferred the keyframes extracted using our LRI-based method, outperforming the alternative by 6%.

REFERENCES

[1] Y. Lipman, O. Sorkine, D. Levin, and D. Cohen-Or, "Linear rotation-invariant coordinates for meshes," ACM Trans. Graph., vol. 24, no. 3, p. 479–487, [Online]. Available: https://doi.org/10.1145/1073204.1073217, jul, (2005).

[2] A. Ma´ckiewicz and W. Ratajczak, "Principal components analysis (pca)," Computers & Geosciences, vol. 19, no. 3, pp. 303–342, [Online]. Available: https:
//www.sciencedirect.com/science/article/pii/009830049390090R, (1993).

[3] S. Lloyd, "Least squares quantization in pcm," IEEE Transactions on Information Theory, vol. 28, no. 2, pp. 129–137, (1982).

[4] M. Kapadia, I.-k. Chiang, T. Thomas, N. I. Badler, and J. T. Kider, "Efficient motion retrieval in large motion databases," in Proceedings of the ACM SIGGRAPH Symposium on Interactive 3D Graphics and Games, ser. I3D '13. New York, NY, USA: Association for Computing Machinery, p. 19–28. [Online]. Available: https://doi.org/10.1145/2448196.2448199, (2013).

[5] C. Jin, T. Fevens, and S. Mudur, "Optimized keyframe extraction for 3d character animations," Computer Animation and Virtual Worlds, vol. 23, no. 6, pp. 559–568, [Online]. Available: https://onlinelibrary.wiley.com/doi/abs/10.1002/cav.1471, (2012)

[6] A. Voulodimos, I. Rallis, and N. Doulamis, "Physics-based keyframe selection for human motion summarization," Multimedia Tools and Applications, vol. 79, no. 5, pp. 3243–3259, [Online]. Available: https://doi.org/10.1007/s11042-018-6935-z, Feb (2020).

[7] T. Sapin´ski, D. Kamin´ska, A. Pelikant, and G. Anbarjafari, "Emotion recognition from skeletal movements," Entropy, vol. 21, no. 7, [Online]. Available: https://www.mdpi.com/1099-4300/21/7/646, (2019).

[8] G. Xia, H. Sun, X. Niu, G. Zhang, and L. Feng, "Keyframe extraction for human motion capture data based on joint kernel sparse representation," IEEE Transactions on Industrial Electronics, vol. 64, no. 2, pp. 1589–1599, (2017).

[9] W. Choensawat, M. Nakamura, and K. Hachimura, "Genlaban: A tool for generating labanotation from motion capture data," Multimedia Tools and Applications, vol. 74, no. 23, pp. 10823–10846, [Online]. Available: https://doi.org/10.1007/s11042-014-2209-6, Dec (2015).

[10] T. Miura, T. Kaiga, N. Matsumoto, H. Katsura, K. Tajima, and H. Tamamoto, "Application of the bayesian information criterion to keyframe extraction from motion capture data," in SIGGRAPH Asia Posters, ser. SA '11. New York, NY, USA: Association for
Computing Machinery, 2011. [Online]. Available: https://doi.org/10.1145/2073304.2073345, (2011).

[11] E. Bulut and T. Capin, "Key frame extraction from motion capture data by curve saliency," CASA, 01 (2007).

[12] H. Togawa and M. Okuda, "Position-based keyframe selection for human motion animation," in 11th International Conference on Parallel and Distributed Systems (ICPADS'05), vol. 2, pp. 182–185, (2005).

[13] Y. Yang, L. Zeng, and H. Leung, "Keyframe extraction from motion capture data for visualization," in International Conference on Virtual Reality and Visualization (ICVRV), 2016, pp. 154–157, (2016).

[14] Q. Zhang, X. Xue, D. Zhou, and X. Wei, "Motion key-frames extraction based on amplitude of distance characteristic curve," International Journal of Computational Intelligence Systems, vol. 7, no. 3, pp. 506–514, [Online]. Available: https://doi.org/10.1080/18756891.2013.859873, (2014).

[15] C. Halit and T. Capin, "Multiscale motion saliency for keyframe extraction from motion capture sequences," Computer Animation and Virtual Worlds, vol. 22, no. 1, pp. 3–14, [Online]. Available: https://onlinelibrary.wiley.com/doi/abs/10.1002/cav.380, (2011).

[16] R. Roberts, J. P. Lewis, K. Anjyo, J. Seo, and Y. Seol, "Optimal and interactive keyframe selection for motion capture," in SIGGRAPH Asia 2018 Technical Briefs, ser. SA '18. New York, NY, USA: Association for Computing Machinery, [Online]. Available: https://doi.org/10.1145/3283254.3283256, (2018).

[17] B. Sun, D. Kong, S. Wang, and J. Li, "Keyframe extraction for human motion capture data based on affinity propagation," IEEE 9th Annual Information Technology, Electronics and Mobile Communication Conference (IEMCON), 2018, pp. 107–112, (2018).

[18] Q. Zhang, S.-P. Yu, D.-S. Zhou, and X.-P. Wei, "An efficient method of key-frame extraction based on a cluster algorithm," Journal of Human Kinetics, vol. 39, no. 1, pp. 5–14, [Online]. Available: https://doi.org/10.2478/hukin-2013-0063, (2013).

[19] K.-S. Huang, C.-F. Chang, Y.-Y. Hsu, and S.-N. Yang, "Key probe: A technique for animation keyframe extraction," The Visual Computer, vol. 21, pp. 532–541, 09 (2005).

[20] Q. Zhang, S. Zhang, and D. Zhou, "Keyframe extraction from human motion capture data based on a multiple population genetic algorithm," Symmetry, vol. 6, pp. 926–937, 12 (2014).

[21] X.-m. Liu, A.-m. Hao, and D. Zhao, "Optimization-based key frame extraction for motion capture animation," The Visual Computer, vol. 29, 01 (2012).

[22] M. Mu¨ller, T. R¨oder, M. Clausen, B. Eberhardt, B. Kru¨ger, and A. Weber, "Documentation mocap database hdm05," Universit¨at Bonn, Tech. Rep. CG-2007-2, June (2007).

DEPARTMENT OF COMPUTER ENGİNEERİNG, HACETTEPE UNİVERSİTY, ANKARA, TURKEY
Email address: hasanmutlu9@gmail.com

DEPARTMENT OF COMPUTER ENGİNEERİNG, HACETTEPE UNİVERSİTY, ANKARA, TURKEY
Email address: celikcan@cs.hacettepe.edu.tr

A STUDY ON MODELING OF CONFLICT AND AGREEMENT WITH GAME THEORY

HAŞİM ÇAPIN, ŞÜKRAN KONCA

0000-0001-8168-5360, 0000-0003-4019-958X

ABSTRACT

Game theory is a mathematical approach to analyze the state of competition between players. The foundations of this theory go back about 170 years, and the main development of the subject is based on the last 55 years. In this study, the effect of game theory on political elections and political behaviors has been examined. The Nash equilibrium is investigated by creating a mathematical model of the gains and losses that two political parties obtain in the elections according to the coalition formation status of two political parties by using the Prisoners' Dilemma game model in cooperative and non cooperative games.

REFERENCES

[1] M. Shubik, Game theory and political science, Cowles Foundation Discussion Papers, 584, (1973).
[2] E. Çam, Oyun teorisinin mahiyeti ve oyunlar, İstanbul Üniversitesi İktisat Fakültesi Mecmuası, 29, 1-4, (2012).
[3] E. Kontacı, Siyasî istikrar temelli koalisyon eleştirileri: Anayasa hukuku açısından ampirik bir analiz, Türkiye Barolar Birliği Dergisi, (2016).
[4] A. Chinchuluun, P. Pardalos, A. Migdalas & L. Pitsoulis, Pareto Optimality, Game Theory And Equilibria, (2008).
[5] P. Roozendaal, Centre parties and coalition cabinet formations: a game theoretic approach, European Journal of Political Research, 18, 3, 325-348, (1990).
[6] I. Curiel, Cooperative combinatorial games, in Chinchuluun A., Pardalos P.M., Migdalas A., Pitsoulis L., Pareto Optimality, Game Theory And Equilibria, Springer Optimization and Its Applications, 17, Springer, New York, (2008).
[7] B. A. Bhuiyan, An Overview of game theory and some applications, Philosophy and Progress, 111–128, (2018).
[8] J. Du, X. Xu, H. Li, X. Zhou & R. Han, Playing prisoner's dilemma with quantum rules, Fluctuation and Noise Letters, 02(04), R189–R203, (2002).
[9] X. Vives, Duopoly information equilibrium: Cournot and bertrand, Journal of Economic Theory, 34(1), 71–94, (1984).
[10] H. Karabacak, Herkes için oyun teorisi: oyunlar, kavramlar, stratejileri, Seçkin Yayıncılık, (2016).
[11] C. Shapiro, Chapter 6 Theories of oligopoly behavior, Handbook of Industrial Organization, Volume 1, 329–414, (1989).
[12] Ö. Özdamar, Oyun kuramının uluslararası ilişkiler yazınına katkıları, Uluslararası İlişkiler, 15, 33-66, (2007).
[13] S. Güner, Oyun kuramı ve uluslararası politika, METU Studies in Development, 163-180, (2003).
[14] E. Weese, Political mergers as coalition formation, Working Papers 997, Economic Growth Center, Yale University, (2011).

İZMİR BAKIRÇAY ÜNİVERSİTESİ, LİSANSÜSTÜ EĞİTİM ENSTİTÜSÜ, AKILLI SİSTEMLER MÜHENDİSLİĞİ YÜKSEKLİSANS PROGRAMI, UYGULAMALI MATEMATİK VE HESAPLAMALI BİLİMLER BİLİM DALI, İZMİR, TÜRKİYE
E-mail address: 6016008@bakircay.edu.tr

İZMİR BAKIRÇAY ÜNİVERSİTESİ, TEMEL BİLİMLER BÖLÜMÜ, MÜHENDİSLİK VE MİMARLIK FAKÜLTESİ, İZMİR, TÜRKİYE
E-mail address: sukran.konca@bakircay.edu.tr

PERTURBATION SOLUTION FOR A CRACKED EULER-BERNOULLI BEAM

L. EMİR SAKMAN

0000-0002-9599-8875

ABSTRACT

The natural frequencies and mode shapes of an Euler-Bernoulli beam with a rectangular cross- section, which has a surface crack, is investigated. The crack is modeled as a change (sudden or gradual) in the cross-section of the beam, and a modified perturbation approach is used assuming that the crack geometry is much smaller than the beam cross section. Computations of natural frequencies and mode shapes were carried out for various crack shapes and compared with a range of experiments and finite element analyses. It is concluded that the suggested modified perturbation approach gives reliable results with minimal effort for eigenfrequencies of cracked beams. Furthermore, as a new feature, the present perturbation method includes the shape of the crack in eigenfrequency computations and in principle, can work for any type of disturbance on the surface including a small bump for example.

REFERENCES

[1] R.D. Adams, P. Cawley, C.J. Pye, B.J. Stone, A vibration technique for non-destructively assessing the integrity of structures, Journal of Mechanical Engineering Science, 20 (2), 93 – 100, (1978).

[2] L. Rubio, An efficient method for crack identification in simply supported Euler – Bernoulli Beams, Journal of Vibration and Acoustics, 131 (5), 1– 6, (2009).

[3] A. Morassi, Crack-induced changes in eigenparameters of beam structures, Asce - Journal Engineering Mechanics, 119 (9), 1798 – 1803, (1993).

[4] M.H.H. Shen, C. Pierre, Natural modes of Bernoulli-Euler Beams with symmetric cracks, Journal of Sound and Vibration, 138 (1), 115 – 134, (1990).

[5] N. Papaeconomou, A. Dimarogonas, Vibration of cracked beams, Computational Mechanics, 5 (2), 88 – 94, (1989).

[6] T.G. Chondros, A.D. Dimarogonas, Vibration of a cracked cantilever beam, Journal of Vibration and Acoustics, 120 (3), 742 – 746, (1998).

[7] N.T. Khiem, L.K. Toan, A novel method for crack detection in beam-like structures by measurements of natural frequencies, Journal of Sound and Vibration, 333 (18), 4084 – 4103, (2014).

[8] J.F. Sáez, A. Morassi, M. Pressacco, L. Rubio, Unique determination of a single crack in a uniform simply supported beam in bending vibration, Journal of Sound and Vibration, 371 (9), 94 – 109, (2016).

[9] T.D. Chaudhari, S.K. Maiti, Modelling of transverse vibration of beam of linearly variable depth with edge crack, Engineering Fracture Mechanics 63 (4), 425 – 445, (1999).

[10] Q. He, Y. Lin, Assessing the severity of fatigue crack using acoustics modulated by hysteretic vibration for a cantilever beam, Journal of Sound and Vibration, 370 (26), 306 – 318, (2016).

[11] F.B. Nejad, A. Khorram, M. Rezaeian, Analytical estimation of natural frequencies and mode shapes of a beam having two cracks, International Journal of Mechanical Sciences, 78 (1), 193 – 202, (2014).

[12] K. Mazanoglu, I. Yesilyurt, M. Sabuncu, Vibration analysis of multiple-cracked non-uniform beams, Journal of Sound and Vibration, 320 (4-5), 977 – 989, (2009).

[13] X.F. Yang, A.S.J. Swamidas, R. Seshadri, Crack identification in vibrating beams using the energy method, Journal of Sound and Vibration, 244 (2), 339 – 357, (2001).

[14] K. Aydin, Free vibration of functionally graded beams with arbitrary number of surface cracks, European Journal of Mechanics - A/Solids, 42 (11-12), 112 – 124, (2013).

[15] S. Caddemi, A. Morassi, Multi-cracked Euler–Bernoulli Beams: Mathematical modeling and exact solutions, International Journal of Solids and Structures, 50 (6), 944 – 956, (2013).

[16] M. Kisa, J. Brandon, M. Topcu, Free vibration analysis of cracked beams by a combination of finite elements and component mode synthesis methods, Computers and Structures, 67 (4), 215 – 223, (1998).

[17] D.Y. Zheng, N.J. Kessissoglou, Free vibration analysis of a cracked beam by finite element method, Journal of Sound and Vibration, 273 (3), 457 – 475, (2004).

