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15th International Geometry Symposium Abstracts Book

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FOREWORD

Hosted by Amasya University between July 3-6, 2017, the 15th International Geometry Symposium was held in Amasya, a city of learning throughout history. Undergraduate students aiming to do scholarly studies as well as new researchers had a great opportunity of getting together with highly experienced researchers. In light of scientific developments in Geometry and Geometry Education, presentations were made, and discussions were held, thus paving the way for new research. All the studies in this booklet were peer-reviewed, and then brought up to the attention of the audience. Through their presentations, the keynote speakers helped the researchers explore some new ways of thinking.

In making our event happen, special thanks go to the following: Office of the Rector of Amasya University for letting us use its facilities, office of the Governor of Amasya for its support and belief in science as a key element in fostering social development, Amasya Municipality, Ziraat Bankası, Pegem Akademi, and Silverline.

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Invited Speakers

Lie Groups, Translating Solitions and Semi-Riemannian Manifolds

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ABSTRACT

Famous solutions to the Mean Curvature Flow in Euclidean and Minkowski spaces are the translating solitons, which are submanifolds such that their mean curvature vector H satisfy $H=v^{\perp}$, where v is a fixed constant unit vector in the Euclidean Space, and $v^{\perp}$ stands for the normal component of v along the immersion. For simpleness, it is very common to choose v = (1,0,...,0). These objects have been extensively studied. Now, let (M, g) be a semi-Riemannian manifold, and $\varepsilon \in \{1, -1\}$ a constant. Given a map $u:M\to R$, we say that its graph $F:M\to(M\times R, g+\varepsilon\, dt)$ is a (vertical) translating soliton if the mean curvature vector H of F satisfies $H=\partial t^{\perp}$. As a first result, when the graph is semi-Riemannian, we obtain the PDE that function u must satisfy.

Next, in the same setting, when we consider a semi-Riemannian submersion such that the mean curvature of the fibers is zero, we will obtain a lift-type theorem, i.e., a translating soliton on M can be lifted to a translating soliton on P, and viceversa (i.e., projected from P to M.)

As an application, we will let a Lie group Σ act on M in such a way that the space of orbits M/Σ is diffeomorphic to an open interval $(a, b) \subset R$. In this way, the PDE can be transformed in a ODE. In many situations, there is an associated boundary problem with a singularity, and we can obtain a solution. Next, we will see how we can extend this solution. The last part of the talk will be devoted to obtaining examples.

These results are based on two works, one with M.-A. Lawn (Imperial College,UK) and one with E. Kocakuşaklı(Ankara University, Turkey) which are under revision.

Key Words: Translating Solitons, Lie Groups, Semi-Riemannian products.

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Intrinsic and Extrinsic Riemannian Invariants of Submanifolds

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ABSTRACT

The curvature invariants are the most natural and the most important Riemannian invariants. They play key roles in physics and biology. Classically, among the Riemannian curvature invariants the most studied were the sectional curvature, the scalar curvature and the Ricci curvature.

S.S. Chern [4] asked to search for necessary conditions for a Riemannian manifold to admit a minimal isometric immersion in a Euclidean space.

B.Y. Chen ([2], [3]) introduced new curvature invariants, which are known as Chen invariants. Moreover, he established optimal estimates of these (intrinsic) invariants of Riemannian submanifolds in Riemannian space forms in terms of the main extrinsic invariant, namely the mean curvature function. Chen inequalities provided new solutions to Chern's problem.

We have some contributions in this topic for submanifolds in complex space forms and Sasakian space forms, respectively (see [6], [5]).

Recently, in a joint paper with M.E. Aydin and A. Mihai [1], we extended the study of curvature invariants to submanifolds in statistical manifolds of constant curvature.

In the present lecture, we recall fundamental results from the above mentioned papers and outline some new directions of research in this topic.

Keywords: Riemannian invariants, curvature invariants, scalar curvature, Ricci curvature, Chen invariants, Chen inequalities, Riemannian space form, complex space form, Sasakian space form, statistical manifold.

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On Warped Product Manifolds

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ABSTRACT

A warped product manifold is a generalization of a Riemannian product manifold. It is very important in differential geometry and physics especially in the theory of the general relativity. It was defined in 1969 by Bishop and O'Neill. The study of a warped product submanifold was started to study by B. Y. Chen in 2000. After the studies of Bishop and O'Neill (1969) and Chen (2000), the study of warped product manifolds and submanifolds become a very attractive research subject and about 600 papers have been published related to this notion.

In the present talk, we give a survey on warped product manifolds and submanifolds in different ambient spaces.

Key Words: Warped product manifolds, warped product submanifold.

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Harran and Geometry

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ABSTRACT

Harran (Assyrian *Harraru*) is an ancient city of strategic importance, now a village of Şanlıurfa, in southeastern Turkey. It has always been an important center of history, culture and science. In this talk, we firstly mention the historical significance of Harran. Then, we refer to scientific fields throughout history in Harran. Moreover, we speak of an academy called Beytü'l Hikme, a significant education, research and translating center. We also mention important scientists having researched in Beytü'l Hikme.

Key Words: Harran, Beytü'l Hikme, history of Harran.

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Abstracts of Geometry

Curvature Characterizations of Pseudo-Hermitian Slant Curves in Sasakian Space Forms

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ABSTRACT

The Tanaka-Webster connection is a unique connection satisfying some special properties. Slant curves are more general than Legendre curves. They form an important class of curves since they have constant contact angles. In this study, we consider slant curves with respect to the Tanaka-Webster connection and find pseudo-Hermitian biharmonicity conditions.

Key Words: Sasakian space form, slant curve, pseudo-Hermitian biharmonic curve, the Tanaka-Webster connection.

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On a Special Class of Semi-Tensor Bundle of Type (2,0)

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ABSTRACT

Using projection (submersion) of the tangent bundle TM over a manifold M, we define a semi-tensor (pull-back) bundle tM of type (2,0).

The main purpose of this paper is to investigate complete and horizontal lift of vector fields for semi-tensor (pull-back) bundle tM of type (2,0). In this context cross- sections in a special class of semi-tensor (pull-back) bundle tM of type (2,0) can be also defined.

Key Words: Vector field, complete lift, cross-section, horizontal lift, pull-back bundle**,** tangent bundle**,** semi-tensor bundle.

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Finding Minimum Area Ellipse for Data Points using a Genetic Algorithm

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ABSTRACT

Ellipses provide a descriptive boundary for data points in various applications ranging from data mining to image processing. Finding the ellipse with minimum area is different from conventional ellipse fitting process. The former problem requires heuristic search techniques specially designed for minimizing the area.

This paper tackled the problem by regarding it as an optimization problem and employing genetic algorithm to solve it. The general ellipse equation was given as ($x^2/a^2+y^2/b^2=1$). The orientation of the point dataset (angle with the positive x-axis) and equation parameters (a, b) are computed using the central moments of order two. After a change of variables in the form $u=1/a^2$, and $v=1/b^2$, then the product u.v is maximised subject to two constraints (1) $u\geq0$ and $v\geq0$ (2) $xi^2u+yi^2v\leq1$ for all data points (xi, yi). Genetic operators (cross-over and mutation) were developed to yield better results.

Results obtained from randomly generated and actual datasets show that different datasets require varying numbers of generations for convergence; however, the algorithm was able to shrink the initially computed ellipse into a smaller size after the completion of the genetic algorithm for all datasets.

Key Words: Minimum Area Ellipse, Genetic Algorithm, Optimization.

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Some Notes on Integrability Conditions and Operators on Contangent Bundle $C_{T(M_n)}$

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ABSTRACT

In this study firstly, It was studied almost paraholomorphic vector field with respect to almost para-Nordenian structure ($F,{}^{S}g$) and the purity conditions of the Sasakian metric ${}^{S}g$ is investigate with respect to almost paracomplex structure F on cotangent bundle. Secondly, we obtained the integrability conditions of almost paracomplex structure F by calculating the Nijenhuis tensors $N_F(X^H, Y^H)$, $N_F(X^H, \omega^H)$ and $N_F(\omega^H, \theta^H)$ of almost paracomplex structure F of type (1,1) on ${}^{C}T(M_m)$. Finally, the Tachibana operator ϕ_φ applied to ${}^{S}g$ according to an almost paracomplex structure F and the Vishnevskii operators (ψ_φ -operator) applied to the vertical and horizontal lifts with respect to F on cotangent bundle.

Key Words: Sasakian metrics, integrability conditions, almost paracomplex structure, Nijenhuis tensor, Tachibana operators, Vishnevskii operators.

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Some Notes on the Diagonal Lifts and Operators on Cotangent Bundle

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ABSTRACT

In this paper firstly, the Tachibana operators were applied to 1-form, vertical, complete and horizontal lifts with respect to almost paracomplex structure I^D (The diagonal lift I^D) on cotangent bundle. Secondly, the Vishnevskii operators were applied to 1-form according to the diagonal lift I^D on cotangent bundle. Finally, covariant derivatives of almost paracomplex structure I^D with respect to vertical, complete and horizontal lifts were obtained.

Key Words: Tachibana operators, Vishnevskii operators, almost paracomplex structure, vertical lift, horizontal lift, diagonal lift.

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Magnetic Surfaces

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ABSTRACT

The magnetic surface is defined as the surface on which the magnetic vector field lines are located.

In the present paper we study the problem of consructing a family of magnetic surfaces from a given magnetic field lines. We derive a parametric representation for the surfaces pencil whose members share the same magnetic field lines. By utilizing the Frenet trihedron frame along the given magnetic field lines, we express the surface pencil as a linear combination of the components of this local coordinate frame. Moreover we give some examples and draw the pictures of these surfaces.

Key Words: Special surfaces, magnetic field, Frenet frame.

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Notes on the Cheeger-Gromoll metric ${}^{CG}g$ on Cotangent Bundle

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ABSTRACT

In this study, we define the Cheeger-Gromoll metric in the cotangent bundle $T^{*}M^{n}$, which is completely determined by its action on vector fields of type X^{H} *and* ω^{V} .Later, we obtain the covarient and Lie derivatives applied to the Cheeger- Gromoll metric with respect to the horizontal and vertical lifts of vector and kovector fields, respectively.

Key Words: Covarient derivative, Lie derivative, cheeger-gromoll metric, horizontal lift, vertical lift.

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Bicovariant Differential Calculus on *F*(R*q*(2))

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ABSTRACT

The basic structure giving a direction to the noncommutative geometry is a differential calculus on an associative algebra. There exist covariant differential calculi on coordinate algebras of quantum spaces. Differential calculus (DC) can be applied to a Hopf algebra considered as a left (right) quantum space with respect to the coproduct. The function algebra on the extended quantum plane is a Hopf algebra, denoted by *F* (R*q* (2)). Using the left and the right covariance, a bicovariant differential calculus on the Hopf algebra *F* (R*q* (2)) is given. A quantum group that is the symmetry group of the differential calculus is introduced.

Key Words: Quantum plane, hopf algebra, differential calculus.

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Properties of the Timelike Ruled Surfaces with Darboux Frame in E_1^3

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ABSTRACT

In this paper, the timelike ruled surfaces with respect to Darboux frame are studied. We give the characteristic properties of the timelike ruled surfaces related to the geodesic torsion, the normal and the geodesic curvatures. Furthermore, some special cases of non-null rulings are demonstrated according to {**T**, **N**, **B**} Frenet frame with **{T**, **g**,**n}** Darboux frame. Finally, the integral invariants of these surfaces are examined.

Key Words: Ruled surface, Darboux frame, Lorentz 3-space, integral invariants.

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The Spacelike Ruled Surfaces with Darboux Frame in E_3^1

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ABSTRACT

In this study, the spacelike ruled surfaces with Darboux frame in E_1^3 are introduced and characterization of them which are related to the geodesic torsion, the normal curvature and the geodesic curvature with respect to Darboux frame are examined. Additionally, we have given some theorems about the integral invariants of the spacelike surface with Darboux frame.

Key Words: Ruled surface, Darboux frame, Lorentz 3-space, integral invariants.

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Notes on a New Metric in the Cotangent Bundle

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ABSTRACT

In this paper we introduce a new metric $\tilde{G} = {}^{R}\nabla + \sum_{i,j}^{n} g^{ij}\partial_{p_j}\delta_{p_i}$ which defined with Riemannian extension ${}^{R}\nabla$ in the cotangent bundle. Then we investigate some curvature properties and geodesics for the metric $\tilde{G}$.

Key Words: Riemannian extension, cotangent bundle, Levi-Civita connection, geodesic.