[18] M. Kisa, M.A. Gurel, Free vibration analysis of uniform and stepped cracked beams with circular cross sections, International Journal of Engineering Science, 45 (2-8), 364 – 380, (2007).

[19] J.P. Blasques, R.D. Bitsche, An efficient and accurate method for computation of energy release rates in beam structures with longitudinal cracks, Engineering Fracture Mechanics, 133 (1), 56 – 69, (2015).

[20] C. Dundar, I.F. Kara, Three dimensional analysis of reinforced concrete frames with cracked beam and column elements, Engineering Structures, 29 (9), 2262 – 2273, (2007).

[21] T. Xu, A. Castel, Modeling the dynamic stiffness of cracked reinforced concrete beams under low-amplitude vibration loads, Journal of Sound and Vibration, 368 (4),135 – 147, (2016).

[22] M. Heydari, A. Ebrahimi, M. Behzad, Forced vibration analysis of a Timoshenko cracked beam using a continuous model for the crack, Engineering Science and Technology, an International Journal, 17 (4), 194 – 204, (2014).

[23] B. Panigrahi, G. Pohit, Nonlinear modelling and dynamic analysis of cracked Timoshenko functionally graded beams based on neutral surface approach, Journal of Mechanical Engineering Science, 230 (9), 1486 – 1497, (2016).

[24] P. Gudmundson, Eigenfrequency changes of structures due to cracks, notches or other geometrical changes, Journal of the Mechanics and Physics of Solids, 30 (5), 339 – 353, (1982).

[25] W.M. Hasan, Crack detection from the variation of the eigenfrequencies of a beam on elastic foundation, Engineering Fracture Mechanics 52 (3), 409 – 421, (1995).

[26] P.E. Cooley, J.C. Slater, O.V. Shiryayev, Fatigue crack modeling and analysis in beams, 53rd IAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference AIAA Paper 2012-1874, (2012).

[27] M.H.H. Shen, C. Pierre, Natural modes of Bernoulli-Euler Beams with a single-edge crack, 31st ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, AIAA Paper 1990-1124, (1990).

[28] Y.C. Chu, M.H.H. Shen, Analysis of forced bilinear oscillators and the application to cracked beam dynamics, AIAA J. 30 (10), 2512 – 2519, (1992).

[29] T.D. Dang, R.K. Kapania, M.J. Patil, Analytical modeling of cracked thin-walled beams under torsion, AIAA Journal, 48 (3), 664 – 675, (2010).

[30] Y.S. Lee, M.J. Chung, A study on crack detection using eigenfrequency test data, Computers and Structures, 77 (3), 327 – 342, (2000).

[31] S. Moradi, P. Razi, L. Fatahi, On the application of bees algorithm to the problem of crack detection, Computers and Structures, 89 (23-24), 2169 – 2175, (2011).

[32] K.H. Barad, D.S. Sharma, V. Vyas, Crack detection in cantilever beam by frequency based method, Procedia Engineering, 51, 770 – 775, (2013).

[33] N. Hu, X. Wang, H. Fukunaga, Z.H. Yao, H.X. Zhang, Z.S. Wu, Damage assessment of structures using modal test data, International Journal of Solids and Structures, 38 (18), 3111 – 3126, (2001).

[34] N.T. Khiem, L.K. Toan, A novel method for crack detection in beam-like structures by measurements of natural frequencies, Journal of Sound and Vibration, 333 (18), 4084 – 4103, (2014).

[35] J.K. Sinha, M.I. Friswell, S. Edwards, Simplified models for the location of cracks in beam structures using measured vibration data, Journal of Sound and Vibration, 251 (1), 13 –38, (2002).

[36] H.I. Yoon, I.S. Son, S.J. Ahn, Free vibration analysis of Euler-Bernoulli Beam with double cracks, Journal of Mechanical Science and Technology, 21 (3), 476 – 485, (2007).

DEPARTMENT OF MECHANICAL ENGINEERING, ISTANBUL UNIVERSITY – CERRAHPASA, ISTANBUL, TURKEY

Email Address: sakman@istanbul.edu.tr

SOME PROPERTIES OF GENERALIZED OPEN SETS IN IDEAL TOPOLOGICAL SPACES

MERYEM ÖZCAN, and H. FULYA AKIZ

0000-0002-5101-0124 and 0000-0002-8547-2175

ABSTRACT

In [1], S. Kasahara defined an operation $\gamma : \tau \to P(X)$ as a function from τ to the power set of X such that $\gamma (V) \subseteq V$, for each $V \in \tau$, where $V\gamma$ denotes the value of γ at V. A subset A of a space X is called a γ-semi-open set, if there exists a γ-open set O such that $O \subseteq A \subseteq cl\gamma(O)$ [2] . In [3], Hussain introduced and explore generalized open sets namely γ-pre-open and γ-b-open sets in topological spaces. In 1966, Kuratowski [2] studied and applied the concept of ideals. An ideal on a topological space (X, τ) is a collection of subsets of X having the heredity property (i) if $A \in$ I and $B \subset A$, then $B \in I$ and (ii) if $A \in I$ and $B \in I$, then $A \cup B \in I$. In this presentation, we introduce above mentioned generalized open sets in ideal topological spaeces and give some properties.

REFERENCES

[1] S. Kasahara, Operation-Compact Spaces, Math. Japon. 24,97-105, (1979).
[2] S. Hussain, Ahmad, B., Noiri, T., -Semi-Open Sets in Topological Spaces, Assian Eur, J. Math. 3(3), 427-433, (2010).
[3] S. Hussain, On Generalized Open Sets, Hacettepe Journal of Mathematics and Statistics 47(6) ,1438-1446, (2018).
[4] K. Kuratowski, Topology Vols 1 and 2, Academic Press, (1966).

YOZGAT BOZOK UNIVERSITY, FACULTY OF ART AND SCIENCE, YOZGAT, TURKEY
E-mail address: ulubag@hotmail.com

YOZGAT BOZOK UNIVERSITY, FACULTY OF ART AND SCIENCE, YOZGAT, TURKEY
E-mail address: fulya.gencel@yobu.edu.tr

A NEW FUZZY CONTRACTION IN EXTENDED FUZZY METRİC SPACES

MERYEM ŞENOCAK and ERDAL GÜNER

0000-0002-2988-9419 and 0000-0003-4749-1321

ABSTRACT

In this paper we would like to present a new kind of contraction which is called F-M^o-fuzzy contraction, and then we prove some fixed point theorems given by Huang et al. [9] in the extended fuzzy metric space introduced by Gregori at al. [6]. And so we combine and generalize some existing notions in the literature. Contractivity's role in the fixed point theory is very important. There are a lot of studies in the literature different versions contractive mappings in the different spaces ([3], [4], [9], [11], [12], [13], [15]). Wardowski [15] manifested a contraction refered F-contraction and proved a fixed point theorem in metric spaces. And then inspiring by him, H. Huang and coauthors [9] presented fuzzy F-contraction. Inspired by this, we define a new notion which is generalized version of fuzzy F-contraction in extended fuzzy metric spaces.

REFERENCES

[1] S. Banach, Sur les oprations dans les ensembles abstrails et leur application aux quations intgrales, Fund Math., 3, 133-181,(1922).

[2] C. Di Bari, C.Vetro, Fixed points, attractors and weak fuzzy contractive mappings in a fms, J. Fuzzy Math., 13(4), 973-982 (2005),.

[3] A. George, P.Veeramani, On some results in fuzzy metric spaces, Fuzzy Sets and Systems, 64, 395-399, (1994).

[4] D. Gopal and C.Vetro, Some new fixed point theorems in fuzzy metric spaces, Iranian Journal of Fuzzy Systems, 11/3, 95-107, (2014).

[5] M. Grabiec, Fixed points in fuzzy metric spaces, Fuzzy Sets and Systems, 27, 385-389, (1988).

[6] V. Gregori, J.J. Minana and D.Miravet, Extended fuzzy metrics and fixed point theorems, Mathematics Journal, 7, 303, (2019).

[7] V. Gregori, S. Romaguera, Characterizing completable fuzzy metric spaces, Fuzzy Sets and Systems, 144, 411-420, (2014).

[8] V. Gregori, A. Sapena, On fixed point theorems in fuzzy metric spaces, Fuzzy Sets and Systems, 125, 245-252, (2002).

[9] H. Huang, B. Caric, T. Dosenovic, D.Rakic and M.Brdar, Fixed point theorems in fms via fuzzy F-contraction, Math. J., 9, 641.10, (2021).

[10] I. Kramosil, J. Michalek,Fuzzy metrics and statistical metric spaces, Kybernetika, 11, 336-344, (1975).

[11] D. Mihet, Fuzzy ψ- contractive mappings in non-Archimedean fuzzy metric space, Fuzzy Sets and Systems, 159, 739-744. 10., (2008).

[12] D. Mihet, A note on fuzzy contractive mappings in fuzzy metric spaces, Fuzzy Set. Syst., 251, 83-91,16, (2014).

[13] B. Samet, C. Vetro, P.Vetro, Fixed point theorems for α-ψ contractive type mappings, Nonlinear Analysis Theory, Methods and Applications, 75, 2154-2165, (2012).

[14] B. Schwizer, A. Sklar, Statistical metric spaces, Pacific Journal of Mathematics 10, 315-367, (1960).

[15] D. Wardowski, Fixed points of a new type of contractive mappings in complete metric spaces, Fixed Point Theory Appl., 94,(2012).

[16] L. A. Zadeh, Fuzzy sets, Inform. Control, 8, 338-353, (1965).

DEPARTMENT OF MATHEMATICS, FACULTY OF SCIENCES, ANKARA UNIVERSITY, TURKEY
E-mail address: meryemsnck@gmail.com

DEPARTMENT OF MATHEMATICS, FACULTY OF SCIENCES, ANKARA UNIVERSITY, TURKEY
E-mail address: guner@science.ankara.edu.tr

COMPARISON OF THREE-PARAMETER WEIBULL DISTRIBUTION PARAMETER ESTIMATORS WITH THE MAXIMUM LIKELIHOOD METHOD

LAZIM KAMBERI, SENAD ORHANI, MIRLINDA SHAQIRI and SEJHAN IDRIZI

0000-0001-6995-9189, 0000-0003-3965-0791, 0000-0002-9330-8156, 0000-0003-1287-6571

ABSTRACT

Important distributions used to model and analyse data in various real-life sciences such as natural sciences, engineering, and medicine are the Weibull distribution, the Weibull exponential distribution, and the Weibull Rayleigh distribution. The main objective of this paper is to determine the best evaluators and compare them for the distribution with three-parameters of Weibull, Weibull Rayleigh and Exponential Weibull. The methods under consideration for comparing the parameter estimators for these distributions is that of maximum likelihood using the statistical program R for the application of real data. Based on the results obtained from this study, the maximum likelihood approach used in estimating the parameters is the comparison between these distributions. Comparisons are made to determine the performance of these distributions.

REFERENCES

[1] G. T. Basheer, Z. Y. Algamal, Reliability Estimation of Three Parameters Weibull Distribution based on Particle Swarm Optimization, Pakistan Journal of Statistics and Operation Research, 17, 35-42, (2021).
[2] R. D. Gupta, D. Kundu, Exponentiated exponential family: an alternative to gamma and Weibull distributions, Biometrika Journal, 43, 117-130, (2001).
[3] E. K. AL-Hussaini, M. Ahsanullah, Exponentiated Distributions, Springer, 5, (2015).
[4] G. S. Mudholkar, A. D. Hustson, The exponentiated Weibull family: some properties and a flood data application, Communications in Statistics-Theory and Methods, 25, 3059-3083, (1996).
[5] A. M. Abd Elfattah, , A. S. Hassanand, D.M. Ziedan, Efficiency of Maximum Likelihood Estimators under Different Censored Sampling Schemes for Rayleigh Distribution, Interstat, (2006).
[6] K..Cooray, Generalization of the Weibull distribution: the odd Weibull family, Statistical Modelling, 6, 265-277, (2006).
[7] B. Marcelo, R. B. Silva , G. Cordeiro, The Weibull - G Family of Probability Distributions. Journal of Data Science, 12, 53-68, (2014).
[8] D. F. Andrews, A. M. Herzberg, Data: A Collection of Problems from Many Fields for the Student and Research Worker, Springer Series in Statistics, New York, (1985).
[9] W. Barreto-Souza, A.H.S. Santos, G.M. Cordeiro, The beta generalized exponential distribution, Journal of Statistical Computation and Simulation, 80, 159-172, (2010).
[10] W. Barreto-Souza, A. L. Morais, G.M. Cordeiro, The Weibull-geometric distribution, Journal of Statistical Computation and Simulation, 81, 645-657, (2011).
[11] A. Choudhury, A Simple derivation of moments of the exponentiated Weibull distribution, Metrika, 62, 17-22, (2005).
[12] C. Kundu, A. K. Nanda, Some reliability properties of the inactivity time, Communications in Statistics-Theory and Methods, 39, 899-911, (2010).
[13] E. Mahmoudi, A. Sepahdar, Exponentiated Weibull-Poisson distribution: Model, properties and applicatios, Submitted to Journal of Mathematics and Computer in Simulation, (2011).
[14] A. L. Morais, W. Barreto-Souza, A compound class of Weibull and power series distributions, Computational Statistics and Data Analysis, 55, 1410-1425, (2011).
[15] A. K. Nanda, H. Singh, N. Misra, P. Paul, Reliability properties of reversed residual lifetime, Communications in Statistics-Theory and Methods, 32, 2031-2042, (2003).
[16] M. M. Nassar, F. H. Eissa, On the exponentiated Weibull distribution, Communications in Statistics-Theory and Methods, 32, 1317-1336, (2003).
[17] R. Tahmasbi, S. Rezaei, A two-parameter lifetime distribution with decreasing failure rate, Computational Statistics and Data Analysis, 52, 3889-3901, (2008).
[18] L. Kamberi, T. Iljazi, S. Orhani, Statistical Analysis on Information Technology Impact in Quality Learning of Mathematics (for Grades VI-IX), Journal of Natural Sciences and Mathematics of UT, 6, 11-12, 123-134, (2021).
[19] F. Merovci, I. Elbatal, Weibull Rayleigh Distribution: Theory and Applications, Appl. Math. Inf. Sci. 9, 4, 2127-2137, (2015).

DEPARTMENT OF MATHEMATICS, FACULTY OF MATHEMATICS-NATURAL SCIENCE, UNIVERSITY OF TETOVA, TETOVO, NORTH MACEDONIA
Email Address: lazim.kamberi@unite.edu.mk

DEPARTMENT OF EDUCATION, FACULTY OF EDUCATION, UNIVERSITY OF PRISHTINA "HASAN PRISHTINA", PRISHTINA, KOSOVO
Email Address: senad.orhani@uni-pr.edu

DEPARTMENT OF MATHEMATICS, FACULTY OF MATHEMATICS-NATURAL SCIENCE, UNIVERSITY OF TETOVA, TETOVO, NORTH MACEDONIA
Email Address: mirlinda.selami@unite.edu.mk

DEPARTMENT OF MATHEMATICS, FACULTY OF MATHEMATICS-NATURAL SCIENCE, UNIVERSITY OF TETOVA, TETOVO, NORTH MACEDONIA
Email Address: sejhan.idrizi@unite.edu.mk

NUMERICAL SIMULATION OF GENERALIZED OSKOLKOV EQUATION VIA THE SEPTIC B-SPLINE COLLOCATION METHOD

Seydi Battal Gazi KARAKOÇ, Derya Yıldırım SUCU and Mohammad Arif TAGHACHI

0000-0002-2348-4170, 0000-0001-8396-8081 and 0000-0001-5760-6538

ABSTRACT

In this paper, one of the nonlinear evolution equation (NLEE) namely generalised Oskolkov equation which defines the dynamics of an incompressible visco-elastic Kelvin-Voigt fluid is investigated [1,2,3,4]. We discuss numerical solutions of the equation for two test problems including single solitary wave and Gaussian initial condition, applying the collocation finite element method. The numerical scheme, based on a Crank Nicolson approximation in time, is unconditionally stable. In order to prove the proficiency and accuracy of the numerical algorithm, error norms L_2 , L_∞ and invariant I are computed and the obtained results are indicated both in tabular and graphical form. The obtained numerical results provide that the method is more suitable and systematically handle the solution procedures of nonlinear equations arising in mathematical physics.

REFERENCES

[1] M. Alquran, Bright and dark soliton solutions to the Ostrovsky-Benjamin-Bona-Mahony (OS-BBM) equation, J. Math. Comput. Sci., 2, pp.15-22, (2012).
[2] G.A. Sviridyuk, A.S. Shipilov, On the stability of solutions of the Oskolkov equations on a graph, Differential Equations, 46,pp.742-747, (2010).
[3] M.M. Roshid, H.O. Roshid, Exact and explicit traveling wave solutions to two nonlinear evolution equations which describe incompressible viscoelastic Kelvin-Voigt uid, Heliyon, 4, pp.1-21, (2018)
[4] A.O. Kondyukov, T.G. Sukacheva, Phase space of the initial-boundary value problem for the Oskolkov system of nonzero order, Computational Mathematics and Mathematical Physics , 55, pp.823-828, (2015).

DEPARTMENT OF MATHEMATICS, FACULTY OF SCIENCE and ARTS, NEVSEHIR HACİ BEKTAS VELİ UNİVERSITY, NEVSEHIR, TURKEY.
E-mail address: sbgkarakoc@nevsehir.edu.tr

DEPARTMENT OF MATHEMATICS, FACULTY OF SCIENCE and ARTS, NEVSEHIR HACİ BEKTAS VELİ UNİVERSITY, NEVSEHIR, TURKEY.
E-mail address: dryldrmsucu@gmail.com

DEPARTMENT OF MATHEMATICS, FACULTY OF SCIENCE and ARTS, NEVSEHIR HACİ BEKTAS VELİ UNİVERSITY, NEVSEHIR, TURKEY.
E-mail address: Taghachi1990@gmail.com

α-INTERVAL VALUED FUZZY SETS

ARIF BAL AND GÖKHAN ÇUVALCIOĞLU

0000-0003-4386-7416 and 0000-0001-5451-3336

ABSTRACT

In this study, the new order relation is introduced on α-interval valued set whose elements are closed intervals of [0,1] including α ∈ [0,1]. α-interval valued set is a complete lattice according to new order relation. Afterwards, the negation function on α-interval valued set is defined. By the help of α-interval valued set, α-interval valued fuzzy sets are defined. The fundamental algebraic properties of these sets are examined. The level subsets of α-interval valued fuzzy sets are introduced. Some propositions and examples are given.

REFERENCES

[1] R. Biswas, Rosenfeld's Fuzzy Subgroups with Interval Valued Membership Functions. Fuzzy Sets and Systems , 63, 87-90, (1994).
[2] I. Grattan-Guiness, Fuzzy Membership Mapped onto Interval and Many-valued Quantities. Z. Math. Logik. Grundladen Math., 22, 149-160, (1975).
[3] B. Gorzalczany, Approximate Inference with Interval-valued Fuzzy Sets, an Outline, in: Proc. Polish Symp. on Interval and Fuzzy Mathematics, Poznan, 89–95, (1983).
[4] B. Gorzalczany, A Method of Inference in Approximate Reasoning Based on Interval-valued Fuzzy Sets, Fuzzy Sets and Systems, 21, 1-17, (1987).
[5] K. U. Jahn, Intervall-wertige Mengen, Math.Nach, 68, 115-132, (1975).
[6] T. K. Mondal, S. K. Samanta , Topology of Interval-Valued Fuzzy Sets, Indian J. Pure Applied Math., 30, (1), 20-38, (1999).
[7] R. Sambuc, Fonctions φ-floues. Application L'aide au Diagnostic en Pathologie Thyroidi- enne, Ph. D. Thesis, Univ. Marseille, France, (1975).
[8] I. Turksen, Interval Valued Fuzzy Sets Based on Normal Forms, Fuzzy Sets and Systems , 20, 191–210, (1986).
[9] L. A. Zadeh, Fuzzy Sets, Information and Control, 8, 338-353, (1965).
[10] L. A. Zadeh, The Concept of a Linguistic Variable and Its Application to Approximate Reasoning. Part 1, Infor. Sci., 8, 199-249, (1975).
[11] L. A. Zadeh, The Concept of a Linguistic Variable and Its Application to Approximate Reasoning. Part 2, Infor. Sci., 8, 301-357, (1975).
[12] L. A. Zadeh, The Concept of a Linguistic Variable and Its Application to Approximate Reasoning,.Part 3, Infor. Sci., 9, 43-80, (1975).
[13] X. Li, G. Wang, The S_H-Interval-valued Fuzzy Subgroups. Fuzzy Sets and Systems, 112, 319-325, (2000).

MERSIN UNIVERSITY, FACULTY OF ARTS AND SCIENCES, DEPARTMENT OF MATHEMATICS, MERSIN, TURKEY
E-mail address: gcuvalcioglu@gmail.com

MERSIN UNIVERSITY, VOCATIONAL SCHOOL OF TECHNICAL SCIENCES, DEPARTMENT OF MOTOR VEHICLES and TRANSPORTATION TECHNOLOGIES, MERSIN, TURKEY
 E-*mail address:* arif.bal.math@gmail.com

A TILING INTERPRETATION FOR (p, q)-FIBONACCI AND (p, q)-LUCAS NUMBERS

YASEMİN TAŞYURDU and NAİME ŞEYDA TÜRKOĞLU

0000-0002-9011-8269 and 0000-0003-2301-3958

ABSTRACT

In this paper, we introduce a tiling approach to (p,q)-Fibonacci and (p,q)-Lucas numbers that generalize of the well-known Fibonacci, Lucas, Pell, Pell-Lucas, Jacobsthal ve Jacobsthal-Lucas numbers. We get that nth (p,q)-Fibonacci number is interpreted as the number of ways to tile a $1 \times n$ board with cells labeled $1, 2, \ldots, n$ using colored 1×1 squares and 1×2 dominoes, where there are p different colors for squares and q different colors for dominoes. Then nth (p,q)-Lucas number is interpreted as the number of ways to tile a circular $1 \times n$ board with squares and dominoes. We also present some generalized Fibonacci and Lucas identities using this tiling approach.

REFERANSLAR

[1] R.C. Brigham, R.M. Caron, P.Z. Chinn, R.P. Grimaldi, A tiling scheme for the Fibonacci numbers, J. Recreational Math., 28(1), 10–17, (1996-97).
[2] A.T. Benjamin, J.J. Quinn, The Fibonacci Numbers Exposed More Discretely, Math. Magazine, 33, 182–192, (2002).
[3] A.T. Benjamin, J.J. Quinn, Proofs That Really Count: The Art of Combinatorial Proof, Mathematical Association of America, (2003).
[4] A. Suvarnamani, M. Tatong, Some Properties of (p,q)-Fibonacci Numbers, Science and Technology RMUTT Journal, 5(2), 17-21, (2015).
[5] A. Suvarnamani, Some Properties of (p,q)-Lucas Number, Kyungpook Mathematical Journal, 56, 367-370, (2016).
[6] Y. Taşyurdu, Generalized (p,q)-Fibonacci-Like Sequences and Their Properties, Journal of Mathematics Research, 11(6), 43-52, (2019).

DEPARTMENT OF MATHEMATICS, FACULTY OF ARTS AND SCIENCES, ERZINCAN BİNALİ YILDIRIM UNIVERSITY, 24100 ERZINCAN, TURKEY
E-mail address: ytasyurdu@erzincan.edu.tr

GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES, ERZİNCAN BİNALİ YILDIRIM UNIVERSITY, DEPARTMENT OF MATHEMATICS, 24100 ERZINCAN, TURKEY
E-mail address: naimeseydaturkogu@gmail.com

BI-PERIODIC (p,q)-FIBONACCI AND BI-PERIODIC (p,q)-LUCAS SEQUENCES

YASEMİN TAŞYURDU and NAİME ŞEYDA TÜRKOĞLU

0000-0002-9011-8269 and 0000-0003-2301-3958

ABSTRACT

In this paper, we define bi-periodic (p,q)-Fibonacci and bi-periodic (p,q)-Lucas sequences which generalize the bi-periodic Fibonacci type and bi-periodic Lucas type sequences using recurrence relations of (p,q)-Fibonacci and (p,q)-Lucas sequences. Binet formulas that allow us to calculate the nth number of these sequences and generating functions are given. Also we prove some fundamental identities conform to the well-know properties of Fibonacci and Lucas sequences.

REFERANSLAR

[1] A.F. Horadam, A Generalized Fibonacci Sequence, American Mathematical Monthly, 68(5), 455-459, (1961).
[2] M. Edson, O. Yayenie, A new generalizations of Fibonacci sequences and extended Binet's Formula, Integers, 9, 639–654, (2009).
[3] G. Bilgici, Two generalizations of Lucas sequence, Appl. Math. Comput., 245, 526–538, (2014).
[4] A. Suvarnamani, M. Tatong, Some Properties of (p,q)-Fibonacci Numbers, Science and Technology RMUTT Journal, 5(2), 17-21, (2015).
[5] A. Suvarnamani, Some Properties of (p,q)-Lucas Number, Kyungpook Mathematical Journal, 56, 367-370, (2016).
[6] Y. Taşyurdu, Generalized (p,q)-Fibonacci-Like Sequences and Their Properties, Journal of Mathematics Research, 11(6), 43-52, (2019).

DEPARTMENT OF MATHEMATICS, FACULTY OF ARTS AND SCIENCES, ERZINCAN BİNALİ YILDIRIM UNIVERSITY, 24100 ERZINCAN, TURKEY
E-mail address: ytasyurdu@erzincan.edu.tr

GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES, ERZİNCAN BİNALİ YILDIRIM UNIVERSITY, DEPARTMENT OF MATHEMATICS, 24100 ERZINCAN, TURKEY
E-mail address: naimeseydaturkogu@gmail.com

A DIFFERENT DISCREZATION SCHEME FOR A MODEL WITH MICHAELIS-MENTEN HARVESTING RATE

NIHAL ÖZDOĞAN , MEVLÜDE YAKIT ONGUN

0000-0002-7551-1636, 0000-0003-2363-9395

ABSTRACT

 In this paper, the ratio dependent continuous model with Michaelis-Menten harvesting rate was discretized using nonstandard finite difference scheme (NSFD). The new method preserves both the local stability of the equilibrium points and the positivity of the solutions. Also, the NSFD method shows dynamic consistency with the proposed continuous predator-prey model. However, due to the difficulty of solving such models, the behaviour of numerical solutions have been examined. The phase portrait and solution graphics of the discretized model are shown.

REFERENCES

[1] A.A. Berryman, The origins and evolution of predator-prey theory, Ecology, 73 (5), 1530-1535, (1992).
[2] L.I. Roege, G. Lahondy, Dynamically consistent discrete Lotka-Volterra competition systems, Journal of Difference Equations and Applications, 19 (2), 191-200, (2015).
[3] M. Sajjad, Q. Din, M. Safeer, M.A. Khan, K. Ahmad, A dynamically consistent nonstandard finite difference scheme for a predator-prey model. Advances in Difference Equations, 2019:381, (2019).
[4]A. Lotka, L.I. Dublin. On the True Rate of Natural Increase: As Exemplified by the Population of the United States, Journal of American Statistical Association, 150, 305-339, (1925).
[5] Y.O. El-Dib, J.H. He, Homotopy perturbation method with three expansions, Journal of Mathematical Chemistry, 1139-1150, (2021).

DEPARTMENT OF MATHEMATİCS, BURSA TECHNICAL UNIVERSITY, BURSA, TURKEY.
Email Address: nihal.ozdogan@btu.edu.tr

DEPARTMENT OF MATHEMATİCS, SULEYMAN DEMİREL UNIVERSITY, ISPARTA, TURKEY.
Email Address: mevludeyakit@sdu.edu.tr

ON FIXED POINTS OF d_{D}^{b} – CYCLICAL CONTRACTIONS

NİLAY DEĞİRMEN

0000-0001-8192-8473

ABSTRACT

In the current study, we give some new fixed point results by using different types of cyclic contractions in the setting of hyperbolic valued $b-$ metric space. Also, we establish several illustrative examples to verify accuracy of our findings.