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Some Coplanar Points in Tetrahedron

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ABSTRACT

In this work, we determine the conditions for coplanarity of the vertices, the incenter, the excenters, and the symmedian point of a tetrahedron.

Key Words: Coplanarity, tetrahedron, barycentric coordinates.

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A Useful Orthonormal Basis for Slant Submanifolds of Almost Product Riemannian Manifolds

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ABSTRACT

Slant submanifolds of an almost product Riemannian manifold are investigated. Some examples of these frame of submanifolds are presented. The existence of a useful orthonormal basis in proper slant submanifolds is proved.

Key Words: Almost Product Riemannian manifold, slant submanifold, proper slant submanifold.

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Some Inequalities for Submanifolds of Quasi Constant Curvature Manifolds and Nearly Constant Curvature Manifolds

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ABSTRACT

Some inequalities involving the intrinsic and extrinsic invariants of submanifolds of quasi constant curvature manifolds and nearly constant curvature manifolds are established. By the help of these inequalities, some characterizations for these submanifolds are mentioned.

Key Words: Submanifold, quasi-constant curvature manifold, curvature.

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Matched Pair Vlasov Dynamics

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ABSTRACT

Starting with a brief summary of the Lagrangian and Hamiltonian dynamics (Euler-Lagrange, and Euler-Poincare equations) on matched pairs of Lie groups [1,2], in the present talk we aim to develop the core concepts of the Euler-Lagrange and Euler-Poincare formulation of the Vlasov equations. More precisely, we present the main components of a similar analysis on the (infinite dimensional) group *Can(T*Q)* of the canonical diffeomorphisms on the symplectic manifold *T*Q*, and its Lie algebra *X(T*Q)* of Hamiltonian vector fields.

To this end, we first recall the Lie algebra of contravariant tensor fields with the Schouten concomitant as the Lie bracket, in order to present a better point of view towards the structure of the Lie algebra of Hamiltonian vector fields. We then provide the matched pair decomposition of this infinite dimensional Lie algebra, presenting the mutual actions of the subalgebras of this decomposition explicitly. (This is an ongoing joint work with O. Esen)

Key Words: Matched pair of Lie groups and Lie algebras, Euler-Lagrange equations, Euler-Poincaré equations, Vlasov equations, Lie algebra of Hamiltonian vector fields.

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B-Darboux Frame of Spacelike Curve on a Surface in Minkowski Space

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ABSTRACT

In this paper, we introduce a new frame on a surface in Minkowski space E_1^3, called as B-Darboux frame. It is well known that we derive the parallel transport frame from the Frenet frame along a space curve. Analogously, we derive the B- Darboux frame from the Darboux frame on a surface.

Key Words: Bishop frame, Darboux frame, Parallel surfaces.

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Surfaces of Revolution with Vanishing Curvature in Galilean 3-Space

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ABSTRACT

In this article, we define and study three types of surfaces of revolution in Galilean 3-space. The construction of the well-known surface of revolution, being the trace of a planar curve that is rotated about an axis in the supporting plane of the curve, is carried over to Galilean 3-space. Because of the existence of on the one hand isotropic and non-isotropic vectors and by that isotropic and Euclidean rotations, and on the other hand isotropic and Euclidean planes, one must distinguish three different possibilities for the construction of a surface of revolution in Galilean 3- space. Then, we classify the surfaces of revolution with vanishing Gaussian curvature or vanishing mean curvature in Galilean 3-space.

Key Words: Galilean 3-space, Surface of revolution, Flat surface, Minimal surface, Rotational surface.

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On Multiply Warped Product Submanifolds

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ABSTRACT

We consider multiply warped product submanifolds with two fibers. We observe the non-existence of such submanifolds under some circumstances. We also check that the existence of this kind of submanifolds in case of the ambient manifold is Kaehlerian and locally product Riemannian.

Key Words: Warped product submanifold, Kaehler manifold, locally product Riemann manifold.

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Some Characterizations of Rectifying Curves in Minkowski n-Space E_v^n

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ABSTRACT

In this article, we study the so-called rectifying curves in an arbitrary dimensional Minkowski space. A curve is said to be a rectifying curve if, in all points of the curve, the orthogonal complement of its normal vector contains a fixed point. If this fixed point is chosen to be the origin, then this condition is equivalent to saying that the position vector of the curve in every point lies in the orthogonal complement of its normal vector. Here we characterize rectifying curves in the n-dimensional Minkowski space in different ways: using conditions on their curvatures, with an expression for the tangential component, the normal component, or the binormal components of their position vector, and construct them starting from an arclength parametrized curve on the unit hypersphere.

Key Words: Minkowski n-space, Frenet equations, rectifying curves

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Some Notes on a Special Class of Semi-Tensor Bundle

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ABSTRACT

Using projection (submersion) of the cotangent bundle T*M over a manifold M, we define a semi-tensor (pull-back) bundle tM of type (p,q). In this context cross- sections in a special class of semi-tensor (pull-back) bundle tM can be also defined.

Key Words: Vector field, complete lift, cross-section, horizontal lift, pull-back bundle**,** tangent bundle**,** semi-tensor bundle.

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Musical Isomorphisms from Semi-Tangent Bundle to Semi-Cotangent Bundle

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ABSTRACT

We transfer complete lifts from the semi-tangent bundle tM to the semi-cotangent bundle t*M using a musical isomorphism between these bundles. In this article, we also analyze complete lift of vector and affinor (tensor of type (1,1)) fields for semi-tangent (pull-back) bundle tM. Finally, we study compatibility of transferring lifts with complete lifts in the semi-cotangent bundle t*M.

Key Words: Semi-tangent bundle, semi-cotangent bundle, complete lift, musical isomorphism, vector field, pull-back bundle**.**

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1.1

Construction of Maximal Surfaces via Björling Formula

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ABSTRACT

Minimal surface has zero mean curvature at every point in Euclidean space. Björling formula is a way to create minimal surfaces from a curve with the help of complex variables. Minimal surfaces which based on circle and helix are obtained via Björling formula, then they are called bending helicoids and helicoidal helicoids respectively. In this talk we consider Björling problem in Lorentz-Minkowski space to get maximal surfaces. We investigate bending helicoids and helicoidal helicoids in this space.

Key Words: Björling problem, maximal surfaces , circle, helix.

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The Control Type of a Bézier Curve and Minimal Complete System of Control Invariants of a Bézier Curve

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ABSTRACT

Let G be the group M(n) of all motions of the n-dimensional Euclidean space R^n or G = SM(n) is the subgroup of M(n) generated by rotations and translations of R^n. The present paper is devoted to a study of complete systems of Euclidean control invariants of Bézier curves. According to the group M(n) and SM(n), the type of a Bézier curve and the second minimal complete system of control invariants of a Bézier curve are obtained.

Key Words: Bézier curve, control invariant, equivalence.

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The Taxicab Type and an Invariant Parametrizations of a Curve in 3-dimensional Taxicab Space

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ABSTRACT

Let $M_T(3)$ be the taxicab space group. In this study, according to the group $M_T(3)$, the definitions of taxicab curve and the taxicab arc length function of a curve are given. Besides, the definition of an invariant parametrization of a curve and invariant parametrization of a curve with a fixed taxicab type are decribed. The problem of the $M_T(3)$ –equivalence of curves is reduced to that of paths.

Key Words: Taxicab space, curve, invariant.

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On the Geometry of Semi-Slant $\xi^{\perp}$-Riemannian Submersions

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ABSTRACT

The aim of the present paper to define and study semi-slant $\xi^{\perp}$-Riemannian submersions from Sasakian manifolds onto Riemannian manifolds as a generalization of anti-invariant $\xi^{\perp}$-Riemannian submersions, semi-invariant $\xi^{\perp}$-Riemannian submersions and slant Riemannian submersions. We obtain characterizations; investigate the geometry of foliations which arise from the definition of this new submersion. After we investigate the geometry of foliations, we obtain necessary and sufficient condition for base manifold to be a locally product manifold and proving new conditions to be totally umbilical and totally geodesicness, respectively. Moreover, some examples of such submersions are mentioned.

Key Words: Riemannian submersion, Sasakian manifold, anti-invariant $\xi^{\perp}$-Riemannian submersion, semi-invariant $\xi^{\perp}$-Riemannian submersion, slant Riemannian submersion.

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On Conformal Semi-Invariant Submersions whose Total Manifolds are Locally Product Riemannian

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ABSTRACT

As a generalization of semi-invariant submersions, we introduce conformal semi-invariant submersions from almost product Riemannian manifolds onto Riemannian manifolds. We give examples, investigate the geometry of foliations which are arisen from the definition of a conformal submersion and show that there are certain product structures on the total space of a conformal semi-invariant submersion. Moreover, we also find necessary and sufficient conditions of a conformal semi-invariant submersion to be totally geodesic.

Key Words: Almost product Riemannian manifold, Riemannian submersion, Semi-invariant submersion, conformal submersion, conformal semi-invariant submersion

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Poisson and Symplectic Geometry of 3D and 4D Dynamical Systems

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ABSTRACT

Some basic notions of the Poisson and the symplectic geometry will be introduced. Fundamentals of (multi-)Hamiltonian systems will be summarized in finite dimensions. Using the Darboux integrability method and the method of the Jacobi's last multiplier, we shall derive integrals and (bi-,tri-)Hamiltonian realizations of some particular models in 3D and 4D models such as Lü, Qi, Chen, T systems.

Key Words: Poisson geometry, symplectic geometry, Hamiltonian dynamics, integrability.

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On the m-Generalized Taxicab Metric

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ABSTRACT

In this talk, we present the m-generalized taxicab metric which includes the slightly generalized taxicab metric and so the well-known taxicab metric as special cases. Then, we give some distance properties of the plane with the m-generalized taxicab metric such as shortest path, circle, minimum distance set of any two points and isometry.

Key Words: Taxicab metric, generalized taxicab metric, shortest path, minimum distance set, isometry.

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Burmester Theory in Affine Cayley-Klein Planes

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ABSTRACT

In this paper, we study the circular Burmester theory in Euclidean, Galilean and Lorentzian planes, respectively and extend the classical Burmester theory to the affine Cayley-Klein planes by following unified method. For this purpose we use the generalized complex numbers and define generalized form of Bottema's instantaneous invariants. By this way we expose the instantaneous geometric properties of motion of rigid bodies in the affine Cayley-Klein planes.

Key Words: Instantaneous invariants, Burmester theory, affine Cayley-Klein planes.

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Some Characterizations of Semi Q-Discrete Surfaces of Revolution

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ABSTRACT

Discrete differential geometry has a lot of applications in geometry. One kind of applications is semi discrete surfaces. Semi discrete surfaces consist of bivariate function of one discrete and one continuous variable. In this study, we briefly introduce semi q- discretization of smooth surfaces. We also study semi q-discrete surface of revolution. Then, we give some definitions of semi q- discrete surface by using q- trigonometric functions. Finally, we discuss basic theorems about the study.

Key Words: Semi q- discrete surface, surface of revolution, discrete surfaces.

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Fibonacci Tessarines with Fibonacci and Lucas Number Components

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ABSTRACT

Lately, some results about Fibonacci numbers and Lucas numbers are given by the authors. In this present paper, our object introduce a detailed study of a new generation of Fibonacci tessarine with Fibonacci and Lucas number components. We define a new vector which are called Fibonacci tessarine vector. We give properties of this vector to expert some applications on Fibonacci tessarines and Fibonacci tessarines vector in geometry.

Due to the matter is given Fibonacci tessarine with Fibonacci and Lucas number components, we give some formulas, facts and properties about Fibonacci tessarine with Fibonacci and Lucas numbers and variety of geometric and algebraic properties which are not generally known.

Key Words: Tessarine, Fibonacci numbers and Lucas numbers, Fibonacci vector.

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Affine Solutions of Pseudo-Finsler Eikonal Equations

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ABSTRACT

In this paper, affine solutions of pseudo-Finsler eikonal equations and some related theorems are derived. Besides, we introduce a natural definition for the affine maps between pseudo-Finsler manifolds and we give some geometrical properties of these maps.

Key Words: Affine solutions, pseudo-Finsler eikonal equations, affine maps between pseudo-Finsler manifolds.

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Singular Perturbations of Rational Maps

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ABSTRACT

In this study is to describe what happens when Newton's method is applied to the complex polynomial $Fc(z) = (z^2 + c)(z - 1)$ when the parameter c is non-zero but quite small.

Key Words: Newton's method, Julia set, Fractal

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Timelike Directional Bertrand Curves in Minkowski Space

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ABSTRACT

It is well known that a characteristic property of the Bertrand curve is the existence of a linear relation between its curvature and torsion. In this paper, we propose a new method for generating timelike Bertrand curves, which avoids the basic restrictions. Our main result is that every timelike space curve is a directional timelike Bertrand curve with infinite directional timelike Bertrand mates.