REFERENCES

[1] S. Banach, Sur Les Operations Dans Les Ensembles Abstraits Et Leurs Applications Aux Equations Integrales, Fund. Math. 3, 133-181, (1922).
[2] W. A. Kirk, P. S. Srinivasan, P. Veeramani, Fixed Points for Mapping Satisfying Cyclic Contractive Conditions, Fixed Point Theory, 4, 79-89, (2003).
[3] E. Karapinar, I. M. Erhan, Best Proximity on Different Type Contractions, Appl. Math. Inf. Sci., 5, 558-569, (2010).
[4] I. A. Bakhtin, The Contraction Mapping Principle in Quasimetric Spaces, Functional Analysis, 30, 26–37, (1989).
[5] S. Czerwik, Nonlinear Set-Valued Contraction Mappings in $b-$ Metric Spaces. Atti del Seminario Matematico e Fisico dell'Universita di Modena, 46(2), 263–276, (1998).
[6] R. George, C. Alaca, K. P. Reshma, On Best Proximity Points in $b-$ Metric Space, Nonlinear Anal. Appl., 1, 45-56, (2015).
[7] R. George, K. P. Reshma, A. Padmavati, Fixed Point Theorems for Cyclic Contractions in $b-$ Metric Spaces, J. Nonlinear Funct. Anal., 5, (2015).
[8] S. Radenović, T. Došenović, T. A. Lampert, Z. Golubović, A Note on Some Recent Fixed Point Results for Cyclic Contractions in $b-$ Metric Spaces and An Application to Integral Equations, Appl. Math. Comput., 273, 155-164, (2016).
[9] N. Değirmen, Hyperbolic Valued $b-$ Metric Spaces and Zamfirescu Type Contractions, 12th International Conference on Engineering & Natural Sciences, Bingol, Turkey, December 24-25, (2021).
[10] R. Kumar, H. Saini, Topological Bicomplex Modules, Adv. Appl. Clifford Algebr., 26(4), 1249-1270, (2016).
[11] R. Kannan, Some Results on Fixed Points, Bull. Calcutta Math. Soc., 10, 71-76, (1968).
[12] S. K. Chatterjea, Fixed-Point Theorems, C.R. Acad. Bulgare Sci., 25, 727-730, (1972).
[13] T. Zamfirescu, Fix Point Theorems in Metric Spaces, Archiv der Mathematik, 23(1), 292-298, (1972).
[14] S. Reich, Fixed Points of Contractive Functions, Boll. Unione Mat. Ital., 5, 26-42, (1972).
[15] L. B. Ćirić, A Generalization of Banach's Contraction Principle. Proc. Amer. Math. Soc., 45(2), 267-273, (1974).
[16] G. B. Price, An Introduction to Multicomplex Spaces and Functions, M. Dekker, (1991).
[17] M. E. Luna-Elizarrarás, M. Shapiro, D. C. Struppa, A. Vajiac, Bicomplex Holomorphic Functions: The Algebra, Geometry and Analysis of Bicomplex Numbers, Birkhäuser, (2015).
[18] N. Sager, B. Sağır, Fixed Points of Hyperbolic Contraction Mappings on Hyperbolic Valued Metric Spaces, Sarajevo J. Math., 17 (30), (2), 223-236, (2021).

DEPARTMENT OF MATHEMATICS, FACULTY OF SCIENCE AND ARTS, SAMSUN, TURKEY
E-mail address: nilay.sager@omu.edu.tr

ON FIXED CIRCLES IN HYPERBOLIC VALUED METRIC SPACES

NİLAY DEĞİRMEN

0000-0001-8192-8473

ABSTRACT

In this work, we give a concept of a fixed circle on a hyperbolic valued metric space. We also investigate some fixed circle theorems for self-mappings in different ways by supporting our newly obtained results with some numerical examples.

REFERENCES

[1] S. Banach, Sur Les Operations Dans Les Ensembles Abstraits Et Leurs Applications Aux Equations Integrales, Fund. Math., 3, 133-181, (1922).

[2] N. Y. Özgür, N. Taş, Some Fixed-Circle Theorems on Metric Spaces. Bull, Malays. Math. Sci. Soc., 42(4), 1433-1449, (2019).

[3] N. Sager, B. Sağır. Fixed Points of Hyperbolic Contraction Mappings on Hyperbolic Valued Metric Spaces. Sarajevo J. Math., 17 (30) (2), 223-236 (2021).

[4] R. Kumar, H. Saini, Topological Bicomplex Module, Adv. Appl. Clifford Algebr., 26(4), 1249-1270, (2016).

[5] N. Sager, B. Sağır, Common Fixed Coupled Coincidence and Common Coupled Fixed Point Results in Hyperbolic Valued Metric Spaces, Boletim da Sociedade Paranaense de Matemática, (accepted for publication), (2021).

[6] N. Değirmen, Hyperbolic Valued Dislocated Metric Spaces, Avrupa Bilim ve Teknoloji Dergisi, 28, 1152-1158, (2021).

[7] N. Değirmen, Hyperbolic Valued $b-$ Metric Spaces and Zamfirescu Type Contractions, 12th International Conference on Engineering & Natural Sciences, December 24-25, Bingol, Turkey, (2021).

[8] G. B. Price, An Introduction to Multicomplex Spaces and Functions, M. Dekker, (1991).

[9] M. E. Luna-Elizarrarás, M. Shapiro, D. C. Struppa, A. Vajiac, Bicomplex Holomorphic Functions: The Algebra, Geometry and Analysis of Bicomplex Numbers, Birkhäuser, (2015).

[10] R. Kannan. Some Results on Fixed Points. Bull, Calcutta Math. Soc., 10, 71-76, (1968).

[11] S. K. Chatterjea, Fixed-Point Theorems, C.R. Acad. Bulgare Sci., 25, 727-730, (1972).

[12] L. B. Ćirić, A Generalization of Banach's Contraction Principle, Proc. Amer. Math. Soc., 45(2), 267-273, (1974).

[13] S. Reich, Fixed Points of Contractive Functions, Boll. Unione Mat. Ital., 5, 26-42, (1972).

DEPARTMENT OF MATHEMATICS, FACULTY OF SCIENCE AND ARTS, SAMSUN, TURKEY
E-mail address: nilay.sager@omu.edu.tr

GROVER'S SEARCH ALGORITHM OR QUANTUM SEARCH ALGORITHM

NURCAN BOZKURT and MUTTALİP ÖZAVŞAR

0000-0002-0403-7527 and 0000-0003-1471-6774

ABSTRACT

In this presentation, we will discuss Grover's quantum search algorithm (Grover iteration), which is an impressive discovery not only because of its simplicity and elegance, but also for its potential range of applications. Based on some basic principles of quantum mechanics, a quantum Grover search algorithm can be constructed. The Quantum Grover search algorithm has an important role in terms of the speed of the search action. The Quantum Grover search algorithm models the holistic structure formed by quantum states and provides a much faster solution than classical search algorithms.

REFERENCES

[1] M. A. Nielsen and I. L. Chuang, Quantum Computing and Quantum Information, Cambridge University Press,(2010).
[2] M. Lanzagorta and J. Uhlmann, Quantum Computer Science, (2009).
[3] D. C. Marinescu and G. M. Marinescu, Quantum Information and Error Correction From Classical to Quantum Concepts, (2009).
[4] P. Kaye, R. Laflamme, M. Mosca, An Introduction to Quantum Computing, (2007)

DEPARTMENT OF MATHEMATICS, YILDIZ TECHNICAL UNIVERSITY, İSTANBUL, TURKEY
E-mail address: nurcan.bozkurt@std.yildiz.edu.tr

DEPARTMENT OF MATHEMATICS, YILDIZ TECHNICAL UNIVERSITY, İSTANBUL, TURKEY
E-mail address: muttalipmat@gmail.com

QUASI HEMI SLANT SUBMANIFOLDS OF LORENTZIAN CONCIRCULAR STRUCTURES

TOUKEER KHAN, SHEEBA RİZVİ and OĞUZHAN BAHADIR

0000-0003-1176-4666, 0000-0002-3394-8725 and 0000-0001-5054-8865

ABSTRACT

In this paper, we define and study quasi hemi-slant submanifolds as a generalization of slant submanifolds, semi-slant submanifolds and hemi-slant submanifolds of Lorentzian concircular structures – manifolds or $(LCS)_n$- manifolds. Further, we obtain necessary and sufficient conditions for integrability of distributions which are involved in the definition of quasi hemi-slant submanifolds of Lorentzian concircular structures – manifolds or $(LCS)_n$- manifolds. After it, we investigate the necessary and sufficient condition for quasi hemi-slant submanifolds of Lorentzian concircular structures – manifolds or $(LCS)_n$- manifolds to be totally geodesic and study the geometry of foliations determine by the distribution.

REFERENCES

[1] A. Akram and L-I. Piscoran, Geometry classification of warped products isometrically immersed into Sasakian space form, Mathematische Nachrichten, 1-8.https://doi.org/10.1002/mana.201700121, (2018).
[2].A. Ali, S. Uddin and W. A. O. Othman, Geometry of warped product pointwise semi-slant submanifolds in Kaehler manifolds, Filomat 31, 3771-3788, (2017).
[3] M, Ahmed, CR-submanifolds of LP-Sasakian manifolds endowed with a quarter symmetric metric connection, Bull. Korean Math. Soc., 49(1), 25-32, (2012).
[4] D. E. Blair, Contact manifold in Riemannian geometry, Lecture notes in Math. 509, Springer-Verlag, New York, (1976).
[5] A. Bejancu and N. Papaghuic, Semi-invariant submanifolds of a Sasakian manifold, An St. Univ. AI. I. Cuzu. Isai. Math. (N. S.) 27, 163-170, (1981).
[6.] A. M. Blaga, Invariant, anti-invariant and slant submanifolds of a para-Kenmotsu manifolds, BSG Proc, 24, 19-28, (2017).
[7] M. Ahmed and J. P. Ojha, CR-submanifolds of LP-Sasakian manifolds with a canonical semi-symmetric semi-metric connection, Int. J. Contemp. Math Sci. 5(33), 1637-1643, (2010).
[8] R. Prasad, S. K. Verma and S. Kumar, Quasi hemi-slant submanifolds of Sasakian manifolds, J. math. Comput. Sci. 10, (2), 418-435, (2020).
[9] R. Prasad, S. K. Verma, S. Kumar and S. K. Chaubey, Quasi hemi-slant submanifolds of Cosymplectic manifolds, Korean J. Math. 28, (2), 257-273. http://dx.doi.org/10.11568/kjm.2020.28.2.257, (2020).
[10] B. Y. Chen, Geometry of slant submanifolds, Katholieke Universiteit, Leuven, (1990).
[11] T. Pal and S. K. Hui, Hemi-slant $\xi^\perp$ −Lorentzian Submersions from $(LCS)_n$- manifolds, MATEMATICKI VESNIC, 72, 2, 106-116, (2020).
[12] M. Atceken, On geometry of submanifolds of $(LCS)_n$- manifolds, Int. J. Math. Sci. DOI: 10.1155/2012/304647, (2012).
[13] M. Atceken and S. Kumarthi, Slant and pseudo slant submanifolds in $(LCS)_n$- manifolds, Czeshoslovak Math. J. 63(138), 177-190, (2013).
[14] U. C. De and A. A. Shaikh, Complex manifolds and contact manifolds, Narosa Publ. House, (2009).
[15] M. Kon, Remarks on anti-invariant submanifolds of a Sasakian manifolds, Tensor (N.S.) 30, 239.-245, (1976).
[16] A. Bejancu, Geometry of CR-submanifolds, Mathematics and Application, D. Reidel Publishing Co., Dordrecht (1986).
[17] A. Lotta, Slant submanifolds in contact geometry, Bull. Math. Soc. Romanie 39, 183-198, (1996).
[18] N. Papaghuic, Semi-slant submanifold of Kaehlerian manifold, An. St. Univ. Al. I. Cuza. Iasi. Math. (N.S.), 9, 55-61, (1994).
[19] K. S. Park and R. Prasad, Semi-slant submersions, Bull. Korean Math. Soc. 50, 951-962, (2013).
[20] B. Sahin, Warped product submanifolds of a Kaehler manifold with a slant factor, Ann. Pol. Math., 95, 197-126, (2019).
[21] B. Sahin, Slant submersions from almost Hermitian manifolds, Bull. Math. dela Soc. des Sciences Math. de Roumanie, 54, 93-105, (2011).
[22] F. Sahin, Cohomology of hemi-slant submanifolds of a Kaehler manifolds, J. Adv. Studies Topology, 5 , 27-31, (2014).
[23] U. C. De and A. K. Sengupta, CR-submanifolds of Lorentzian para-Sasakian manifolds, Bull. Malay. Math. Sci. Soc. 23, 199-206, (2000).
[24] K. Matsumoto, On Lorentzian paracontact manifolds, Bull. Of Yamagata Univ. Nat. Sci. 12(2), 151-156,)1989).
[25] S. Uddin, B. Y. Chen and F. R. Al-Solamy, Warped product bi-slant immersions in Kaehler manifolds, Mediterr. J. Math., 14, 14-95, (2017).

[26] I. Mihai and R. Rosca, On Lorentzian P-Sasakian manifolds, Classical Analysis, Word Scientific Publi., 155-169, (1992).

[27]. I. Mihai, A. A. Shaikh, U. c. De, On Lorentzian para-Sasakian manifolds, Rendicontidel Senario Matematicodi Messina Serie II, (1999).

[28] T. Khan, M. Danish Siddiqi, O. Bahadir and M. Ahmed, Quasi Hemi-Slant Submanifolds of Quasi-Sasakian Manifolds, Acta Universitatics Apulensis., (67), 19-35. DOI: 10.17114/j.aua.2021.67.03, (2021).

[29] A. A. Shaikh, On Lorentzian almost Paracontact manifolds with a structure of the concircular type, Kyunpook Math. J. Vol. 43(2), 305-314, (2003).

[30] A. A. Shaikh and K.K. Baishya, "On concircular structure on space-times", J. Math. Stat. 1(2), 129-132, (2005).

SCHOOL OF LİBERAL ARTS AND SCİENCES, ERA UNİVERSİTY, LUCKNOW-226003, INDİA
E-mail address: toukeerkhan@gmail.com

SCHOOL OF LİBERAL ARTS AND SCİENCES, ERA UNİVERSİTY, LUCKNOW-226003, INDİA
E-mail address: drsheebarizvi@erauniversity.in

DEPARTMENT OF MATHEMATİCS, FACULTY OF ARTS AND SCİENCES, K.S.U, KAHRAMANMARAS, TURKEY
E-mail address: oguzbaha@gmail.com

OSCULATOR-LIKE CURVES WITH RESPECT TO THE SPECIAL CASES OF THE ED-FRAME IN EUCLIDEAN 4-SPACE

ÖZCAN BEKTAŞ

0000-0002-2483-1939

ABSTRACT

The aim of this study is to present osculator-like curves with respect to the special cases of the ED-frame in Euclidean 4-space. Furthermore, the relationship between geodesic torsion and curvature is given so that a curve lying on an oriented surface M in 4-dimensional Euclidean space is congruent to an osculator-like curve according to the special cases of the Ed-frame. Finally, an example of the study is presented.

REFERENCES

[1] O. Bektas , N. Gürses, S. Yüce, Quaternionic Osculating Curves in Euclidean and Semi-Euclidean Space, Journal of Dynamical Systems and Geometric Theories, 14(1), 65-84, (2016).

[2] B.Y. Chen, When Does the Position Vector of a Space Curve Always Lie in its Rectifying Plane?,

The Amer. Math. Monthly, 110, 147-152, (2003).

[3] G. Darboux, Leçons sur la Theorie Generale des Surfaces I-II-III-IV, Gauthier-Villars, Paris, (1896).

[4] M. Çimdiker, Y. Ünlütürk, On the Variational Curves due to the ED-frame Field in Euclidean 4-space, Turkish Journal of Mathematics, 44(4), 1442-1452, (2020).

[5] M. Düldül, B. Uyar Düldül, N. Kuruoğlu, E. Özdamar, Extension of the Darboux frame into Euclidean 4-space and its invariants, Turkish Journal of Mathematics, 41(6), 1628-1639, (2017).

[6] H. Gluck, Higher Curvatures of Curves in Euclidean Space, The Amer. Math. Monthly, 73(7), 699-704, (1966).

[7] H. Guggenheimer, Comuting Frames Along Trajectory, Computer Aided Geometric Design, 6, 77-78, (1966).

[8] K. Ilarslan, E. Nesovic, Some Characterizations of Osculating Curves in the Euclidean Spaces, Demonstratio Math., XLI(4), 931-939, (2008).

[9] A.A. Shaikh, P.R. Ghosh, Rectifying and Osculating Curves on a Smooth Surface, Indian Journal of Pure and Applied Mathematics, 51(1), 67-75, (2020).

[10] B. Uyar Düldül, Smarandache Curves According to the Extended Darboux Frame in Euclidean 4-Space, Journal of Computer Science & Computational Mathematics, 9(2), 17-22, (2019).

[11] M. Z. Williams, F. M. Stein, A Triple Product of Vectors in Four-Space, Mathematics Magazine, 37(4), 230-235 (1964).

DEPARTMENT OF MATHEMATICS, RECEP TAYYIP ERDOGAN UNIVERSITY, RİZE, TURKEY
Email Address: ozcan.bektas@erdogan.edu.tr

INCLUSION THEOREMS IN THE FUNCTION SPACES WITH WIGNER TRANSFORM

ÖZNUR KULAK and ARZU ÖMERBEYOĞLU

0000-0003-1433-3159 and 0000-0001-5607-2570

ABSTRACT

In this paper, we consider inclusion relations of CW spaces of functions whose Wigner transforms are in weighted Lebesgue spaces. We then discuss compact embeddings theorems between these function spaces.

REFERENCES

[1] H. Feichtinger, A.T. Gürkanlı, On a family of weighted convolution algebras, Internat J. Math. Sci, 13(3), 517-526, (1990).

[2] K. Gröchenig, Foundation of Time-Frequency Analysis, Boston, Birkhauser, (2001).

[3] A.T. Gürkanlı, Compact Embeddings of The Spaces $A^p_{\omega,w}(R^d)$, Taiwanese Journal of Mathematics, 12(7), 1757-1767, (2008).

[4] Ö. Kulak, A. Ömerbeyoğlu, On Function Spaces Characterized By The Wigner Transform, Journal of Universal Mathematics, 4(2), 188-200, (2021).

DEPARTMENT OF MATHEMATICS, FACULTY OF ARTS AND SCIENCES, AMASYA UNIVERSITY, AMASYA, TURKEY
E-mail address: oznur.kulak@amasya.edu.tr

DEPARTMENT OF MATHEMATICS, FACULTY OF ARTS AND SCIENCES, GIRESUN UNIVERSITY, GİRESUN, TURKEY
E-*mail address:* yunusfatel@gmail.com

BILINEAR MULTIPLIERS OF SOME VARIABLE EXPONENT FUNCTION SPACES

ÖZNUR KULAK

0000-0003-1433-3159

ABSTRACT

This work is motivated to consider the bilinear multipliers of weighted amalgam spaces whose local component is a variable exponent Lorentz space and also give examples of bilinear multipliers.

REFERENCES

[1] H. Feichtinger, A characterization of Wiener's algebra on locally compact groups, Arch. Math. (Basel), 29, 136–140, (1977).
[2] C. Heil, An introduction to weighted Wiener amalgams, In Wavelets and Their Applications, Allied Publishers, New Delhi, 183–216, (2003).
[3] Ö. Kulak, A.T. Gürkanlı, Bilinear Multipliers of Weighted Wiener Amalgam Spaces and Variable Exponent Wiener Amalgam Spaces, Journal of Inequalities and Applications, 476, (2014).
[4] Ö. Kulak, The Bilinear Hardy-Littlewood Maximal Function and Littlewood- Paley Square Function on Weighted Variable Exponent Wiener Amalgam Spac, Çankaya University Journal of Science and Engineering, 16(1), 063-080, (2019).

DEPARTMENT OF MATHEMATICS, FACULTY OF ARTS AND SCIENCES, AMASYA UNIVERSITY, AMASYA, TURKEY
E-mail address: oznur.kulak@amasya.edu.tr

ON THE WEIGHTED PSEUDO ANTI-PERIODIC SOLUTIONS OF HIGH-ORDER HOPFIELD NEURAL NETWORKS

RAMAZAN YAZGAN

0000-0003-1569-8715

ABSTRACT

In this paper high-order Hopfield neural networks (HHNNs) with time-varying delays are considered. Sufficient conditions are derived for the existence, exponential stability and global attractive of weighted pseudo anti-periodic solutions for the proposed neural networks. The conditions obtained are new and complementary to previous studies. Moreover, give an example as an application of these results.

REFERENCES

[1] J. Cao, Global exponential stability of Hopfield neural networks, Internat. J. Systems Sci. 32(2), 233–236, (2001) .
[2] Y. Li, and L. Huang, Anti-periodic solutions for a class of Liénard-type systems with continuously distributed delays, Nonlinear Anal. Real World Appl., 10(4), 2127–2132, (2009).
[3] M. Akhmet, M. Karacaören, A Hopfield neural network with multi-compartmental activation, Neural Comput. Appl. 29 (10), 815–822, (2018).
[4] R. Yazgan, C. Tunç, On the almost periodic solutions of fuzzy cellular neural networks of high order with multiple time lags, Int. J. Math. Comput. Sci., 1, 183-198, (2020).
[5] R. Yazgan, C. Tunç, On the weighted pseudo almost periodic solutions of Nicholson's blowflies equation, Appl. and Appl. Math., 14(2), 875-889, (2019).
[6] R. Yazgan, An analysis for a special class of solution of a Duffing system with variable delays, AIMS Math., 6(10), 11187–11199, (2021).

DEPARTMENT OF MATHEMATICS, FACULTY OF SCIENCES, VAN, TURKEY
E-mail address: ryazgan503@gmail.com

EXISTENCE AND EXPONENTIAL STABILITY OF PSEUDO ALMOST PERIODIC SOLUTIONS FOR LASOTA–WAZEWSKA MODEL WITH PERTURBATION ON TIME SCALES

RAMAZAN YAZGAN

0000-0003-1569-8715

ABSTRACT

This paper deals with Lasota–Wazewska red blood cell model with perturbation on time scales. We obtained sufficient conditions for the existence of unique pseudo almost periodic positive solution By applying the fixed point theorem of decreasing operator. Particularly, we give iterative sequence which converges to the pseudo almost periodic positive solution. Moreover, we analyze exponential stability of the pseudo almost periodic positive solution.

REFERENCES

[1] M. Wazewska-Czyzewska, A. Lasota, Mathematical problems of the dynamics of red blood cells system, Annals of Polish Mathematical Society, Series III, AppliedMathematics, 6, 23–40, (1976).
[2] M.R.S. Kulenovic, G. Ladas, Y.G, Sficas, Global attractivity in population dynamics. Computers and Mathematics with Applications, 18, 925–928, (1989).
[3] M. Bohner, A. Peterson, Dynamic Equations on Time Scales: An Introduction with Applications, Birkhauser: Boston, (2001).
[4] M. Bohner, A. Peterson, Advances in Dynamic Equations on Time Scales, Birkhauser: Boston, (2003).
[5] S. Hilger, Analysis on measure chains—a unified approach to continuous and discrete calculus, Results in Mathematics, 18, 18–56, (1990).
[6] R. Yazgan,, An analysis for a special class of solution of a Duffing system with variable delays, AIMS Math. 6(10), 11187–11199, (2021).

DEPARTMENT OF MATHEMATICS, FACULTY OF SCIENCES, VAN, TURKEY
E-mail address: ryazgan503@gmail.com

ONCE AGAIN ABOUT THE PYTHAGOREAN TRIPLES

A.B. Urdaletova, S.K. Kydyraliev, and A.A. Doolotova

0000-0003-4420-3961, 0000-0001-6305-9251, 0000-0002-4743-1145

ABSTRACT

The enormous popularity of finding the natural solutions of the Fermat-Pythagorean equation $x^2 + y^2 = z^2$ has given rise to a large number of works devoted to finding formulas that allow one to directly write out solutions of the equation. Nevertheless, the magic contained in this problem makes us refer to it again and again. Another such case is described in this paper. The starting point is the formula for the difference of squares. It turns out to be sufficient to obtain a rather interesting result: if we take any natural odd number, square it, and consider the resulting number as the sum of two consecutive natural numbers, these numbers together with the original number give the Fermat-Pythagorean triplet. The proposed work is devoted to the proof of this and other more complex and interesting statements.

REFERENCES

[1] H. Eves, An Introduction to the History of Mathematics, Philadelphia: Saunders College Pub., (1990).

[2] A. Hall, Genealogy of Pythagorean Triads, The Math. Gazette, 54, 377–379, (1970).

[3] O. Neugebauer, The Exact Sciences in Antiquity, New York: Dover Publications, (1969).

[4] A. Weil, Number Theory: An Approach through History from Hummarapi to Legendre, Birkhauser Boston, 21, (1984).

[5] R. A. Beauregard & E. R. Suryanarayan, Pythagorean Triples: The Hyperbolic View, The College Mathematics Journal, 27, 170-181, (1996).

[6] E. Marcorini, The History of Science and Technology: A Narrative Chronology, 91, 889 (1988).

[7] D. Turing, The Story of Computing, Arcturus Publishing, (2018).

DEPARTMENT OF MATHEMATICS, KYRGYZ-TURKISH MANAS UNIVERSITY, BISHKEK, KYRGYZSTAN
e-mail address: anarkul.urdaletova@manas.edu.kg

DEPARTMENT OF APPLIED MATHEMATICS AND INFORMATICS, AMERICAN UNIVERSITY OF CENTRAL ASIA, BISHKEK, KYRGYZSTAN
e-mail address: kydyraliev_s@auca.kg

DEPARTMENT OF BUSINESS ADMINISTRATION, AMERICAN UNIVERSITY OF CENTRAL ASIA, BISHKEK, KYRGYZSTAN
e-mail address: doolotova_a@auca.kg

NOTE ON POINTWISE I-CONTINUITY

SELAHATTİN KILINÇ

0000-0003-3708-9443

ABSTRACT

In this paper, we will reveal some basic properties of pointwise I-continuity, which is a weaker form of continuity. We will obtain some generalizations of this continuity in the τ^* topology that are finer than the τ topology. Conclusion, we have revealed many new features of this type of continuity. In the future, the relationship of pointwise- I-continuity with locally connectedness and local I- connectedness can be studied.

REFERENCES

[1]] E. Hayashi, Topologies defined by local properties, Mathematische Annalen, 156, 205-215, (1964).

[2] D. Jankovic, T. R. Hamlett, Compatible extensions of ideals, Bollettino Unione Matematica Italiana, 7, 453-465, (1992).

[3] D. Jankovic and T. R. Hamlett, New topologies from old via ideals, American Mathematical Monthly, 97(4), 295-310, (1990).

[4] J. Kaniewski, Z. Piotrowski, Concerning continuity apart from a meager set. American mathematical society, $98, (2), 324 - 328,$(1986).

[5] K. Kuratowski, Topology, Vol. I, Academic Press, New York, (1966).

[6] N. Sathiyasundari, V. Renukadevi, Note on *-connected ideal spaces, Novi Sad Journal of Mathematics, 42, 15-20, (2012)

[7] R. L. Newcomb, Topologies which are compact modulo an ideal, Ph.D Dissertation, Universityof California, Santa Barbara (1967).

[8] R. Vaidyanathaswamy, The Localisation Theory in Set Topology, Proceedings of the Academic ofSciences, 20, 51-61, (1945).

ATAKENT BORSA ISTANBUL VOCATIONAL AND TECHNICAL ANATOLIAN HIGH SCHOOL , YÜREĞIR\ADANA
E-mail address: selahattinkilinc@hotmail.com

NEW FORM OF WEAK CONNECTEDNESS

SELAHATTİN KILINÇ

0000-0003-3708-9443

ABSTRACT

In this paper, we have introduced a weak form connectedness with respect to ideal. We also investigate its relation to connectedness. We have shown that some basic theorems of connectedness are provided in the weak connectedness that we have just defined. Next, we put forward the definitions of I-component, totally I-disconnected, and locally I-connected, respectively. We have revealed some of the main features of them.