Key Words: Bertrand Curves, Offset, Frenet frame, Minkowski space.

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Accretive Darboux Growth Along a Space Curve

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ABSTRACT

For a space curve to evolve in time and construct a surface, it is more convenient to use the alternative moving frame. A growth velocity in the direction of the Darboux vector at every point on the generating curve is defined in this work. Also, the Darboux growth along a general helix is investigated and the components of the growth velocity are calculated for an arbitrary space curve.

Key Words: Alternative moving frame, accretive growth, Darboux vector, general helix.

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On the Kinetic Energy of the Projective Curve for the 1-Parameter Closed Spatial Motion

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ABSTRACT

We investigate the kinetic energy formula of the projective curve for 1-parameter closed spatial motion and find the formula as following,

$$2S = 2S_0 + p\sum_{i=1}^{3} x_i^2 - \sum_{i,j=1}^{3} b_{ij} x_i x_j + \sum_{i=1}^{3} c_i x_i$$

Also, we obtain some results related with that formula.

Key Words: Kinetic energy, motion, kinematic.

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Non-null Darboux Slant Ruled Surfaces in Minkowski 3-space

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ABSTRACT

In this study, we investigate non-null Darboux slant ruled surfaces in Minkowski 3-space. We define different kinds of Darboux slant ruled surfaces and introduce some characterizations. We also determine some significant relations between Darboux slant ruled surfaces and some other slant ruled surfaces in Minkowski 3- space. We finally give examples for the obtained results.

Key Words: Frenet frame, Darboux slant ruled surface, Minkowski 3-space.

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On the Bertrand Supercurves in Super-Euclidean Space

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ABSTRACT

Using the Banach Grassmann algebra B_L, given by Rogers, a new scalar product, a new definition of the orthogonality and of the Frenet frame associated to supersmooth supercurve are introduced on the (m,n)-dimensional total super-Euclidean space $B_L^{(m,n)}$. It is well known that a characteristic property of the Bertrand curve is the existence of a linear relation between its curvature and torsion. In this study, definition of the Bertrand super curve in $B_L^{(m,n)}$ is given and also some theorems for the Bertrand curve in $B_L^{(4,4)}$ are obtianed.

Key Words: Super-Euclidean space, Supercurve, Bertrand supercurve, Frenet frame.

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Bessel Collocation Method to Determinate the Curves of Constant Breadth According to Bishop Frame in Euclidean 3-Space

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ABSTRACT

In Euclidean 3-space, curves of constant breadth according to the Bishop Frame are characterized by a system of first order linear three differential equations. In this study, we present a numerical method based on Bessel polynomials to determine curves of constant breadth according to Bishop frame in Euclidean 3- space. By using the matrix operations and collocation points, original problem is transformed into a system of linear algebraic equations. So, the coefficients of the approximate solution are computed. Error estimation is made by using residual function. Numerical applications are given to explain the method.

Key Words: Bishop frame, curves of constant breadth, system of linear differential equations, Bessel collocation method.

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On Null Bertrand Partner D-Curves on Spacelike Surface

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ABSTRACT

In this paper, by using the Darboux frame of null curves, we define null Bertrand partner D- curves and give the relations between curvatures of these curves in Minkowski 3-space E_1^3. Besides, we obtain some special results. Finally, by considering surface construction methods, we give examples for null Bertrand partner D-curvature in E_1^3.

Key Words: Null Curve; Bertrand partner D-curves; Darboux frame; Geodesic.

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Rectifying Curves in n-Dimensional Euclidean Space

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ABSTRACT

A rectifying curve is defined as a space curve whose orthogonal complement $N^{\perp}$ of its normal vector contains a fixed point in all points of the curve. In this study, first of all, we recharacterize rectifying curves with their harmonic curvature functions in n-dimensional Euclidean space. Furthermore, we introduce some relations between rectifying curves and focal curves. Finally, we investigate a rectifying Salkowski curve with the condition that its focal curve is a rectifying curve.

Key Words: Rectifying curve, harmonic curvature, focal curve.

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The Invariants of a Parameter Ruled Surfaces with Common Smarandache Curves of the Line Congruence According to Type-2 Bishop Frame

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ABSTRACT

In this work, we investigate the invariants of a parameter ruled surface with common Smarandache curves of the line congruence according to Type-2 Bishop frame in Euclid space. Also we obtain some interesting results and illustrate of the examples by the aid Maple program.

Key Words: Type-2 Bishop Frame, İnvariants, Congruence, Parameter Ruled Surface, Euclid Space.

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Twisted Surfaces in Isotropic 3-Space

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ABSTRACT

In this paper, we describe twisted surfaces in isotropic 3-space.This surfaces are generated by synchronized rotations of non-isotropic planar curve lying in the non-isotropic xz-plane and this supporting plane with the z-axis as its containing rotation axis. Then we give some characterizations and examples about flat, constant Gaussian curvature, minimal and constant mean curvature twisted surfaces in isotropic 3-space.

Key Words: Twisted surface, Isotropic Space, Gaussian curvature, minimal surface, mean curvature.

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$Spin^T(p,q)$ Manifolds

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ABSTRACT

In this study, we define the group Spin^T(p,q) and give some properties of this group. By using the spinor representation of the group Spin^T(p,q), we construct Spin^T spinor bundle S. We describe the covariant derivative operator and Dirac operator on the spinor bundle S.

Key Words: Spinor bundle, Dirac operator, the group Spin^T(p,q).

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On a Generalization of Dual Octonions

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ABSTRACT

In this study, we investigate the Horadam sequence as a generalization of the linear recurrence equations of order two. We define dual Horadam sequence. By the aid of this sequence we obtain a new generalization for the sequences quaternions and octonions. Moreover, we give some important algebraic properties related with them..

Key Words: Recurrence Relations, Quaternion, Octonions.

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Quaternionic (1,3)- Bertrand Direction Curves

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ABSTRACT

In this paper, we introduce a new type of associated curves called quaternionic (1,3)-Bertrand direction curves. These curves are defined as the integral curves of quaternionic functions generated by Frenet frame of a given quaternionic curve. We give some relationships concerning Frenet vectors and curvatures of the quaternionic curves.

Key Words: associated curves, direction curves, quaternionic curves, quaternionic Bertrand curves.

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On The Pseudo Null Curves in 4-dimensional Semi-Euclidean Space with Index 2

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ABSTRACT

In this study, we give some characterizations for pseudo null curves which lie on some subspaces of 4-dimensional Semi-Euclidean space with index 2.

Key Words: Pseudo null curves, Semi-Euclidean space, Frenet frame.

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Spherical Curves and Quaternionic Helices

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ABSTRACT

Quaternionic curves are defined by using the quaternions. ɣ is a quaternionic helices in Quaternionic space if and only if non-zero curvatures $r_1(s)$,$r_2(s)$ and $r_3(s)$ of the quaternionic curve ɣ satify the following characterization

$$\left(\frac{r_1(s)}{r_2(s)}\right)^2+\left[\left(\frac{1}{r_3(s)-r_1(s)}\right)\frac{d}{ds}\frac{r_1(s)}{r_2(s)}\right]^2=\text{constant.}$$

In this talk we obtain some characterizations for quaternionic helices with the help of the spherical curves.

Key Words: quaternionic curve, quaternionic helices, spherical curves.

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An Examination on Perpendicular Transversal Intersection of IFRS and BFRS in E^3.

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ABSTRACT

We have already define and find the parametric equations of Frenet ruled surfaces which are called IFRS and BFRS an involute curve and Bertrand mate of a curve α respectively. In this paper, first we find only one matrix gives us all sixteen positions of normal vector fields of eight IFRS and BFRS in terms of Frenet apparatus of curve α. Further using orthogonality conditions of the eight normal vector fields,. we give perpendicular transversal intersection curves of eight IFRS and BFRS in terms of Frenet apparatus of curve α. ITRS and BDRS have always normal vector fields, but IDRS and BNRS may not have normal vector fields. Also involutive normal ruled surface (INRS) and Bertrandian normal ruled surface (BNRS) of the curve α have perpendicular normal vector fields along the curve $\phi_2^{\wedge}\{**\}(s)=\alpha+(\lambda+((-y(\lambda^2+\beta^2)k_2/(1+y^2))))V_2$.

Key Words: Involute curve, Bertrand curve, ruled surface.

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An Examination Perpendicular Transversal Intersection of IFRS and MFRS in E^3

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ABSTRACT

We have already define and find the parametric equations of Frenet ruled surfaces which are called IFRS and MFRS an involute curve and Mannheim partner of a curve α. In this paper, first we find only one matrix gives us all sixteen positions of normal vector fields of eight IFRS and MFRS in terms of Frenet apparatus of curve α and using orthogonality conditions of the eight normal vector fields. We give perpendicular transversal intersection curves of eight IFRS and MFRS as the solution of SSS problem.

Key Words: Involute curve, Mannheim curve, ruled surface.

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An Examination Perpendicular Transversal Intersection of BFRS and MFRS in E^3

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ABSTRACT

We have already define and find the parametric equations of Frenet ruled surfaces which are called BFRS and MFRS of Bertrand mate, Mannheim partner of a curve α respectively. In this paper, Surface Surface Section (SSS) problems about Perpendicular transversal intersection of BFRS and MFRS of Bertrand mate, Mannheim partner of a curve α, respectively are examined. First we find only one matrix gives us all sixteen positions of normal vector fields of eight BFRS and MFRS in terms of Frenet apparatus of curve α. Further using orthogonality conditions of the eight normal vector fields, we give perpendicular transversal intersection curves of eight BFRS and MFRS in terms of Frenet apparatus of curve α.

Key Words: Bertrand curve, Mannheim curve, ruled surface.

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Perpendicular Transversal Intersection of IFRS , BFRS; and MFRS in E^3

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ABSTRACT

In this paper, Surface Surface Intersection (SSI) problems about Perpendicular transversal intersection of IFRS, BFRS, and MFRS of an involute curve, Bertrand mate, Mannheim partner of a curve α respectively are examined. We have already define and find the parametric equations of IFRS, BFRS, MFRS which the Frenet ruled surfaces.

First using definition of transversal surface and orthogonality conditions of the sixteen normal vector fields, we find only one matrix which gives us all intersections of sixteen normal vector fields of sixteen FRS, IFRS, BFRS, and MFRS in terms of Frenet apparatus of curve α. Further, we give perpendicular transversal intersection curves of eight FRS, IFRS, BFRS, MFRS in terms of Frenet apparatus of curve α.

Key Words: Involute curve, Bertrand curve, Mannheim curve, Frenet ruled surface.

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On a Class of Warped Product Statistical Manifolds

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ABSTRACT

We consider Einstein statistical warped product manifolds $I\times_f N, M\times_f N$ and $M\times_f I$, where I,M and N are 1,m and n dimensional Riemannian manifolds, respectively. We show that if $I\times_f N$ (resp. $M\times_f I$) is an Einstein statistical manifold then *N* (resp. *M*) is an Einstein statistical manifold. We also show that if $M\times_f N$ is a statistical space of constant sectional curvature $K>0$ then the Hessian of the conjugate connection D^* is $H^f_{D^*}=-Kfg_M$.

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On Some Volume Elements of Anderson's Moduli Space[1]

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ABSTRACT

As a topological invariant, Reidemeister torsion (R-torsion) was introduced by K. Reidemeister [4]. The notion of symplectic chain complex was introduced by E. Witten [6]. Using this algebraic tool and R-torsion, he obtained a volume element on the moduli space of representations from the fundamental group of a surface to a compact gauge group.

Let ∑ be a closed oriented surface of genus g ≥ 2. Teichmüller space Teich(∑) of ∑ is the deformation classes of complex structures on ∑. On Teich(∑), there are the well known naturally defined symplectic forms, namely, Weil-Petersson, Atiyah- Bott-Goldman(ABG) [3], and Thurston [2] symplectic forms.

In [1], it was proved by M.T. Anderson that the moduli space *M* of constant curvature (+1) compact 3-manifolds with ∑ minimal surface boundary is a finite dimensional smooth manifold and it can be locally parametrized by Teich(∑). It was also proved that similar results hold for the moduli space *M* of constant curvature (-1) Riemannian metrics on a handlebody with minimal surface of genus at least 2.

In this work, we establish volume elements on the moduli space *M*, by using Anderson's results, R-torsion, and the symplectic structures of Teich(∑).

Key Words: Reidemeister torsion, ABG-symplectic form, Thurston symplectic form, Weil-Petersson form, 3-manifold with minimal surface, Teichmüller space.