REFERENCES

[1] K. Kuratowski, Topology, Vol. I, Academic Press, New York, (1966).
[2] R. Vaidyanathaswamy, The Localisation Theory in Set Topology, Proceedings of the Academic of Sciences, 20 51-61, (1945).
[3] D. Jankovic, T. R. Hamlett, Compatible extensions of ideals, Bollettino Unione Matematica Italiana, 7, 453-465, (1992).
[4] E. Ekici and T. Noiri, Connectedness in ideal topological spaces, Novi Sad Journal of Mathematics, 38 (2), 65-70, (2008).
[5] N. Sathiyasundari, V. Renukadevi, Note on ∗-connected ideal spaces, Novi Sad Journal of Mathematics, 42, 15-20, (2012).
[6] S. Modak, T. Noiri, Connectedness of ideal topological spaces, Filomat, 29, 661-665, (2015).
[7] S. Kilinc, More on ∗∗-connectedness, Matematiqki Bilten, 43(LXIX) No.2 ,53-60, (2019).
[8] B. K. Tyagi, M. Bhsrdwaj, S.Singh, Cl*-connectedness and Cl-Cl*-connectedness in ideal topological spaces, Matematiqki Bilten, 42(LXVIII) No.2, 91-100, (2018).
[9] O. Njastad, Remarks on topologies defined by local properties, Avhandlinger Norske Videnskaps-Akademi Oslo, I(NS), 8, 1-16, (1966).
[10] D. Jankovic and T. R. Hamlett, New topologies from old via ideals, American Mathematical Monthly, 97(4), 295-310, (1990).
[11] E. Ekici, T. Noiri, ∗-Hyperconnected ideal topological spaces, Analele Stiintifice Ale Universitatii "AL.I. CUZA" Din Ia, si(S.N.) Matematica, Tomul LVIII, f.1, DOI:10.247/v10157-011-0045- 9, (2012).
[12] A.Keskin, S. Y¨uksel,T. Noiri, I-extremal disconnected spaces, Communications Faculty of Sciences University of Ankara Series A1 Mathematics and Statistics, Volume 56, Number 1, 33, 33-40, (2007).
[13] R. L. Newcomb, Topologies which are compact modulo an ideal, Ph.D Dissertation, University of California, Santa Barbara (1967).
[14] E. Hayashi, Topologies defined by local properties, Mathematische Annalen, 156, 205-215, (1964).

ATAKENT BORSA ISTANBUL VOCATIONAL AND TECHNICAL ANATOLIAN HIGH SCHOOL, YÜREĞIR\ADANA
E-mail address: selahattinkilinc@hotmail.com

ANALYSIS OF LINEARLY CORRELATED MULTI-RESPONSES IN MULTI-OBJECTIVE PERSPECTIVE

S. TUNÇEL AND Ö. TÜRKŞEN

0000-0002-3598-0331 and 0000-0002-5592-1830

ABSTRACT

In this study, analysis of multi-response experimental data sets were considered in multi-objective perspective. The multi-response experimental data sets, which have linearly correlated responses, were analyzed in three stage. In the first stage, called modeling, the multi-response experimental data sets were modeled by using Seemingly Unrelated Regression (SUR) due to linear relationship between the responses. The second stage, called multi-objective optimization, was achieved by using multi-objective metaheuristic algorithms, Non-dominated Sorting Genetic Algorithm-II (NSGA-II) and Multi Objective Differential Evolution (MODE). In the last stage, called decision making, the obtained results were discussed and compromise experimental conditions were determined by using Multi-Criteria Decision Making methods.

REFERENCES

[1] A. Zellner, An efficient method of estimating seemingly unrelated regressions and tests of aggregation bias, Journal of the American Statistical Association, 57, 348-368, (1962).
[2] N. S. Revankar, Some finite sample results in the context of two seemingly unrelated regression equations. Journal of the AmericanStatisticalAssociation,69(345),187-190,(1974).
[3]K. Deb, Multi-Objective Optimization Using Evolutionary Algorithms, John- Wiley and Sons ,497 p., New Yok, (2001).
[4] R. Storn and K. Price, Differential evolution- a simple and efficient adaptive scheme for global optimization over continuous spaces,Journal of Global Optimization, 23(1), (1995).
[5] H. Monsef, M. Naghashzadegen, A. Jamali, and R. Farmani, Comparison of evolutionary multi objective optimization algorithms in optimum design of water distribution network, Ain Shams Engineering Journal, 10, 103-111, (2019).

DEPARTMENT OF STATISTICS, FACULTY OF SCIENCE, HACETTEPE UNIVERSITY, 06800, ANKARA-TURKEY
E-mail address: serhan.tuncel@hacettepe.edu.tr

DEPARTMENT OF STATISTICS, FACULTY OF SCIENCE, ANKARA UNIVERSITY, 06100, ANKARA-TURKEY
E-mail address: turksen@ankara.edu.tr

IMPROVED LINK PREDICTION METHODS IN SOCIAL NETWORK UNDER FUZZY ENVIRONMENT

SOVAN SAMANTA and KOUSIK DAS

0000-0003-3200-8990, 0000-0003-1834-3776

ABSTRACT

Link creation and deletion is an ongoing process in social network. To grow the popularity and other purpose, all the networks has an intention to increase links through the existing links. Therefore, a better way to evaluate link prediction is an important task in social network analysis. In this study, a new link prediction method in fuzzy environment has been proposed based on path and node membership values. An application of link prediction to a friendship network has been illustrated and compared with the latest model and analyzed.

REFERENCES

[1] JK. Das, S. Samanta & M. Pal, Study on centrality measures in social networks: a survey, Social Network Analysis and Mining, 8, 13, (2018).
[2] L. C. Freeman, Centrality in social networks conceptual clarification. Soc. Netw. 1, 215–239, (1978).
[3] S. Samanta, & M. Pal, Link prediction in social networks, IGI Global, Chapter 10, (2016).
[4] L. Lü, & T. Zhou, Link prediction in complex networks: A survey. Phys. A: Stat. Mech. its Appl. 390, 1150–1170, (2011).
[5] C. Ma, T. Zhou, & H. Zhang, Playing the role of weak clique property in link prediction: A friend recommendation model, Scientific Reports, 5, 1-6, (2016).
[6] X. -S. He, M. -Y. Zhou, Z. Zhuo, Z. -Q. Fu, & J. -G. Liu, Predicting online ratings based on the opinion spreading process. Physica A 436, 658–664, (2015).
[7] M. E. Newman, Clustering and preferential attachment in growing networks. Phys.Rew. E 64, 025102, (2001).
[8] L. Nowell, & J. Kleinberg,, The link prediction problem for social networks, In: CIKM, 2003.
[9] P. Jaccard, Etude comparative de la distribution florale dans une portion dse Alprs et des Jura, Bull. Soc. Vaud. Sci. Nat. 37(1901), 547.
[10] L. Lü, C. -H. Jin, & T. Zhou, Similarity index based on local paths for link prediction of complex networks. Phys. Rev. E 80, 046122, (2009).

DEPARTMENT OF MATHEMATICS, TAMRALIPTA MAHAVIDYALAYA, TAMLUK, INDIA
E-mail address: ssamanatavu@gmail.com

DEPARTMENT OF MATHEMATICS, DJHS, DANTAN, INDIA.
E-mail address: kousikmath@gmail.com

UPPER BOUNDS FOR THE BLOW UP TIME OF LAME EQUATION

Yavuz DİNÇ, Erhan PİŞKİN and Cemil TUNÇ

0000-0003-0897-4101, 0000-0001-6587-4479 and 0000-0003-2909-8753

ABSTRACT

In this presentation, we consider the Lame equation with variable exponent. This type problem has been widely used in many mathematical models of various applied sciences such as flows of electrorheological fluids, thin liquid films, etc. We prove the upper bound for blow up time under suitable conditions.

REFERENCES

[1] S.A. Messaoudi, A.A. Talahmeh, J.H. Al-Shail, Nonlinear damped wave equation: Existence and blow-up. Comp. Math. Appl., 74, 3024-3041, (2017).

[2] E. Pişkin, Y. Dinç, C. Tunç, Lower And Upper Bounds For The Blow Up Time For Generalized Heat Equations With Variable Exponents, Palestine Journal of Mathematics. 10, 601–608, (2021).

[3] Z. Tebba, H. Degaichia, M. Abdalla, B.B. Cherif, I. Mekawy, Blow-up of solutions for a class quasilinear wave equation with nonlinearity variable exponents, J. Funct. Spaces, 1-9, (2021).

[4] S.T. Wu, Lower and upper bounds for the blow-up time of a class of damped fourth-order nonlinear evolution equations, J. Dyn. Control Syst., 24, 287-295, (2018).

DEPARTMENT OF ELECTRONICS TECHNICAL, MARDIN ARTUKLU UNIVERSITY
Email: yavuzdinc@artuklu.edu.tr

DEPARTMENT OF MATHEMATICS, DICLE UNIVERSITY
Email: episkin@dicle.edu.tr

DEPARTMENT OF MATHEMATICS, VAN YUZUNCU YIL UNIVERSITY
Email: cemtunc@yahoo.com

BASIC SECOND ORDER DISCONTINUOUS BOUNDARY VALUE PROBLEM WITH RETARDED ARGUMENT THAT CONTAINS SPECTRAL PARAMETER AT THE TRANSMISSION CONDITIONS

ÖZGÜR MIZRAK

0000-0001-5961-6019

ABSTRACT

In this paper basic discontinuous boundary value problem with retarded argument that contains spectral parameter at the transmission conditions will be investigated. Existence of eigenvalues and eigenfunctions will be studied. Asmyptotic properties of eigenvalues and eigenfunctions will be obtained.

References

[1] S.B. Norkin, On boundary problem of Sturm–Liouville type for second-order differential equation with retarded argument, Izv. Vyss. Ucebn. Zaved. Matematika 6 (7), 203-214, (1958).

[2] S.B. Norkin, Differential equations of the second order with retarded argument, Translations of Mathematical Monographs, 31, (1972).

[3] A. Bayramov, S. Calıskan, S .Uslu Computation of eigenvalues and eigenfunctions of a discontinuous boundary value problem with retarded argument. Applied Mathematics and Computation, 191, 592-600, (2007).

[4] E. Şen, A. Bayramov, Asmyptotic formulations of the eigenvalues and eigenfunctions for a boundary value problem, Math. Meth. Appl. Sci., 36 1512-1519 (2013).

Department of Mathematics, Mersin University, Mersin, Turkey
Email address: mizrak@mersin.edu.tr

SOME CLASSES OF RICCATI EQUATIONS INTEGRABLE IN QUADRATURES

ANARKUL URDALETOVA, OLGA ZABINYAKOVA, AND SYRGAK KYDYRALIEV

0000-0003-4420-3961, 0000-0002-6675-426 and 0000-0001-6305-9251

ABSTRACT

As it is known, the second-order ordinary linear differential equation with variable coefficients is solvable in case if related Riccati equation can be integrated by quadratures. This paper considers establishment of correspondence between such equations by the authors' method which means the second-order equation representation by a chain of the first-order equations. The algorithm of special Riccati equation solving is demonstrated (coefficients of these Riccati equations satisfy special conditions). One more peculiarity of this paper stands in consideration of exact applicational example – the Riccati equation which describes the magnetotellurics impedance behavior in geological media.

References

[1] S.K. Kydyraliev, A.B. Urdaletova Solving Linear Differential Equations by Operator Factorization. The College Mathematics Journal, USA, 27(3), pp. 199-204, (1996).

[2] S.K. Kydyraliev, A.B. Urdaletova, E.S. Burova Advantages of the chain method for solving linear differential and difference equations. Bulletin of the Kyrgyz-Russian Slavic University, 20(8), pp. 16-20, (2020).

[3] S.K. Kydyraliev, A.B. Urdaletova The linear ordinary differential equations' solution formula. Bulletin of the Kyrgyz-Russian Slavic University, 20(8), pp. 11-15, (2020).

[4] A.D. Polyanin, V.F. Zaitsev Handbook of Ordinary Differential Equations: Exact Solutions, Methods, and Problems. Chapman & Hall/CRC Press, Boca Raton, 1496 p., (2017).

[5] M.N. Berdichevskii, V.I. Dmitriev Magnetotelluric Sounding of Horizontally Homogeneous Media, Moscow, Nedra, 250 p.(1992).

Kyrgyz-Turkish Manas University, Department of Mathematics, Bishkek, Kyrgyz Republic
Email address: anarkul.urdaletova@manas.edu.kg

Research Station of RAS, Bishkek, Kyrgyz Republic; American University of Central Asia, Applied Mathematics and Informatics Department, Bishkek, Kyrgyz Republic
Email address: perah.92@inbox.ru

American University of Central Asia, Applied Mathematics and Informatics Department, Bishkek, Kyrgyz Republic
Email address: kydyraliev_s@auca.kg

AN APPLICATION OF CONTROL SET TO AGRICULTURAL LAND IRRIGATION

GÖKHAN ÇUVALCIOĞLU, CANSU ALTINCI, DİLARA GÜNDOĞDU

0000-0001-5451-3336, 0000-0003-0675-9555, 0000-0003-4146-8737

ABSTRACT

Intuitionistic Fuzzy Set was defined by Krassimir Atanassov in 1983. After that, many properties of intuitionistic fuzzy set were studied intuitionistic fuzzy set have many application fields. These include medicine, education, economy controlled sets were defined by Çuvalcıoğlu in 2014. In this paper, the work agricultural land irrigation studied by Çuvalcıoğlu et al are studied on controlled sets.

In an agricultural land, soil properties, tree species, age of trees might be different. Therefore we don't expect the irrigation on different parts of the land to be the same. Fort his aim, we worked with controlled sets, and we used $Z_{\alpha,\beta}^{\omega}$, $F_{\alpha,\beta}$, $B_{\alpha,\beta}$ operators.

REFERENCES

[1] K.T. Atanassov, Intuitionistic Fuzzy Sets, VII ITKR's Session, Sofia, June, (1983).

[2] K. T. Atanassov, Intuitionistic Fuzzy Sets: Theory and Applications, Spinger Physica-Verlag, Heidelberg, (1999).

[3] G. Çuvalcıoğlu, Some Properties of Controlled Set Theory, Notes on Intuitionistic Fuzzy Set, 20(2), 37-42, (2014).

[4] G. Çuvalcıoğlu, An Application of Some Intuitionistic Fuzzy Modal Operators to Agriculture, 21(2), 140-149, (2015).

[5] G. Çuvalcıoglu, (2013) On the Diagram of One Type Modal Operators on Intuitionistic Fuzzy Sets: Last Expanding with $Z_{\alpha,\beta}^{\omega,\theta}$, *Iranian J. of Fuzzy Systems*, 10(1), 89–106

[6] 5 L.A. Zadeh, Fuzzy Sets, Information and Control, Vol 8, 1965, 338-353.

DEPARTMENT OF MATHEMATICS, MERSIN UNIVERSITY, MERSIN, TURKEY
E-mail address: gcuvalcioglu@mersin.edu.tr
DEPARTMENT OF MATHEMATICS, MERSIN UNIVERSITY, MERSIN, TURKEY
E-mail address: cansu.altinci01@gmail.com
DEPARTMENT OF MATHEMATICS, MERSIN UNIVERSITY, MERSIN, TURKEY
E-mail address: dilaragundogdu8@gmail.com

THE PERIODICITY OF THE DETERMINANT OF A (0, 1) DOUBLE BANDED MATRIX

CARLOS M. DA FONSECA, MILICA ANDELIC, ZHIBIN DU

0000-0001-7742-4416, 0000-0002-3348-1141, 0000-0001-5795-3580

ABSTRACT

In this talk, we establish the periodicity of the determinant of a (0, 1) double banded matrix. As a corollary, we answer two recent conjectures and other extensions. Several illustrative examples are provided as well.

REFERENCES

[1] Y. Amanbek, Z. Du, Y. Erlangga, Z. Du, C.M. da Fonseca, B. Kurmanbek, A. Pereira, Explicit determinantal formula for a class of banded matrices, Open Mathematics 18, 1227-1229, (2020).
[2] M. Andelic, C.M. da Fonseca, Some determinantal considerations for pentadiagonal matrices, Linear and Multilinear Algebra, 69(16), 3121-3129, (2021).
[3] Z. Du, C.M. da Fonseca, A periodic determinantal property for $(0,1)$ double banded matrices, Linear and Multilinear Algebra, to appear, DOI: 10.1080/03081087.2021.1913980
[4] Z. Du, C.M. da Fonseca, A. Pereira, On determinantal recurrence relations of banded matrices, Kuwait Journal of Science 49(1), 1-9, (2022).

KUWAIT COLLEGE OF SCIENCE AND TECHNOLOGY, KUWAIT
E-mail address: c.dafonseca@kcst.edu.kw

KUWAIT UNIVERSITY, KUWAIT
E-mail address: milica.andelic@ku.edu.kw

SOUTH CHINA NORMAL UNIVERSITY, GUANGDONG, CHINA

INTUITIONISTIC FUZZY MATRICES WITH UNCERTAIN ROWS AND COLUMNS

MADHUMANGAL PAL

0000-0002-6709-836X

ABSTRACT

In this article, a very new kind of intuitionistic fuzzy matrix (IFM) is introduced, whose rows and columns are uncertain. In conventional fuzzy and intuitionistic fuzzy matrices the rows and columns are certain. But, in some real life problems it is seen that certain rows and columns may be uncertain or insignificant. Motivated from this idea, a new kind of IFM is defined. New arithmetic operators, viz. addition and complement are introduced. A new parameter called density is defined for IFM and presented several results for this new type of IFMs. This new concept is used to solve a decision making problem.

REFERENCES

[1] K.T.Atanassov, Intuitionistic fuzzy sets, VII ITKR's Session, Sofia, Bulgarian (1983).
[2] M.Bhowmik and M.Pal, Generalized intuitionistic fuzzy matrices, Far-East Journal of Mathematical Sciences, 29(3) 533-554, (2008).
[3] M.Bhowmik and M.Pal, Some results on intuitionistic fuzzy matrices and circulant intuitionistic fuzzy matrices, International Journal of Mathematical Sciences, 7(1-2) 81-96, (2008).
[4]S.Mondal and M.Pal, Intuitionistic fuzzy incline matrix and determinant, Annals of Fuzzy Mathematics and Informatics, 8(1) 19-32, (2014).
[5]S.Mondal and M.Pal, Similarity relations, invertibility and eigenvalues of intuitoinistic fuzzy matrix, Fuzzy Inf. Eng., 4 431-443, (2013).
[6]M.Pal, Intuitionistic fuzzy determinant, V.U.J. Physical Sciences, 7, 87-93, (2001).
[7]M.Pal, S.K.Khan and A.K.Shyamal, Intuitionistic fuzzy matrices, Notes on Intuitionistic Fuzzy Sets, 8(2), 51-62, (2002).
[8]M.Pal, Fuzzy matrices with fuzzy rows and columns, Journal of Intelligent & Fuzzy Systems, 30(1), 561-573, (2016).
[9]M.Pal, Interval-valued fuzzy matrices with interval-valued fuzzy rows and columns, Fuzzy Information and Engineering, 7(3), 335-368, (2015).
[10]M.Pal, Intuitionistic Fuzzy Matrices with Uncertain Rows and Columns and Their Application in Decision Making Problem, Journal of Multiple-Valued Logic and Soft Computing, 35(3-4), 281-306, (2020).
[11]R.Pradhan and M.Pal, Intuitionistic fuzzy linear transformations, Annals of Pure and Applied Mathematics, 1(1), 57-68, (2012).
[12]R.Pradhan and M.Pal, Generalized inverse of block intuitionistic fuzzy matrices, International Journal of Applications of Fuzzy Sets and Artificial Intelligence, 3, 23-38, (2013).
[13]R.Pradhan and M.Pal, Convergence of maxgeneralized mean-mingeneralized mean powers of intuitionistic fuzzy matrices, The Journal of Fuzzy Mathematics, 22(2), 477-492, (2013).

DEPARTMENT OF APPLIED MATHEMATICS WITH OCEANOLOGY AND COMPUTER PROGRAMMING VIDYASAGAR UNIVERSITY, MIDNAPORE - 721102, INDIA.
E-mail address: mmpalvu@gmail.com

185

AN INVERSE SCATTERING PROBLEM FOR A DISCONTINUOUS STURM-LIOUVILLE EQUATION

Kh. R. Mamedov

0000-0002-3283-9535

ABSTRACT

In this paper, we consider the Sturm-Liouville equation on the half line $[0,\infty)$,

$$-u'' + q(x)u = \mu^2 \rho(x)u,$$

with the spectral parameter in the boundary condition. Here, μ spektral parameter, $\rho(x)$ is a real positive piecewise continuous function, potential $q(x)$ is a real valued function and satisfies the condition

$$\int\limits_0^\infty (1+x)|q(x)|\,dx < \infty.$$

It is well known that the boundary value problems with spectral parameter in the boundary condition have many interesting applications in mathematical physics and other applied fields. Therefore, such problems have been handled in detail by many authors in [1-5].

The aim of the work is to study direct and inverse scattering problems for the boundary value problem on the half line $[0,\infty)$. The scattering data of the boundary value problem is defined, some properties of the the scattering data are investigated. Marchenko type main equation is obtained for solving the inverse scattering problem, and the characteristic properties of the scattering data are investigated. Thus, the uniqueness of the solution of the the inverse problem for the boundary value problem is shown.

REFERENCES

[1] V.A. Marchenko. Sturm-Liouville Operators and Their Applications, [İn Russian]. Naukova Dumka, KİEV,(1977).
[2] D.S. Cohen. An integral transform associated with boundary conditions containing an eigenvalue parameter. SIAM Journal on Applied Mathematics 14, 1164-1175, (1966).
[3] V.A.Yurko. Method of Spectral Mappings in the Inverse Problem Theory. Inverse and III-Posed Problems Series, VSP, Utrecht, The Netherlands. (2002).
[4] B. M. Levitan. Inverse Sturm-Liouville problem. Translated from the Russian by O. Efimov .VSP, Zeist. 611-624, (1987).
[5] Kh. R. Mamedov. Uniqueness of the solution of the inverse problem of scattering theory for the Sturm-Liouville operator with a spectral parameter in the boundary condition. Math. Notes. 74(1-2) ,136-140, (2003).

DEPARTMENT OF MATHEMATICS, FACULTY OF SCIENCE and ARTS, Iğdır, TÜRKİYE

E-mail address: hanlar.residoglu@igdir.edu.tr

LAPLACIAN CONTROLLABILITY OF CHAIN GRAPHS

MILICA ANDELIC, ABDULLAH ALAZEMI , TAMARA KOLEDIN , ZORAN STANIC

0000-0002-3348-1141, 0000-0001-9383-3121, 0000-0003-2489-2392, 0000-0002-4949-4203

ABSTRACT

We consider a special class of bipartite graphs, called chain graphs, defined as $\{C_3, C_5, 2K_2\}$-free graphs, that have no repeated Laplacian eigenvalues. Our results include structure theorems, degree constraints and examinations of the corresponding eigenspaces. For example, it occurs that such chain graphs do not contain a triplet of vertices with the same neighbourhood, while those with duplicated vertices (pairs with the same neighbourhood) have additional structural restrictions. As an application, we consider the controllability of multi-agent dynamical systems modelled by graphs under consideration with respect to Laplacian dynamics. We construct particular controllable chain graphs and, in general, provide the minimum number of leading agents as well as their locations in the corresponding graph.

REFERENCES

[1] A. Alazemi, M. Andelic, K.Ch. Das, C.M. da Fonseca, Chain graph sequences and Laplacian spectra of chain graphs, Linear Multilinear Algebra, https://doi.org/10.1080/03081087.2022.2036672

[2] F.K. Bell, D. Cvetkovic, P. Rowlinson, S.K. Simic, Graphs for which the least eigenvalue is minimal, II, Linear Algebra Appl., 429, 2168−2179, (2008).

[3] K.Ch. Das, A. Alazemi, M. Andelic, On energy and Laplacian energy of chain graphs, Discrete Appl. Math., 284, 391−400, (2020).

[4] S-P Hsu, Controllability of the multi-agent system modelled by the threshold graph with one repeated degree, Systems Control Lett., 97.

[5] Z. Ji, Z. Wang, H. Lin, Z. Wang, Interconnection topologies for multi-agent coordination under leader-follower framework, Automatica, 45(12), 2857−2863, (2009).

[6] T. Kailath, Linear systems, Prentice-Hall, Englewood Cliffs, (1980).

[7] R.E. Kalman, Y.C. Ho, K.S. Narendra, Controllability of linear dynamical systems, Contributions to Differential Equations, Vol. 1, No. 2, (1962).

[8] X. Liu, Z. Ji, Controllability of multiagent systems based on path and cycle graphs, Int. J. Robust Nonlinear Control, 28, 296−309, (2016).

[9] N.V.R. Mahadev, U.N. Peled, it Threshold Graphs and Related Topics, North-Holland, New York, (1995).

[10] K. Ogata, Modern Control Engineering, Prentice-Hall, Upper Saddle River, (2002).

[11] A. Rahmani, M. Ji, M. Mesbahi, M. Egerstedt, Controllability of multi-agent systems from a graph theoretic perspective, SIAM J. Control Optim., 48, 162−186, (2009).

KUWAIT UNIVERSITY, KUWAIT

E-mail address: milica.andelic@ku.edu.kw

GRAPHS WITH FEW GENERALIZED ADJACENCY EIGENVALUES

SAKANDER HAYAT, XIMING CHENG, MUHAMMAD JAVAID, AND JACK KOOLEN

0000-0001-5100-6259, 0000-0001-5933-2630, 0000-0001-7241-8172, 0000-0002-8623-5681

ABSTRACT

For an adjacency matrix A of a graph Γ, the choice of 0, 1 and, 0 to represent equality, adjacency and nonadjacency is rather arbitrary, one can more generally consider the matrix $M(x, y, z) := xI + yA + z(J - I - A)$, where x, y and z are real numbers and J (resp. I) is the all-ones matrix (resp. identity matrix) of suitable dimension. Any such matrix with $y \neq z$ is called a *generalized adjacency matrix* of Γ. For a real number h, define the matrix B_h by,

$$B_h := A + h(J - I).$$

Note that,

$$
\begin{aligned}
M(x, y, z) &= (y - z)A + zJ + (x - z)I, \\
&= (y - z)B_{\frac{z}{y-z}} + xI.
\end{aligned}
$$

This means that, if $\mu_1, \mu_2, \ldots, \mu_n$ are the eigenvalues of B_h, then $(y - z)\mu_i + x$, $i = 1, 2, \ldots, n$ are eigenvalues of $M(x, y, z)$, where x, y, z are real numbers such that $y \neq z$ and $\frac{z}{y-z} = h$. There are important special cases of B_h matrix. The Seidel matrix S of a graph defined as $S := J - I - 2A$, then $S = -2B_{-\frac{1}{2}}$. The adjacency matrix of a graph is $A = B_0$ and adjacency matrix of its complement is $\overline{A} := J - I - A$ and $\overline{A} = -B_{-1}$. Note that the B_h matrix is always irreducible if $h \notin \{0, -1\}$.

In this research, we study graphs whose B_h matrix has few distinct eigenvalues. Graphs with one distinct B_h-eigenvalue is trivial and they are edgeless graphs. Afterwards, graphs with two distinct B_h-eigenvalues have been characterized. Just like the adjacency matrix, the case of graphs with three distinct B_h-eigenvalues is very hard to characterize. For three distinct B_h-eigenvalues such that $h \in \mathbb{R}$ is arbitrary, we present several constructions including cones over strongly-regular graphs, graphs with two main and two plain A-eigenvalues, graphs within regular two-graphs, among others. As a by-product of these construction, we obtain

the first example of non-regular non-bipartite graphs with three distinct distance eigenvalues.

Note that the B_h matrix is strictly positive/negative, when $h \notin (-1, 0)$. This implies that the Perron-Frobenius theory is applicable. For graphs with three distinct B_h-eigenvalues such that $h \notin (-1, 0)$, we show some strong results. For instance, we prove some upper bounds on the diameter, as well as Bell-Rowlinson-type bound on the multiplicity of a B_h-eigenvalue. Disconnected graphs with three distinct B_h-eigenvalues such that $h \notin (-1, 0)$ have also been characterized.