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Surface Family with a Common Natural Asymptotic Lift of a Spacelike Curve with Timelike Binormal in Minkowski 3-space

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ABSTRACT

In the present study, we find a surface family possessing the natural lift of a given spacelike curve with timelike binormal as an asymptotic curve in Minkowski 3- space. We express necessary and sufficient conditions for the given curve such that its natural lift is an asymptotic curve on any member of the surface family. Finally, we illustrate the method with some examples.

Key Words: Surface family, asymptotic curve, natural lift, Minkowski 3-space.

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A Note on Representation Varieties of Kähler Manifolds and Reidemeister Torsion

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ABSTRACT

In this study, we consider the representation variety Rep(M,G), where M is a closed Kähler manifold and G = SU(N), N ≥ 2. Firstly, we prove that topological invariant Reidemeister torsion of such representations is well-defined. Furthermore, by using Y.Karshon's symplectic structure of Rep(M,G) [4], we establish a formula for Reidemeister torsion of such representations. In the case M is closed surface, this structure coincides with Atiyah-Bott-Goldman symplectic form for G [1]. As an application, we apply our results to hyperkähler manifold and closed orientable Riemann surface of genus at least 2.

Key Words: Reidemeister torsion, symplectic chain complex, Kähler manifold, ABG-symplectic form, Karshon symplectic form, Hard Lefschetz Theorem.

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Some Properties of Kaluza-Klein Metric on Tangent Bundle

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ABSTRACT

The purpose of the present work is two-fold: Firstly, to investigate the curvature properties of the Kaluza-Klein metric, secondly to study the conditions of which the tangent bundle is almost Kahlerian with respect to a compatible almost complex structure.

(This work was supported by Research Fund of the Iğdır University, Project Number: 2016-FBE-B06).

Key Words: Tangent bundle, Kaluza-Klein metric, curvature tensor.

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Smarandache Curves According to Sabban Frame Belonging to Mannheim Curves Pair

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ABSTRACT

In this study, we investigate special Smarandache curves with regard to Sabban frame for Mannheim partner curve spherical indicatrix. We created Sabban frame belonging to this curves. It was explained Smarandache curves position vector is consisted by Sabban vectors belonging to this curves. Then, we calculated geodesic curvatures of this Smarandache curves. Found results were expressed depending on the Mannheim curve.

Key Words: Mannheim curve pair, Smarandache curve, Sabban frame, Geodesic curvature.

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Kinematic Theory of Invariant Points

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ABSTRACT

In this study, we investigate planar and spatial motions which are composed of a rotation and a translation. First, the geometry of invariant points is expressed in planar motions. Then, this theory is extended the spatial motions. Moreover, spatial motions is interpreted according to whether the invariant points are exist or not.

Key Words: Kinematics, Invariant theory, Rigid body motion.

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Surface Family with a Common Natural Asymptotic Lift of a Timelike Curve in Minkowski 3-space

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ABSTRACT

In the present work, we find a surface family possessing the natural lift of a given timelike curve as an asymptotic curve in Minkowski 3-space. We express necessary and sufficient conditions for the given curve such that its natural lift is an asymptotic curve on any member of the surface family. Finally, we illustrate the method with some examples.

Key Words: Surface family, asymptotic curve, natural lift, Minkowski 3-space.

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Some Characterizations of Curves in n-Dimensional Euclidean Space IE^n

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ABSTRACT

In the present study, we consider a curve whose position vector can be written as a linear combination of its Frenet frame in Euclidean n-space IE^n. We characterize such curve in terms of its curvature functions. Further, we obtain some results of constant ratio, T-constant and N-constant type curves in IE^n.

Key Words: Position vector, W-curves, constant ratio curves.

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Tubular Surface with Pointwise 1-Type Gauss Map in Euclidean 4-Space

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ABSTRACT

In the present paper, we consider a special class of canal surfaces which is called tubular surface in Euclidean 4-space IE^4. We study this surface with respect to its Gauss map. We find that there is no tubular surface with harmonic Gauss map and we give the complete classification of tubular surface with pointwise 1-type Gauss map in Euclidean 4-space IE^4.

Key Words: Tubular surface, Gauss map, pointwise 1-type.

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On The Darboux Vector Belonging to Evolute Curve

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ABSTRACT

In this study, we investigate special Smarandache curves with regard to Sabban frame belonging to Darboux vector of evolute curve.We created Sabban frame belonging to this curves. It was explained Smarandache curves position vector is consisted by Sabban vectors belonging to this curves. Then, we calculated geodesic curvatures of this Smarandache curves. Found results were expressed depending on the base curve.

Key Words: Evolute curve, Smarandache curve, Sabban frame, Geodesic curvature.

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Rotation Minimizing Frame and its Applications in E_1^3

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ABSTRACT

In this paper, in E_1^3 it is showed conditions that any frame is rotation minimizing frame (RMF) using spherical curves. It have also expressed how the Bishop frames can be obtained from frames of any curve on surface and on space. The necessary and sufficient conditions are given. Then, it is investigated whether obtained frames are rotation minimizing frame (RMF) or not. Theorems, warnings and conclusions are expressed. The examined situations are shown over the examples.

Key Words: Spherical curve, Bishop frame, Rotation minimizing frame (RMF).

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On Certain Graph Surfaces in Galilean Geometry

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ABSTRACT

As distinct from the Euclidean case, there exist two different type of graph surfaces immersed in a (pseudo-) Galilean space G_3. In other words, the graphs of the functions *z=z(x,y)* and *x=x(y,z)* have different intrinsic and extrinsic properties in G_3. In this talk, we present the graph surfaces of the sum and the product of two functions with constant Gaussian and mean curvature.

Key Words: Galilean space, Gaussian curvature, mean curvature.

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Spacelike Translation Surfaces in Minkowski 4-Space E_1^4

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ABSTRACT

In the present study, we consider the spacelike translation surfaces in Minkowski 4-space. We characterize such surfaces in terms of their Gaussian curvature and mean curvature functions. We classify flat and minimal spacelike translation surfaces in E_1^4.

Key Words: Translation surface, Minkowski 4-space, Gaussian curvature, mean curvature.

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Affine Translation Surfaces in Euclidean and Isotropic Geometry

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ABSTRACT

An affine translation surface in a Euclidean space is formed by a translation of two curves lying in non-orthogonal planes and is the graph of the function $z(x,y)=f(x)+g(y+ax)$, $a\neq 0$, for an orthogonal coordinate system (x,y,z), [1]. In this presentation, we are interested in such surfaces in Euclidean and isotropic spaces with constant Gaussian and mean curvature.

Key Words: Affine translation surface, Gaussian curvature, mean curvature.

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Structure Equations in Lorentz Space

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ABSTRACT

In kinematics, the motion of planar, spherical aand spatial mechanism is investigated. In this paper, the structure equation of Lorentz plane is studied according to the casual character of normal vector of this plane. The spherical motion in Lorentz space is presented by means of the character of first link on sphere.

Key Words: Planar Mechanism, Open Chain, Closed Chain, Spherical Mechanism.

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Interpretation of Hyperbolic Angles by means of General Relativity

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ABSTRACT

Minkowski space is investigated by using properties such as hyperbolic curves, hyperbolic angles, hyperbolic arc length and so on. In this study, the hyperbolic angles between two timelike vectors and spacelike vectors are presented in terms of Einstein Theory of General Relativity. Some characterizations related to these hyperbolic angles are obtained. Relationships between angle, velocity and time are studied.

Key Words: General Relativity, Hyperbolic Angle, Bondi Factor.

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Orientability of Spheres

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ABSTRACT

In mathematics, if there exist n-1 independent vector fields on S^{n-1}, this sphere is parallelizable. In this paper, by using split complex numbers, split quaternions and split octonions, it is shown that S_1^1, S_2^3 and S_4^7 have one, three and seven independent vector fields, respectively. Since parallelizable manifolds are orientable, these spheres are orientable.

Key Words: Split complex number, Split quaternion, Split octonion, Parallellization

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A New Aspect of Rectifying Curves in Galilean 3-Space

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ABSTRACT

In this work, we give some relations between extended rectifying curves and their modified Darboux vector fields in in Galilean 3-Space. We show that the modified Darboux curves of a unit speed curve are rectifying curve or circular helix in Galilean 3-space. The other aim of the study is to introduce the ruled surfaces whose base curve is rectifying curve in Galilean 3-Space.

Key Words: Galilean space, rectifying curves, ruled surfaces

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Slant Submersions from Almost Paracontact Riemannian Manifolds

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ABSTRACT

In this paper, we introduce slant submersions from almost paracontact Riemannian manifolds onto Riemannian manifolds. We give examples and investigate the geometry of foliations which are arisen from the definition of a Riemannian submersion. We also find necessary and sufficient conditions for a slant submersion to be totally geodesic.

Key Words: Riemannian submersion; almost paracontact Riemannian manifold; slant submersion.

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Intrinsic Metrics on Sierpinski-like Triangles

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ABSTRACT

It is well-known that the classical Sierpinski triangle is a fractal constructed on an equilateral triangle. On the other hand, we can also construct Sierpinski-like triangles on a scalene or isosceles triangles. In [5], we give an explicit formula for the intrinsic metric on the classical Sierpinski triangle via code representation. In this work, we define geodesic metrics on the Sierpinski-like triangles using their code representation. Finally, we mention some properties of these structures.

Key Words: Sierpinski triangle, intrinsic metric, geodesics.

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On Contact Pseudo-Slant Submanifolds in a Sasakian Space Form

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ABSTRACT

In this paper, we study contact pseudo-slant submanifolds of a sasakian space form M(k) with constant φ-sectional curvature *k*. Necessary and sufficient conditions are given for a submanifold to be a contact pseudo-slant submanifold contact pseudo-slant product, mixed geodesic and totally geodesic in sasakian manifolds. Finaly, we obtain some results for such submanifolds in terms of curvature tensor.

Key Words: Sasakian manifold, sasakian space forms, contact pseudo-slant submanifold.

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On the Second-Order Tangent Bundle with Deformed 2-nd Lift Metric

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ABSTRACT

The present paper deals with deformed 2-nd lift metric on the second-order tangent bundle over a Riemannian manifold. First we introduce the deformed 2-nd lift metric and an integrable nilpotent affinor structure, and give some results concerning the lifts of vector fields. Then we show that the second-order tangent bundle with these structures is a plural-holomorphic B-manifold.

Key Words: Second-order tangent bundle, deformed 2-nd lift metric, Conformal Killing vector field.

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Properties of Nearly Para-Kähler Manifolds

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ABSTRACT

In this paper, we consider nearly paraKähler manifolds and give some curvature properties of them. Also, we define a metric connection with torsion on this setting and investigate its some properties.

Key Words: Metric connection, nearly paraKähler manifold, curvature tensor.

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A Survey on Spherical Indicatrix Elastic Curves

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ABSTRACT

We first derive the Euler-Lagrange equation corresponding to curvature energy functional of tangential indicatrix elastic curves and solve this equation. We obtain a classification for curves whose tangential spherical indicatrix are elastic. Similarly, we give this classification for principle normal and binormal indicatrix elastic curves with respect to curvature and torsion. Moreover, we show that there exists no binormal indicatrix elastic curve. We eventually give an example for tangential spherical indicatrix elastic curve.

Key Words: Elastic curve; Euler-Lagrange equation; spherical image.

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Extremals of a Curvature Energy Action in a Two Dimensional Lightlike Cone

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ABSTRACT

We study critical points of the curvature energy functional on regular curves in a two dimensional lightlike cone. We derive the Euler-Lagrange equation corresponding to spacelike elastic curves and solve the equation. Then we find a Killing field along the critical curve and construct three special coordinate systems. Finally we express the elastic curve by quadratures.

Key Words: Elastic curve; Euler-Lagrange equation; Lightlike cone.

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The Fermi-Walker Derivative and Principal Normal Indicatrix in Euclid Space

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ABSTRACT

In this study we explained the Fermi-Walker derivative along the principal normal indicatrix of a curve in Euclid space. We get a unit speed curve in Euclid space. According to the principal normal indicatrix of the curve Fermi-Walker derivative, Fermi-Walker parallelism and Fermi-Walker termed Darboux vector concepts are given. We proved non-rotating frames are explained with Fermi-Walker derivative along the principal normal indicatrix of any curve in Euclid space. Then we proved while the curve is a helix Frenet frame is a non-rotating frame along the principal normal indicatrix.

Key Words: Fermi-Walker derivative, Fermi-Walker parallelism, Non-rotating frame, Fermi-Walker termed Darboux vector, Principal normal indicatrix, Helix

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Curves and Ruled Surfaces obtained from Natural Trihedron of a Ruled Surface

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ABSTRACT

In this paper, we obtain the rotation trihedron $\{e^*, t^*, g^*\}$ by rotating the geodesic Frenet frame $\{e, t, g\}$ at an angle $\varphi = \varphi(s)$ in the plane $\{e, g\}$ We expressed by new curve and ruled surfaces by means of these frames. Also, we give some new results and theorems related to be the asymptotic curve, the geodesic curve and the line of curvature of the base curves on the ruled surfaces.

Key Words: Ruled surface, Asymptotic curve, Geodesic curve, Line of curvature

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The Ruled Surfaces according to Type -2 Bishop Frame in Minkowski 3-Space

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ABSTRACT

In this paper, the timelike ruled surfaces generated by vectors of type-2 bishop frame were investigated. Using this frame, the necessary and sufficient conditions when the ruled surfaces are developable were obtained and some new results and theorems related to be the asymptotic curve, the geodesic curve of the base curve on the ruled surfaces were gived. Also, the gaussian and mean curvatures of timelike ruled surfaces were calculated.

Key Words: Timelike Ruled surfaces, Curves, Bishop frame,

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New Fixed – Circle Theorems on *S* – Metric Spaces

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ABSTRACT

In this talk, we give some basic facts about *S* – metric spaces with necessary examples. We introduce the notion of a fixed circle and investigate some fixed – circle theorems on *S* – metric spaces with a geometric viewpoint.

Key Words: Fixed circle, *S* – metric space, existence theorem, uniqueness theorem.

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An Introduction to Fixed – Circle Theory on Metric Spaces

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ABSTRACT

In this talk, we present the notion of a fixed circle and determine some existence and uniqueness theorems for fixed circles of self-mappings on metric spaces with geometric interpretation. Also we give some illustrative examples.

Key Words: Fixed circle, metric space, existence theorem, uniqueness theorem.

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New Characterizations of Curves in 2-Dimensional Lightlike Cone

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ABSTRACT

Let E_1^3 be the 3-dimensional pseudo-Euclidean space with the

$$g(X,Y)=\langle X,Y\rangle = x_1y_1 + x_2y_2 - x_3y_3$$

for all $X=(x_1,x_2,x_3)$, $Y=(y_1,y_2,y_3)\in E_1^3$ is a flat pseudo-Riemannian manifold of signature (2,1).

Let M be a submanifold of E_1^3. If the pseudo-Riemannian metric g of E_1^3 induces a pseudo-Riemannian metric g (respectively, a Riemannian metric, a degenerate quadratic form) on M, then M is called a timelike (respectively, spacelike, degenerate) submanifold of E_1^3.

The lightlike cone is defined by

$$Q^2 = \{x \in E_1^3 : g(x,x)=0\}.$$

Let E_1^3 be 3-dimensional Minkowski space and Q^2 be the lightlike cone in E_1^3. A vector V≠0 in E_1^3 is called spacelike, timelike or lightlike, if ⟨V,V⟩>0, ⟨V,V⟩<0 or ⟨V,V⟩=0, respectively. A frame field $\{x,\alpha,y\}$ on E_1^3 is called an asymptotic orthonormal frame field, if

$$<x,x>=<y,y>=<x,\alpha>=<y,\alpha>=0, <x,y>=<\alpha,\alpha>=1.$$

We assume that curve $x=x(s):I\to Q^3$ is a regular curve in Q^2 for $t\in I$. In the following, we always assume that the curve is regular. Thus, the derivative formula of the asymptotic orthonormal frame of $x=x(s):I\to Q^2$ is given by

$$x' = \alpha$$
$$\alpha' = \kappa x - y$$
$$y' = -\kappa\alpha$$

In this formula, κ, τ are called the cone curvature and cone torsion, respectively.

The Lorentz force φ of a magnetic field F on Q^2 is defined to be a skew-symetric operator given by

$$g(\varphi(X), Y) = F(X, Y), \text{ for all } X, Y \in Q^2.$$

The α-magnetic trajectories of F are x on Q^2 that satisfy the Lorentzian equation

$$\nabla_{x'}^{x'} = \varphi(x').$$

Furthermore, the mixed product of the vector fields $X, Y, Z \in Q^2$ is the defined by

$$g(X \times Y, Z) = dv_g(X, Y, Z),$$

where dv_g denotes a volume on Q^2.

If V is a Killing vector in Q^2 and let $F_V = \iota_v vol_g$ be the corresponding Killing magnetic field, here the inner product is indicated by ı. Hence the equation Lorentz force of F_V is

$$\varphi(X) = V \times X, \ \forall X \in Q^2.$$

Corresponding the Lorentz equation can be written as

$$\nabla_{x'}^{x'} = \varphi(x') = V \times x'.$$

In Minkowski space E_1^3, consider the Killing vector field $V = a\partial x + b\partial y + c\partial z$, with $a,b,c \in IR$, the magnetic trajectories $x = x(s): I \to Q^2$ determined by V are solutions of the Lorentz equation

$$x'' = V \times x$$

In this study, we examine the impact of magnetic fields on the moving particle trajectories by variational approach to the magnetic flow associated with the Killing magnetic field on 2- dimensional lightlike cone $Q^2 \subset E_1^3$. We find different magnetic curves in the 2- dimensional lightlike cone using the Killing magnetic field of these curves. We also give some characterizations and definitions and examples of these curves with their shapes.

Key Words: Magnetic curve, lightlike cone, killing vector field.

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A Survey on Special Curves in the The Null Cone Q^3

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ABSTRACT

Let E_1^4 be the 4-dimensional pseudo-Euclidean space with the following metric

$$\tilde{G}(X,Y)=\langle X,Y\rangle=\sum_{i=1}^{3}x_i y_j-\sum_{j=3}^{4}x_j y_j$$

for all $X=(x_1,x_2,x_3,x_4),Y=(y_1,y_2,y_3,y_4)\in E_1^4$, E_1^4 is a flat pseudo Riemannian manifold of signature $(3,1)$.

Suppose that M is a submanifold of E_1^4. If the pseudo Riemannian metric $\tilde{G}$ (respectively, a Riemannian metric, a degenerate quadratic form) on M, then M is a timelike(respectively, spacelike, degenerate) submanifold of E_1^4.

Let c be a fixed point in E_1^4 and r>0 be an arbitrary constant. The pseudo-Riemannian null cone (quadratic cone) is defined as follows

$$Q_1^3(c,r)=\{x\in E_1^4:\tilde{G}(x-c,x-c)=0\}.$$

It is known that $Q_1^3(c,r)$ is a degenerate hypersurface in E_1^4. The point c is the center of $Q_1^3(c)$. When c=0 and q=1, we denote $Q_1^3(0)$ by Q^3 and call it the lightlike or null cone. A vector V on E_1^4 is called spacelike if $\langle V,V\rangle>0$ or V=0, timelike if $\langle V,V\rangle<0$ and null if $\langle V,V\rangle=0$ and $V\neq 0$, [4].

Thus, the derivative formula of the asymptotic orthonormal frame of $x=x(s):I\to Q^3$ is given by

$$x' = \alpha$$
$$\alpha' = \kappa x - y$$
$$\beta' = \tau x$$
$$y' = -\kappa\alpha - \tau y$$

$$< x, x >=< y, y >=< x, \alpha >=< x, \beta >=< y, \beta >=< \alpha, \beta >= 0, < x, y >=< \alpha, \alpha >=< \beta, \beta >= 1.$$

In this formula, κ, τ are called the cone curvature and cone torsion, respectively.

Smarandache curve is defined as a regular curve whose position vector is composed by Frenet frame vectors of another regular curve.

In this paper, we studied special Smarandache curves such as $x\alpha\beta, x\beta y, x\alpha\beta, x\alpha\beta y-$ Smarandache curves according to asymptotic orthonormal frame in the null cone Q^3 and we examine the curvature and the asymptotic orthonormal frame's vectors of Smarandache curves. We give theorems related to these Smarandache curves and some characterizations.

Key Words: Smarandache curve, asymptotic orthonormal frame, null cone.

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The Quadratic Trigonometric Bezier Spiral with Single Shape Parameter

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ABSTRACT

Spirals based on quadratic Bezier curves are suitable for computer-aided geometric design applications. Spirals segments are widely used in applications such as highway design, railway design and robot trajectories. Quadratic Bezier curves cause some difficulties in obtaining the desired shape because of their polynomial nature. For overcoming this problem, splines with shape parameters have been developed as alternatives to B-splines and Bezier curves.

The purpose of our paper is to introduce a quadratic trigonometric Bezier spiral with a shape parameter which are similar to quadratic Bezier spirals discussed in [1]. Since curvature of the quadratic trigonometric Bezier spiral segment with a shape parameter varies monotonically with arc-length, it is suitable for applications such as highway design, in which the clothoid has been traditionally used.

Key Words: Spirals, Quadratic Trigonometric Polynomials, The Quadratic Trigonometric Bézier Spiral with Single Shape Parameter.

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Developed Motion of Robot End-Effector of Spacelike Ruled Surfaces (The First Case)

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ABSTRACT

The trajectory of a robot end effector is described by a ruled surface and a spin angle about the ruling of the ruled surface. In this paper, we analyzed the problem of describing trajectory of a robot end-effector by a spacelike ruled surface with spacelike ruling. We obtained the developed frame $\{t_1, r_1, k_1\}$ by rotating the generator frame $\{t, r, k\}$ at an Darboux angle $\theta = \theta(s)$. in the plane $\{r, k\}$ which is on the striction curve β of the spacelike ruled surface X. Afterword, natural frame, tool frame and surface frame which is necessary for the movements of robot are defined derivative formulas of the frames are founded by calculating the Darboux vectors. Tool frame $\{O, A, N\}$. are constituted by means of this developed frame. Thus, robot end effector motion is defined for the spacelike ruled surface φ generated by the orientation vector $t_1 = 0$. Also, by using Lancret curvature of the surface and Darboux angle in the developed frame the robot end-effector motion is developed. Therefore, differential properties and movements an different surfaces in Minkowski space is analyzed by getting the relations for curvature functions which are characterized a spacelike ruled surface with spacelike directix. Finally, to be able to get a member of trajectory surface family which has the same trajectory curve is shown with the examples in every different choice of the Darboux angle which is used to described the developed frame.

Key Words: Curvature theory, Darboux angle, Developed frame, Robot end- effector, Trajectory curve.

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New Type Direction Curves in Euclidean 3-space

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ABSTRACT

In this paper, we give definition normal-direction curve and normal-donor curve. We obtain some theorems and characterizations curves. And we give some applications of normal-direction curves related to helix,slant helix,plane curve in Euclidean 3-space.

Key Words: Normal-direction curve, Normal-donor curve, Helix

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Split Quaternion Rational Ruled Surfaces

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ABSTRACT

Quaternion rational surface which generated from quaternion product of two rational space curves is defined by Wang and Goldman in [1]. They also defined quaternion rational ruled surface which is special quaternion rational surface. In this work, we investigate the new rational ruled surface which generated from the split quaternion product of a line and a space curve. We give some split quaternion rational ruled surface examples by Mathematica 10. Moreover, we describe of syzygy, mu-basis for split quaternion rational ruled surfaces and give its implicit equations.

Key Words: Syzygy, mu-basis, split quaternion rational surface, split quaternion rational ruled surface.

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Generalized Fermi-Walker Derivative in Euclidean Space

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ABSTRACT

In this study generalized Fermi-Walker derivative, generalized Fermi-Walker parallelism and generalized non-rotating frame are investigated along any curve in Euclidean space. Initially, we investigate the conditions of the generalized Fermi- Walker paralellism of any vector field along any curve in Euclidean space by considering the Frenet frame. Then we show that Frenet frame is generalized non- rotating frame along all curves with the choice of tensor field. We analyse that if the generalized Fermi-Walker derivative coincides with the Fermi-Walker one, then the Frenet frame is a non-rotating frame along the planar curves.

Key Words: Generalized Fermi-Walker derivative, generalized Fermi-Walker parallelism, generalized non-rotating frame, Frenet frame.

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Some Notes on Almost Contact Metric Structures on 5-Dimensional Nilpotent Lie Algebras

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ABSTRACT

In this paper, almost contact metric structures on 5-dimensional nilpotent Lie algebras are studied and the classes of left invariant almost contact metric structures on the corresponding Lie groups are investigated. Furthermore, certain classes, that a five dimensional nilpotent Lie group cannot be equipped with, are determined.

Key Words: 5-dimensional nilpotent Lie algebra, almost contact metric structure, left invariant almost contact metric structure.