References

[1] S. Bang, E.R. van Dam, J.H. Koolen, Spectral characterization of the Hamming graphs, *Linear Algebra Appl.* 429, 2678–2686, (2008).

[2] F.K. Bell, P. Rowlinson, On the multiplicities of graph eigenvalues, *Bull. London Math. Soc.* 35(3), 401–408, (2003).

[3] A.E. Brouwer, A.M. Cohen, A. Neumaier, *Distance-Regular Graphs*, Springer-Verlag, New York, (1989).

[4] W.G. Bridges, R.A. Mena, Multiplicative cones–a family of three eigenvalue graphs, *Aequationes Math.* 22, 208–214, (1981).

[5] A.E. Brouwer, W.H. Haemers, *Spectra of Graphs*, Springer, Heidelberg, (2012).

[6] A.E. Brouwer, J.H. van Lint, Strongly regular graphs and partial geometries, In *Enumeration and Design: Papers from the conference on combinatorics held at the University of Waterloo, Waterloo, Ont., June 14-July 2, 1982* (Ed. D. M. Jackson and S. A. Vanstone). Toronto, Canada: Academic Press, pp. 85-122, (1984).

[7] D.de Caen, E.R. van Dam, E. Spence, A nonregular analogue of conference graphs, *J. Combin. Theory Ser. A*, 88, 194–204, (1999).

[8] X.-M. Cheng, A.L. Gavrilyuk, G.R.W. Greaves, J.H. Koolen, Biregular graphs with three eigenvalues, *European J. Combin.*, 56, 57–80, (2016).

[9] X.-M. Cheng, G.R.W. Greaves, J.H. Koolen, Graphs with three eigenvalues and second largest eigenvalue at most 1, *J. Combin. Theory Ser. B*, 129, 55–78, (2018).

[10] A.A. Chesnokov, W.H. Haemers, Regularity and the generalized adjacency spectra of graphs, *Linear Algebra Appl.*, 416, 1033–1037, (2006).

[11] S.M. Cioabă, W.H. Haemers, J.R. Vermette, W. Wong, The graphs with all but two eigenvalues equal to ± 1, *J. Algebr. Comb.*, 41, 887–897, (2015).

[12] S.M. Cioabă, W.H. Haemers, J.R. Vermette, The graphs with all but two eigenvalues equal to -2 or 0, *Des. Codes Cryptogr.*, 84, 153–163, (2017).

[13] K. Coolsaet, J. Degraer, E. Spence, The strongly regular (45,12,3,3) graphs, *Electronic J. Combin.*, 13, #R32, (2006).

[14] D. Cvetković, P. Rowlinson, K. Simić, *Eigenspaces of graphs*, Cambridge University Press, (1997).

[15] D. Cvetković, M. Doob, H. Sachs, *Spectra of graphs*, Academic Press Inc., (1980).

[16] D. Cvetković and M. Petrić, A table of connected graphs on six vertices, *Discrete Math.* 50, 37–49, (1984).

[17] E.R. van Dam, Nonregular graphs with three eigenvalues, *J. Combin. Theory Ser. B* 73, 101–118, (1998).

[18] E.R. van Dam, Regular graphs with four eigenvalues, *Linear Algebra Appl.*, 226-228, 139–162, (1995).

[19] E.R. van Dam, E. Spence, Small regular graphs with four eigenvalues, *Discrete Math.*, 189, 233–257, (1998).

[20] E.R. van Dam, W.H. Haemers, J.H. Koolen, Cospectral graphs and the generalized adjacency matrix, *Linear Algebra Appl.*, 423, 33–41, (2007).

[21] E.R. van Dam, J.H. Koolen, Z.-J. Xia, Graphs with many valencies and few eigenvalues, *Electronic J. Lin. Alg.*, 28, 12–24, (2015).

[22] M. Doob, Graphs with a small number of distinct eigenvalues, *Ann. New York Acad. Sci.* 175, 104–110, (1970).

[23] F. Esser, F. Harary On the spectrum of a complete multipartite graph, *European J. Combin.*, 1, 211–218, (1980).

[24] C.D. Godsil, G. Royle, *Algebraic Graph Theory*, Springer-Verlag, Berlin, (2001).

[25] E.M. Hagos, Some results on graph spectra, *Linear Algebra Appl.,* 356(1-3), 103–111, (2002).

[26] W.H. Haemers, G.R. Omidi, Universal adjacency matrix with two eigenvalues, *Linear Algebra Appl.,* 435, 2520–2529, (2011).

[27] S. Hayat, M. Javaid, J.H. Koolen, Graphs with two main and two plain eigenvalues, *Appl. Anal. Discrete Math.*, 11, 244–257, (2017).

[28] X. Huang, Q. Huang, On regular graphs with four distinct eigenvalues, *Linear Algebra Appl.*, 512, 219–233, (2017).

[29] C.R. Johnson, M. Newman, A note on cospectral graphs, *J. Combin. Theory Ser. B,* 28, 96–103, (1980).

[30] L. Mao, W. Wang, On the construction of graphs determined by their generalized characteristic polynomials, *Linear Algebra Appl.* 485, 454–464, (2015).

[31] M. Muzychuk, M. Klin, On graphs with three eigenvalues, *Discrete Math.* 189, 191–207, (1998).

[32] J.J. Seidel, A survey of two-graph, *Colloquio Internazionale sulle Teorie Combinatorie* (Proceedings, Rome, 1973) Vol. I, pp. 481–511. Academia Nazionale dei Lincei, Rome, (1976).

[33] J.J. Seidel, Strongly regular graphs with $(-1, 1, 0)$-adjacency matrix having eigenvalue 3, *Linear Algebra Appl.,* 1, 281–298, (1968).

[34] J.H. Smith, Some properties of the spectrum of a graph, in: Combinatorial Structures and their Applications (Proc. Calgary Internat. Conf., Calgary, Alta., 1969), Gordon and Breach, New York, pp. 403–406, 1970.

[35] P. Rowlinson, The main eigenvalues of a graph: A survey, *Appl. Anal. Discr. Math.* 1, 445–471, (2007).

[36] W. Wang, F. Li, H. Lu, Z. Xu, Graphs determined by their generalized characteristic polynomials, *Linear Algebra Appl.,* 434, 1378–1387, (2011).

[37] W. Wang, C.-X. Xu, A sufficient condition for a family of graphs being determined by their generalized spectra, *European J. Combin.,* 27, 826–840, (2006).

[38] W. Wang, C.-X. Xu, An excluding algorithm for testing whether a family of graphs are determined by their generalized spectra, *Linear Algebra Appl.,* 418, 62–74, (2006).

[39] W. Wang, C.-X. Xu, Note: On the generalized spectral characterization of graphs having an isolated vertex, *Linear Algebra Appl.,* 425, 210–215, (2007).

[40] P.Terwilliger, A new feasibility condition for distance-regular graphs, *Discrete Math.* 61, 311–315, (1986).

Faculty of Engineering Sciences, GIK Institute of Engineering Sciences and Technology, Topi, Swabi, 23460, Pakistan

Email address: sakander1566@gmail.com

School of Mathematical Sciences, University of Science and Technology of China (USTC),Hefei, Anhui, China

Email address: xmcheng@mail.ustc.edu.cn

Department of Mathematics, School of Science, University of Management and Technology, Lahore 54770, Pakistan

Email address: javaidmath@gmail.com

School of Mathematical Sciences, University of Science and Technology of China (USTC), Hefei, Anhui, China

Email address: koolen@ustc.edu.cn

INTUITIONISTIC FUZZY POLYNOMIAL IDEAL OF A POLYNOMIAL RING

AND ITS NIL RADICAL STRUCTURE

P.K. SHARMA

0000-0001-5463-8665

ABSTRACT

In this talk we introduce the notion of intuitionistic fuzzy polynomial ideal Ax of a polynomial ring R[x] induced by an intuitionistic fuzzy ideal A of a ring R. Then many properties of Ax will be discussed. We shall also establish an isomorphism theorem of a ring of intuitionistic fuzzy cosets of Ax. It will be shown that an intuitionistic fuzzy ideal A of a ring R is an intuitionistic fuzzy prime if and only if Ax is an intuitionistic fuzzy prime ideal of R[x]. However, if Ax is an intuitionistic fuzzy maximal ideal of R[x], then A is an intuitionistic fuzzy maximal ideal of R, but converse is not true. We will also investigate the nil radical structure of Ax. The homomorphic image and inverse image of an intuitionistic fuzzy polynomial ideal Ax and nil radical of Ax when A is an intuitionistic fuzzy prime ideal of a ring R will also be discussed.

REFERENCES

[1] K.T. Atanassov (1986) Intuitionistic fuzzy sets,, Fuzzy Sets and Systems, 20(1) pp. 87-96.

[2] K.T. Atanassov (1999) Intuitionistic Fuzzy Sets Theory and Applications, Studies on Fuzziness and Soft Computing, 35, Physica-Verlag, Heidelberg.

[3] I.Bakhadach, S. Melliani,M, Oukessou and S.L. Chadli (2016) Intuitionistic fuzzy ideal and intuitionistic fuzzy prime ideal in a ring, Nots on Intuitionistic Fuzzy Sets and System, 22(2), 59-63.

[4] B. Banerjee, D.K. Basnet (2003) Intuitionistic fuzzy subrings and ideals, The Journal of Fuzzy Mathematics 11(1),139-155. R. Biswas,(1989) Intuitionistic fuzzy subgroup, Mathematical Forum X, 37-46.

[5] K. Hur, H. W. Kang, and H. K. Song, (2003) Intuitionistic Fuzzy Subgroups and Subrings, Honam Math J. 25(1), 19-41.

[6] K. Hur, H. W. Kang, and H. K. Song, (2005) Intuitionistic Fuzzy Ideals of a Ring, Journal of the Korea Society of Mathematical Education, Series B, 12(3), 193-209.

[7] Y.B. Jun, M.A. Ozturk, C.H. Park, (2007) Intuitionistic nil radicals of intuitionistic fuzzy ideals and Euclidean intuitionistic fuzzy ideals in ring, Information Science 177, 4662-4677.

[8] C.B. Kim, H.K. Kim and K.S.So, (2014) On the fuzzy polynomial ideals, Journal of Intelligent and Fuzzy Systems 27, 487-494. D.S. Malik and J.N. Mordeson,(1998) Fuzzy Commutative Algebra, World Scientific Publishing Co-Pvt. Ltd.

[9] K. Meena and K.V. Thomas,(2011) Intuitionistic L-Fuzzy Subrings, International Mathematical Forum 12(52) ,2561-2572.

[10] K. Meena,(2017) Characteristic intuitionistic fuzzy subrings of an intuitionistic fuzzy ring, Advances in Fuzzy Mathematics 12(2) ,229-253.

[11] D.S. Malik,(1991) Fuzzy Maximal, Radical, and Primary Ideals of a Ring, Information Sciences 53 ,237-250.

[12] P.K. Sharma,(2011) Translates of intuitionistic fuzzy subring, International Review of Fuzzy Mathematics 6(2), 77-84. .

[14] P.K. Sharma, Gagandeep Kaur (2018) On the intuitionistic fuzzy polynomial ideals of a ring, Notes on Intuitionistic Fuzzy Sets 24(1) , 48-59.

[15] P.K. Sharma, Gagandeep Kaur (2018) Radical Structures of intuitionistic fuzzy polynomial ideals in a ring, Notes on Intuitionistic Fuzzy Sets 24(4) , 85-96.

DEPARTMENT OF MATHEMATICS, D.A.V. COLLEGE, JALANDHAR, PUNJAB, INDIA.

E-mail address: pksharma@davjalandhar.com

SOME REMARKS ON 2-NORMED SPACES

ŞÜKRAN KONCA

0000-0003-4019-958X

ABSTRACT

The notion of a norm is to be regarded as a generalization of the notion of the distance or length in the real world to the real vector spaces. In a normed space we know how to measure the lengths. How do we measure areas? This is not always easy. We must recognize that the notion of norm has a limitation. To pass this limitation, we need a new notion. One of the treatments is to consider the 2-norm introduced by Gähler in 1963 [Lineare 2-normierte Räume, Mathematische Nachrichten]. Now, consider the 2-normed space: we know how to measure the areas, how can we measure the lengths? At first, this question was asked by Gähler. He defined $\|x\|^{*} = \|x,a\| + \|x,b\|$ where $\{a,b\}$ is linearly independent set and $\dim(X) \geq 2$. The aim of this talk is to evaluate the progress of the subject of 2-norm from the emergence of the concept to the present with a questioning perspective, to talk about its importance and to discuss on some important remarks on 2-normed spaces like measurement of areas, volumes , etc. as a generalization of this concept to the n-normed spaces and orthogonality, convergence, equivalence of norms on the sample spaces lp, Lp and C[a,b] as 2-normed spaces.

REFERENCES

[1] Gähler, S., Lineare 2-normierte Räume, Mathematische Nachrichten, 28, 1-43, (1963).

[2] Gähler, S., Uber 2-Banach Raume, Mathematische Nachrichten, 42, 335-347, (1969).

[3] Gunawan, H., The space of p-summable sequences and its natural n-norm. Bull. Austral. Math. Soc., 2001, 64, 137-147.

[4] Gunawan, H. Orthogonality in 2-normed spaces. Univ. Beograd Publ. Elektrotehn. Fak. Ser. Mat., 17, 1-8, (2006).

[5] Gunawan, H., Setya-Budhi, W., Mashadi, Gemawati, S., On volumes of n-dimensional parallelepipeds in lp spaces, Univ. Beograd. Publ. Elektrotehn. Fak. Ser. Mat. 16, 48–54, (2005).

[6] Kristianto, T.R., Wibawa-Kusumah, R.A., Gunawan, H., Equivalence relations of n-norms on a vector space, Matematicki Vesnik, 65(4), 488-493, (2013).

İZMİR BAKIRÇAY UNIVERSITY, FACULTY OF ENGINEERING AND ARCHITECTURE, FUNDAMENTAL SCIENCES, İZMİR, TÜRKİYE

E-mail address: sukran.konca@bakircay.edu.tr