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On Semi-Symmetric Metric Connection on the Tangent Bundle

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ABSTRACT

In this paper, we define a semi-symmetric metric connection on the tangent bundle equipped with complete lift metric. The Riemannian curvature tensors of this connection are computed and their properties are studied. Also we investigate conditions for the tangent bundle to be locally conformally flat with respect to this connection.

Key Words: Tangent bundle, complete lift metric, semi-symmetric metric connection.

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Cooperation, Eigenvalues, Repellor, Attractor and Jumping Cancer

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ABSTRACT

In this presentation we derive some general conditions for a polygon of orientable hypersurfaces to be repellor (respectively attractor) using modern geometric methods. In order to make easy the presentation clear write some propositions and examples.

Key Words: Manifold, Hypersurface, Cooperation, Orientable, Repellor, Attractor, Jumping Cancer.

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Semi-Parallel Anti-Invariant Submanifolds of a Normal Paracontact Metric Manifold

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ABSTRACT

In this paper, anti-invariant submanifolds of a normal paracontact metric manifold are studied and characterizing the submanifold with respect to covariant derivative of the second fundamental form of anti-invariant submanifold. Furthermore, some special cases are also discussed and we give a non-trivial example.

Key Words: Riemannian curvature tensor, concircular curvature tensor, anti- invariant submanifold, semi-parallel and 2-semiparallel.

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Geometry of Second Order Degenerate Lagrangian Theories

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ABSTRACT

In this study we present the Hamiltonian formulations of the dynamical systems generated by the second order Pais-Uhlenbeck, Sarıoğlu-Tekin and Clèment Lagrangians.

Pais-Uhlenbeck Lagrangian is non-degenerate in the sense of Ostrogradsky whereas Sarıoğlu-Tekin and Clèment Lagrangians are degenerate. For the degenerate or/and constraint systems, the Legendre transformation is not possible in a straight forward way. For the degenerate systems, one additionally needs to employ, for example, the Dirac-Bergmann algorithm in order to arrive at the Hamiltonian picture. An alternative way arriving at the Hamilton's equations is to construct the Dirac bracket.

Key Words: Second order degenerate Lagrangians, Dirac-Bergmann algorithm, Pais-Uhlenbeck Lagrangian, Sarığlu-Tekin Lagrangian, Clement Lagrangian.

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On the Characterizations of Spacelike Curves which Spherical Indicatrices are Conics in Minkowski 3-space

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ABSTRACT

In this study, we investigate spacelike T-conical helix in Minkowski 3-space. Moreover, we obtain characterization of this curve and give some parametric equations for its. Also related examples and their illustrations are drawn with Mathematica 10.1.

Key Words: Conics, spherical curve, spherical conics.

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On Semi-slant Submanifolds of a Cosymplectic Space Form

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ABSTRACT

In this paper, we study semi-slant submanifolds of a cosymplectic space form M(c) with constant φ-sectional curvature *c*. Necessary and sufficient conditions are given for a submanifold to be a semi-slant submanifold, semi-slant product, mixed geodesic and totally geodesic in cosymplectic manifolds. Finaly, we obtain some results for such submanifolds in terms of curvature tensor

Key Words: Cosymplectic manifold, cosymplectic space forms, semi-slant submanifold.

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Codimension 2 Surfaces in Isotropic Spaces

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ABSTRACT

An isotropic space is a Cayley-Klein space obtained from the real projective space with a certain absolute figure. This talk deals with the isotropic counterparts of the surfaces of codimension 2. We present several formulas for such surfaces to compute extrinsic and intrinsic invariants. We also provide the classification results for some types of surfaces with vanishing curvature.

Key Words: Isotropic space, Cayley-Klein space, relative curvature, isotropic mean curvature.

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On Multiply Warped Product with Gradient Ricci Solitons

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ABSTRACT

In this study, we obtain the necessary and sufficient conditions for multiply warped product to be gradient Ricci solitons.

Key Words: Ricci soliton, gradient Ricci soliton, multiply warped product.

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Geometric Properties of Lorentzian Almost Paracontact Submersions

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ABSTRACT

In this paper, we discuss some geometric properties of two types of Lorentzian submersions whose total space is a Lorentzian almost paracontact manifold. The study is focused on the transference of structures.

Key Words: Lorentzian almost paracontact manifold, Lorentzian submersion, Lorentzian almost paracontact submersion.

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A New Method to Obtain Curves According to Bishop Frames

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ABSTRACT

Throughout this work, on the basis of the fundamental theorem of the local theory of curves, we obtain considerable solutions to both the Bishop frame equations and the type-2 Bishop frame equations by means of a new local coordinate system described. Further, we construct the general equations (including bishop curvatures) of regular curves and their frame apparatus for each case. As a consequence of these, we also give results which presents the Frenet apparatus.

Key Words: Bishop frames, Euclidean space, Local coordinate system

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Notes on Translating Solitons of Mean Curvatuve Flow

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ABSTRACT

Mean curvature flow is maybe the most important geometric evolution equation of submanifolds in Riemannian manifolds. In this presentation, we focus on a special family of solutions, known as Translating Solitons. We give some properties and theorems about this in Euclidean and Minkowski space.

Furthermore, we present known examples, such as the Grim Reaper Cylinder, the Translating Catenoid and the Translating Paraboloid. Finally, we study a new family of Translating Solitons which move in a null direction in the Minkowski Plane.

Key Words: Translating solitons, Mean curvature flow, null direction

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Reidemeister Torsion of Compact 3-manifolds with Boundary finitely many closed surfaces

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ABSTRACT

We establish a Reidemeister torsion formula for the three-holed-sphere by taking its double. Using this formula and considering the three-holed-sphere decomposition of orientable closed surfaces, we also establish a formula that computes Reidemeister torsion of orientable closed surfaces. Moreover, we obtain a Reidemeister torsion formula for orientable 3-manifold whose boundary consists of unions of finitely many closed orientable surfaces.

Key Words: Reidemeister torsion, Symplectic chain complex, Three-holed-sphere decomposition of Riemann surfaces, Compact 3-manifolds.

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On Complex η-Einstein Normal Complex Contact Metric Manifolds

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ABSTRACT

The aim of this paper is focusing on η-Einstein geometry of normal complex contact metric manifolds. We give the definition of complex η -Einstein normal complex contact metric manifolds and we obtain some conclusions.

Key Words: Normal complex contact metric manifold, conformal curvature tensor, concircular curvature tensor, projectively semi-symmetric, complex η -Einstein.

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Ricci Collineations on 3-dimensional Paracontact Metric Manifolds

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ABSTRACT

We classify three-dimensional paracontact metric manifold whose Ricci operator Q is invariant along Reeb vector field, that is, L_{ξ}Q=0.

Key Words: Paracontact metric manifold, Ricci collineation, Reeb vector field.

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Some Curvature Properties of CR-Submanifolds of a Lorentzian β- Kenmotsu Manifold

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ABSTRACT

The purpose of this paper is to study CR-submanifolds of an Lorentzian β-Kenmotsu manifold. We investigate that some properties of CR-submanifolds of a Lorentzian β-Kenmotsu manifold whose φ-sectional curvature is constant. We consider bisectional curvature of CR-product of Lorentzian β-Kenmotsu manifold.

Key Words: CR-submanifold, CR-product, Lorentzian β-Kenmotsu manifold.

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Some Curvature Properties of $D-$ conformal Curvature Tensor on Normal Paracontact Metric Space Forms

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ABSTRACT

This paper deals with the study of geometry of normal paracontact metric manifolds. We investigate some properties of $D-$ conformally flat, $D-$ conformally semi-symmetric, $\mathrm{B}(\xi,\mathrm{Y})\mathrm{P}=0, \mathrm{B}(\xi,\mathrm{Y})\tilde{\mathrm{Z}}=0$ and $\mathrm{B}(\xi,\mathrm{Y})\tilde{\mathrm{C}}=0$ curvature conditions on normal paracontact metric space forms.

Key Words: *D*- conformal curvature tensor, Normal paracontact metric manifold, Einstein manifold.

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The Steiner Formula and the Polar Moment of Inertia for the closed Planar Homothetic Motions in Complex Plane

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ABSTRACT

In this paper, the Steiner area formula and the polar moment of inertia were expressed during one-parameter closed planar homothetic motions in complex plane. The Steiner point or Steiner normal concepts were described according to whether rotation number was different zero or equal to zero, respectively. The moving pole point was given with its components and its relation between Steiner point or Steiner normal was specified. The sagittal motion of a telescopic crane was considered as an example. This motion was described by a double hinge consisting of the fixed control panel of telescopic crane and the moving arm of telescopic crane. The results obtained in the second section of this study were applied for this motion.

Key Words: Steiner formula, polar moment of inertia, homothetic motions.

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Constant Mean Curvature Surfaces with Finite Type Gauss Map in Pseudo-Euclidean Space Forms and Their Boundary Curves

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ABSTRACT

In this talk we focus on CMC surfaces in the Minkowski 4-space E_1^4 and pseudo-Euclidean space E_2^4. We firstly present a survey of results on surfaces with finite type Gauss map. Then, we show a construction method of surfaces with the prescribed boundary curve. We also want to show examples of compact surfaces without boundary.

Key Words: CMC surfaces, finite type Gauss map, pseudo-Euclidean space, quasi-minimal surfaces

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Dirac and twistor operators in spin geometry

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ABSTRACT

In a spin manifold *M*, two first-order differential operators can be defined on spinor fields which are Dirac operator and twistor operator. The spinor fields that are in the kernels of the Dirac operator and twistor operator are called harmonic spinors and twistor spinors, respectively. Symmetry operators that map harmonic spinors to harmonic spinors and twistor spinors to twistor spinors are constructed in terms of conformal Killing-Yano forms which are antisymmetric generalizations of conformal Killing vector fields to higher degree differential forms. Transformation operators that transform twistor spinors to harmonic spinors are also constructed in terms of potential forms. These constructions are generalized to Spin^c geometry.

Key Words: spin geometry, Dirac operator, twistor operator, symmetry operators, Spin^c geometry

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An Existence Theorem for an Integral Geometry Problem along Geodesics

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ABSTRACT

In this work, we consider an integral geometry problem along geodesics and related inverse problem. This problem has important applications in various areas, particularly in medicine and industry.

First, we reduce the overdetermined problem to a determined one by using a special method developed by Amirov [1] and later we prove the existence of solution to the inverse problem by the Galerkin method.

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Hamiltonian Energy Systems for Fuzzy Manifolds on Fuzzy Space

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ABSTRACT

In this study, we have investigated the properties of fuzzy spaces by using fuzzy sets. Fuzzy spaces like the fuzzy sphere or fuzzy cylinder have received remarkable attention in string theory. The Fuzzy coordinates on the fuzzy bundle structure of fuzzy-manifolds have been given. For given fuzzy bundle structures, all fundamental geometrical properties have been investigated in Hamiltonian energy equations and applications. Moreover, we have presented a new concept of velocity and time dimensions for fuzzy energy systems.

Key Words: Hamiltonian Energy Equations, Fuzzy Space, Fuzzy Manifold.

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Hamiltonian Energy Systems on Fuzzy Manifolds for Fuzzy Cylinder

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ABSTRACT

The aim of this paper is to improve Hamiltonian energy equations for fuzzy cylinder on fuzzy space. Fuzzy spaces like the fuzzy cylinder have received remarkable attention. The fuzzy spaces coordinates have been given for fuzzy cylinder. For given fuzzy bundle structure, fundamental geometrical properties have been investigated in Hamiltonian energy equations on fuzzy manifolds. We have presented a new concept of velocity and time dimensions for energy movement equations on fuzzy surfaces.

Key Words: Hamiltonian Energy Equations, Fuzzy Cylinder, Fuzzy Manifold.

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New Frenet Frame for Fuzzy Split Quaternion Numbers

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ABSTRACT

In this study, we build the concept of fuzzy split quaternion numbers of a natural extension of fuzzy real numbers. Then, we give some differential geometric properties of this fuzzy quaternions. Moreover, we construct the frenet frame for fuzzy split quaternions. We investigate frenet derivation formulas with fuzzy quaternion numbers.

Key Words: Fuzzy Space, Fuzzy Quaternions, Frenet Frame.

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Hamiltonian Energy Systems for Super Helix on Supermanifolds

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ABSTRACT

The aim of this article is to improve Hamiltonian energy equation for super helix on super manifolds with super jet bundles. The super helix coordinates on the super bundle structure of supermanifolds have been given for body and soul part and also even and odd dimensions. For given super bundle structures,super fundamental geometrical properties have been investigated in super Hamiltonian energy equations and applications to super bundle structures. We have presented a new concept of velocity and time dimensions for energy movement equations. Finally, this study showed a physical application and interpretation of super velocity and super time dimensions in super Hamiltonian energy equations for given example.

Key Words: Supermanifold, Superbundle, Super Helix, Hamiltonian Energy, Hamiltonian energy equations

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Hamiltonian Energy Equations for Super Logarithmic Spiral on Supermanifolds

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ABSTRACT

The aim of this article is to improve Hamiltonian energy equations for equiangular spiral(logarithmic spiral) on supermanifold with super jet bundle. The super logarithmic spiral's super coordinates on the super bundle structure of supermanifolds have been given for body and soul part and also even and odd dimensions. This study showed a physical application and interpretation of super velocity and super time dimensions in super Hamiltonian energy equations for this curve.

Key Words: Supermanifold, Superbundle, Super Logarithmic Spiral, Hamiltonian Energy, Hamiltonian energy equations

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Semi-Quaternions and Unit Tangent Bundle of Euclidean 3-Space

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ABSTRACT

In this study, the basic algebraic structures of semi-quaternions are given. Moreover, the unit tangent bundle of Euclidean 3-space is stated in terms of unit semi-quaternions.

Key Words: Euclidean 3-space, semi-quaternion, unit tangent bundle.

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Split Semi-Quaternions and Unit Tangent Bundle of Minkowski 3-Space

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ABSTRACT

In this study, firstly the basic algebraic structures of split semi-quaternions are given. Afterwards, we have defined the unit tangent bundle of Minkowski 3-space in terms of unit split semi-quaternions.

Key Words: Minkowski 3-space, split semi-quaternion, unit tangent bundle.

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Legendre Curves and Rotation Minimizing Frames

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ABSTRACT

In this study, firstly we will give a brief summary of the concepts Legendre curves and rotation minimizing vector fields. Afterwards, we will give a one-to-one correspondence between the Legendre curves and rotation minimizing frames (RMF).

Key Words: Tangent bundle, Legendre curve, rotation minimizing frame (RMF).

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Structure and Characterization of Parallel Ruled Surfaces in Euclidean 3-Space

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ABSTRACT

In this study, we obtain the parallel surfaces of the non-developable ruled surfaces of which the base curve is the striction line. In this case, we calculate curvatures of parallel non-developable ruled surfaces under the condition that $\boldsymbol{\mu^2 + \nu^2 = 1}$. Under this condition, then, we show that relations between the curvatures of the surfaces are more special.

Finally, the image of the striction line on the parallel surface is obtained and this situation is examined in terms of differential geometric properties.

Key Words: Non-Developable Ruled surface, Parallel surface, Line of striction.

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On Spacelike Rational Bezier Curve with a Timelike Principal Normal

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ABSTRACT

In this paper, we study on the spacelike rational Bezier Curve with a Timelike Principal normal in Minkowski-3 space. Firstly, we consider the Serret-Frenet frames. Secondly, we calculate the curvature and torsion of this curves. Then we obtain derivation formulas. Finally we give an example.

Key Words: Bezier, Minkowski, spacelike.

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Quadratic and Cubic Uniform B-spline Curves on Time Scale

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ABSTRACT

The aim of this paper is to investigate some low-degree uniform B-splines which are called quadratic and cubic uniform B-splines on time scale. Firstly, we define quadratic and cubic uniform B-spline curves on time scale. Secondly, we try to calculate the derivative matrix of these B-spline curves. Then we obtain the derivatives of end points and give some properties of these curves on time scale. Finally, we give an example for this concept.

Key Words: B-spline, time scale, uniform.

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Timelike Uniform B-spline Curves in Minkowski-3 Space

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ABSTRACT

The intention of this article is to study on timelike uniform B-spline curves in Minkowski-3 space. In our paper, we take the control points of uniform B-spline curves as timelike point in Minkowski-3 space. Then we calculate some geometric elements for this new curve in Minkowski-3 space.

Key Words: Minkowski, B-spline, timelike.

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Lifts of Complex Golden Structure to the Cotangent Bundle

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ABSTRACT

In this study, we studied complete and horizontal lifts of complex golden structure to the cotangent bundle. Further, we investigated integrability conditions of complex golden structure in the cotangent bundle.

Key Words: Complex golden structure, complete lift, horizontal lift, cotangent bundle, integrability.

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Alpha Circle Inversion and Fractals

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ABSTRACT

Alpha plane geometry is a non-Euclidean geometry, and also a Minkowski geometry. α-plane is almost the same as Euclidean plane since the points are the same, the lines are the same, and the angles are measured in the same way. Since the α-plane geometry has a different distance function it seems interesting to study the α-analog of the topics that include the concepts of distance in the Euclidean geometry [7].

One of the concepts which include notation of distance is an inversion. Inversion has attracted the attention of scientist from past to present. So there are a lot of studies about inversion. Many scientists studied and also are studying different side of this concept [1,2,5,6].

In this representation, we introduce inversion which is also valid in the alpha plane geometry, and give some properties with respect to inversion in the alpha plane geometry. We also show the inversive images of some basic curves. We apply this new transformation to well-known fractals such as Sierpinski triangle, Koch curve, dragon curve, Fibonacci fractal, among others. Then new fractal patterns is obtained [3,4].

Key Words: Fractal, Alpha plane, Alpha Circular Inversion.

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On The Relations Between Some Chamfered Polyhedra and The Metric Geometries

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ABSTRACT

The one hundred year old concept of "Minkowski space" is a nice topic of recent geometric research. Nevertheless, the phrase "Minkowski space" is applied for two different theories: the theory of normed linear spaces and the theory of linear spaces with indefinite metric. It is interesting that these essentially distinct theories have similar axiomatic foundations. The axiomatic build-up of the theory of linear spaces with indefinite metric comes from H. Minkowski [6] and the similar system of axioms of normed linear spaces was introduced by Lumer [5] much later.

The first concept widely used in physics is the mathematical structure of relativity theory and thus its importance is without doubt. On the other hand, the importance of the second theory is based on the fact that a large part of modern functional analysis works in so-called normed spaces which are more general ones than inner product (or Hilbert) spaces. Of course, in both of these two theories a lot of problems can be formulated or can be solved in the language of geometry. Such a normed space with the branches of its geometric properties is called Minkowski geometry [4,7].

Unit ball of Minkowski geometries is a general symmetric convex set. Therefore this show that one can find a relation between symmetric convex set and metrics. For example, in the 3-dimensional analytical space there are five regular polyhedra. These are known as Platonic solids. We mention existence of metrics which their unit balls are Platonic solids [1,2,3]. Polyhedrons can be formed from other polyhedrons by subjecting them to various geometric

operations. For example, some of the Archimedean solids can be formed by cutting the edges of the Platonic solids at a certain rate, while some Catalan solids are formed by elevating the faces of the Platonic bodies with a point from the center of gravity. One of these geometric operations is a chamfer operation. It is similar to expansion, moving faces apart and outward, but also maintain the original vertices. For polyhedra, this operation adds a new hexagonal face in place of each original edge. Solids obtained by applying this geometric process are called chamfered solids.

One of the fundamental problem in geometry for a space with a metric is to determine the group of isometries. In this work, we show that the group of isometries of the 3-dimesional space covered metrics which their unit balls are chamfered solids is the semi-direct product of octahedral group Oh and T(3) or the semi-direct product of octahedral group Ih and T(3), where T(3) is the group of all translations of the 3- dimensional space.

Key Words: Chamfered solids, Minkowski geometry, Normed finite dimensional Banach space, Isometry.

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Rotational Surfaces with Rotations in x_3x_4-Plane

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ABSTRACT

In the present study we consider generalized rotational surfaces in Euclidean 4- space E^4. Further, we obtain some curvature properties of these surfaces. We also introduce some kind of generalized rotational surfaces in E^4 with the choice of meridian curve γ(u). Finally, we give some examples.

Key Words: Rotational surface, spherical product, Gaussian curvature.

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On scalar curvature on pseudo Riemannian submanifolds

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ABSTRACT

Some special submanifolds of pseudo Riemannian manifolds are introduced. Scalar curvature for pseudo Riemannian submanifolds is investigated. Some basic equalities and inequalities involving curvatures for these submanifolds are given.

Key Words: Submanifold, pseudo Riemannian manifold, scalar curvature.

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Some Characterizations of Quaternionic Normal Curves

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ABSTRACT

In the Euclidean space E3, it is well known that normal curves, i.e., curves with position vector always lying in their normal plane, are spherical curves. In this study, the quaternionic normal curves are studied and some characterizations are obtained for quaternionic normal curves in terms of their curvature functions. Also, it is investigated under what conditions a quaternionic curve is a quaternionic normal curve.

Key Words: Normal curves, real quaternion, quaternionic curve, position vector.

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Grassmann Image of Surfaces in 4-dimensional Euclidean Spaces

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ABSTRACT

In the present study we consider Grassmann manifolds G(2,4) embedded in 6- dimensional Euclidean space E^6 using the Plücker coordinates. Further, for a given smooth surface M^2 in E^4 we describe its Grassmann image a surface $F^2 \subset G(2,4)$.

Key Words: Grassmann manifold, Grassmann image, Regular surface.

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Developable Envelope Surface Generated By Hyperbolic Lifting

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ABSTRACT

In this paper, by using a hyperbolic lifting transformation to a plane curve, we construct an envelope ruled surface. Then we show that it is a developable surface in three dimensional Euclidean space and we give the conditions of this surface to be a minimal surface. Finally, we constructed some examples.

Key Words: Ruled surfaces, Developable surface, Lifting.

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On Tzitzeica Curve in Euclidean 3-Space IE^3

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ABSTRACT

In this study we consider Tzitzeica curves (Tz-curve) in Euclidean 3-space IE^3. We characterize such curves according to their curvatures. We show that there is no Tzitzeica curve with constant curvatures (i.e. W-curves). We consider Salkowski and anti-Salkowski curves.

Key Words: Tzitzeica curve, Salkowski curve, W-curve.

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Rotational Surfaces in Higher Dimensional Euclidean Spaces

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ABSTRACT

In the present study we consider the generalized rotational surfaces in Euclidean *m*-space E^m. Firstly, we introduce some basic concepts of second fundamental form and curvatures of the surfaces in E^m. Further, we obtained some basic properties of generalized rotational surfaces in E^m and some results related with their curvatures. Finally,we give some examples of generalized rotational surfaces in Euclidean 5-space E^5.

Key Words: Generalized tractrix , Gaussian curvature, Rotational surface , Beltrami surface.

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On Fibonacci Vectors

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ABSTRACT

In this study, firstly the corresponding anti-symmetric matrix for 3-dimensional real Fibonacci vectors is described and the vector product is reconsidered by using this matrix. Furthermore, some properties of this vector multiplication are given. Then, the inner product, the Lorentzian inner product, the vector product and the scalar triple product for the 4-dimensional and 7-dimensional Fibonacci vectors are defined and their properties are examined.

Key Words: Fibonacci vectors, anti-symmetric matrix, the vector product, the Lorentzian inner product.

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On Self Similar Curves and Surfaces in Galilean Spaces

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ABSTRACT

In this paper, we investigate the geometric properties of self similar curves and surfaces in the Galilean spaces. Also we obtain some theorem and results of self similar curves and surfaces in the Galilean spaces.

Key Words: Self similar curves, Self similar surface, Galilean space.

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D_a-Homotetic Deformed 3-Dimensional Quasi-Sasakian Manifolds with the Schouten-Van Kampen Connection

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ABSTRACT

In this paper we study the Schouten-van Kampen connection on D_a-homotetic deformed 3-dimensional quasi-Sasakian manifolds. Also we study semisymmetry condition on D_a-homotetic deformed 3-dimensional quasi-Sasakian manifolds with the Schouten-van Kampen connection.

Key Words: D_a-homotetic deformation, The Schouten-van Kampen connection, 3-dimensional quasi-Sasakian manifolds, Semisymmetric manifolds.

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3-Dimensional Quasi-Sasakian Manifolds with Generalized Tanaka- Webster Connection

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ABSTRACT

In this paper we study generalized Tanaka-Webster connection on 3-dimensional quasi-Sasakian manifolds. Also we study semisymmetry condition on 3- dimensional quasi-Sasakian manifolds with generalized Tanaka-Webster connection.

Key Words: Generalized Tanaka-Webster connection, 3-dimensional quasi- Sasakian manifolds, Semisymmetric manifolds.

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Conchoid Curves and Surfaces in Euclidean Spaces

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ABSTRACT

In the present study we consider conchoid curves and surfaces in Euclidean spaces. This study consists of two parts. In the first part we consider planar curves satisfying conchoidal property. We also give some examples and plot their graphics. In the second part we consider conchoid surfaces of rotational surfaces in E^3. Further, we obtain some results related with their curvature properties.

Key Words: Regular surface, Conchoid surface, modelling with surfaces.

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Universal Factorization Equalities for Commutative Quaternions and Their Matrices

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ABSTRACT

In this study, we have established universal similarity factorization equalities (USFE) over the commutative quaternion and their matrices. On the basis of these equalities, real matrix representations of the commutative quaternion and their matrices have been derived. Also, their algebraic properties and fundamental equations have been determined.

Key Words: Commutative quaternion, commutative quaternion matrix, universal similarity factorization equalities (USFE).

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Determination of the Curves of Constant Breadth in Galilean 3-space by Laguerre Collocation Method

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ABSTRACT

In this study, our main interest is a linear system of equations characterizing curves of constant breadth in 3-dimensional Galilean space. In given a space curve, our aim is to determine a second curve of constant breadth with respect to this curve by obtaining solutions of the aforementioned system in terms of Laguerre polynomials. By satisfying the system in a desired number of equidistant collocation points, the problem is reduced to a system of linear algebraic equations. The solution of this system then yields the solutions of the original problem. In order to test the validity and efficiency of the proposed method, we consider an example problem.

Key Words: Curves of constant breadth, Laguerre polynomials, Collocation points, System of differential equations, Galilean space.

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Spherical Orthotomic and Spherical Antiorthotomic on the Pseudo- hyperbolic Space

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ABSTRACT

In this paper, we define spherical orthotomic and spherical antiorthotomic on the pseudo-hyperbolic space. Then, we apply the unfolding theory to spherical orthotomic and spherical antiorthotomic. Finally, we use the technique in [4] to determine their local diffeomorphic type.

Key Words: Spherical curve, orthotomic, antiorthotomic, unfolding.

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Ruled Surface Pair Generated by Darboux Vectors of a Curve and Its Natural Lift in IR^3

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ABSTRACT

In this study,firstly, the darboux vector $\overline{W}$ of the natural lift $\overline{\alpha}$ of the curve α are calculated in terms of those of α in IR^3. Secondly, we obtained striction lines and distribution parameters of ruled surface pair generated by Darboux Vectors of the curve and its natural lift α. Finally, for α and α those notions are compared with each other.

Key Words: Natural Lift, ruled surface, striction line, distribution parameter.

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Direction Curves of Non-degenerate Frenet Curve in Anti de Sitter 3-Space

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ABSTRACT

In this study, we investigate special associated curve of a non-degenerate Frenet curve according to the Sabban frame in anti de Sitter 3-space. Moreover, we give a construction method of Sabban apparatus of a special direction curve in terms of the elements of Sabban apparatus of its donor curve. Furthermore, we obtain some results for the direction curve with respect to special cases of the base curve. Finally, we give an example of a helix and its direction curve which is also a helix and draw theirs images under the stereographic projection in Minkowski 3-space.

Key Words: Frenet curve, associated curve, direction curve, donor curve, helix.

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Convolution of Curves and Surfaces in Euclidean Spaces

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ABSTRACT

In the present study we consider convolution of curves and surfaces in Euclidean spaces. This study consists of two parts. In the first part we consider convolution of curves in Euclidean spaces. We also give some examples related with these types of curves. In the second part we consider convolution of surfaces in Euclidean spaces. Further, we also give some results related with their curvature properties.

Key Words: Regular surface, Convolution of surfaces, modelling with surfaces.

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Semi - Parallel and Harmonic Surfaces in Semi-Euclidean 4-space with Index Two

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ABSTRACT

In this article, we investigate semi - parallel and harmonic surfaces.

Firstly, by considering semi parallelity condition R(X,Y).h=0, we obtain necessary and sufficient conditions for semi - parallel surfaces. We have shown that translation surfaces form a part of semi- parallel surfaces.

Secondly, we have shown that if M is a harmonic surface then it must be a translation surface.

Key Words: Semi parallel surface, harmonic surface, translation surface**.**

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Clairaut Cr-Submanifolds of Kaehler Manifolds

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ABSTRACT

In classical diff erential geometry, an important tool analyzing geodesics on ordi- nary surfaces of revolution is Clairaut's Relation. Let α be a unit-speed curve on a surface of revolution S, let $\rho : S \to$ R be the distance of a point of S from the axis of rotation, and let φ be the angle between $\alpha^{\cdot}$ and the meridians of S. If α is a geodesic, then ρ sin φ is constant along α. Clairauts relation also has a simple me-chanical interpretation, for interested readers, see:[15, page:230]. On the other hand, Clairaut Riemannian submersions have been defined and studied by Bishop in [6]. Moreover, Lorentzian Clairaut submersions have been defined in [1] as a Lorentzian submersion defined from a spacetime onto a Riemannian manifold. It is shown that if the integrability tensor of the submersion vanishes, the null geodesic of the total space behaves like geodesics of static spacetimes. More precisely, in this case, null geodesics in the total space project to null pre-geodesics in the base equipped with a certain conformally related metric.

In this talk, we introduce Clairaut CR-submanifolds and obtain a characteriza-tion. We also show that this notion gives a geometric meaning of CR-products in terms of geodesic and certain angles.

Key Words: Kaehler manifold, Clairaut surface, CR-submanifold, Clairaut CR-submanifold.

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Ruled Surfaces According to Parallel Trasport Frame in E^4

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ABSTRACT

In this paper, we studied the ruled surface generated by a straight line in parallel transport frame moving along a curve in four dimensional Euclidean space and we obtained Gaussian and mean curvatures.

Some results and theorems related to be developable and Chen surfaces were given. As a result we gave a special example of ruled surfaces in E^4.

Key Words: Ruled surface, Gaussian curvature, Developable surface.

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Riemannian Submersions and Planar Sections

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ABSTRACT

Riemannian submersions are widely studied in differential geometry. Planar normal sections were defined by Chen and this subject has been also studied in the submanifold theory by many authors. In this talk, we check relations between Riemannian submersions and planar normal sections. We give a characterization for a Riemannian submersion to have such normal sections. We also related this subject to O'neill's tensor fields and obtain a new criteria.

Key Words: Riemannian submersion, planar normal section, planar horizontal section.

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Energy on some Associated Curves

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ABSTRACT

In this paper, we introduce the notion of the energy on the particle that corresponds to different type of associated curves defined earlier for a given in space. Also, the relationship on the variation of the energy for their mates is investigated.

Key Words: Associated Curves, Energy, Frenet frame.

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The Forward Kinematics of Rolling Contact of Spacelike Curves Lying on Spacelike Surfaces

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ABSTRACT

It is well known that contact kinematics is divided into two categories: forward kinematics and inverse kinematics. The forward kinematics problem is that of using the kinematic equations to compute the motion of the moving surface from a specified contact locus on each surface. In this paper, we study the forward kinematics of rolling contact without sliding for two spacelike contact surfaces tracing on each spacelike trajectory curve in Lorentzian 3-space. One of these spacelike surfaces is a fixed surface and the other is a moving surface. The rolling contact pairs have one, two, or three degrees of freedom (DOFs) consisting of angular velocities. Rolling contact motion can be divided into two categories: spin-rolling motion and pure-rolling motion. Spin-rolling motion has three (DOFs), and pure-rolling motion has two (DOFs).

Key Words: Darboux frame, forward kinematics, Lorentzian 3-space, rolling contact.

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The Inverse Kinematics of Rolling Contact of Spacelike Curves Lying on Spacelike Surfaces

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ABSTRACT

It is well known that contact kinematics is divided into two categories: forward kinematics and inverse kinematics. The inverse kinematics problem is that of determining the control parameters that give the moving surface the desired motion. In this paper, we study the inverse kinematics including three nonlinear algebraic equations by using curvature theory in Lorentzian geometry. These equations can be reduced as a univariate polynomial of degree six by applying the moving frame method. This polynomial enables us to obtain rapid and accurate numerical root approximations. Furthermore, we obtain two fundamental parts of the spin velocity in Lorentzian 3-space: the induced spin velocity and the compensatory spin velocity.

Key Words: Darboux frame, inverse kinematics, Lorentzian 3-space, rolling contact.

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Pedal and Contrapedal Curves of Fronts in de Sitter and Hyperbolic 2-spaces

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ABSTRACT

In this study, the pedal and contrapedal curves of regular curves in hyperbolic and de Sitter 2-spaces are introduced via the Lorentzian Sabban frame. But, the definitions do not work for singular curves since the Lorentzian Sabban frame is not well-defined at singular points. Thus, the differential geometry of pedal and contrapedal curves of singular curves is also considered. The definitions of pedal and contrapedal curves of spacelike and timelike frontals are given by utilizing the Legendrian moving frames along the fronts. Furthermore, some relationships among pedal curves, contrapedal curves and evolutes of spacelike and timelike fronts are presented.

Key Words: Pedal Curve, Front, Singularity, Minkowski Spheres.

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p-Complex Fibonacci Numbers

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ABSTRACT

In 1900's p-complex Fibonacci numbers were defined by means of complex Fibonacci numbers which were described C. J. Harman. Furthermore, A. F. Horadam examined complex Fibonacci numbers and their some general equations. In this study, some identities as Cassini and Binet formulas which include p-complex Fibonacci numbers were analyzed. In this process, Fibonacci identities have benefited. As a result real, complex and hyperbolic numbers' general form has been reached with p-complex Fibonacci numbers.

Key Words: Fibonacci numbers, Complex Fibonacci numbers, p-complex Fibonacci numbers.

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The Finite Type Curves Lying in the Cylinder

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ABSTRACT

In $R^{2n+1}(-3)$ Sasaki space, Baikousis and Blair studied a Legendre curve which lies in a hipercylinder $N^{2n}(c)$ ([2]).Furthermore, they conjectured that a finite type curve which lies on cylinder $N^2(c)$ is of constant curvature ([3]). In PhD. thesis, Camci studied a curve in $N^2(c)$ cylinder and he proved this open problem ([5], ([6]). In this paper, we study the finite type curve in cylinder and It has been shown that only the finite type curves lies in the elliptical cylinder.

Key Words: Legendre curve Sasaki space Finite type curve

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Sliced Almost Contact Manifolds

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ABSTRACT

In our work we introduced sliced almost contact manifolds as a wider class of almost contact manifolds which are studied in mathematics till now. We defined and gave examples of sliced almost contact manifolds, sliced almost contact metric manifolds and sliced contact metric manifolds. Finally we proved the theorems of necessary and sufficient conditions of being sliced contact metric manifolds.

Key Words: Contact manifolds, Sliced Contact Manifolds, Sliced Contact Metric Manifolds.

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On the geometry of modular group

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ABSTRACT

It is known that hyperbolic geometry is used to describe the geometry of the action of discrete groups of Möbious transformations [2,3,4]. In this study, we mention about Fuchsian groups, especially Modular group as an well-known example [1]. It is a discrete subgroup of PSL(2, %) which act discontiously on the upper half- plane H. The discontinuoity implies the existence of a fundamental region. We give some examples pointing out that these are hyperbolic polygons. The hyperbolic area of a fundamental region is shown to be an important invariant and it is used to clarify the structure of the discrete groups as follows.

All Fuchsian groups have signature

$$(g; m_1, ..., m_r : s)$$

where $m_1, \ldots, m_r$ are integers ≥ 2 and called periods, s is the parabolic class number, and g is the genus of the group. For such a group G, the hyperbolic measure is

$$\mu(G) = 2\pi\{2(g-1) + \sum_{i=1}^{n}(1 - \frac{1}{m_i}) + s\}$$

Key Words: Möbiüs transformations, Modular group, Fundamental domain.

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The Relations among Instantaneous Rotation Vectors of a Timelike Ruled Surface

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ABSTRACT

In this paper, the instantaneous velocities for Frenet, Darboux, Blaschke and Bishop trihedrons of timelike ruled surfaces are calculated by using their derivate formulas. The relations among dual Lorenzian instantaneous rotations vectors are obtained for these trihedrons.

Key Words: Dual space, timelike surface, ruled surface.

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Pedal Curves of Fronts in the Euclidean Plane

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ABSTRACT

In this study, we investigate pedal and contrapedal curves of plane curves which have singular points. By utilizing the Legendrian Frenet frame along a front, the pedal and contrapedal curves of a front are introduced and properties of these curves are given. Furthermore, by considering the definitions of the evolute, the involute and the offset of a front some relationships are given.

Key Words: Pedal curve, Front, Legendrian immersion, Euclidean plane

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A Taxicab Version of Apollonius's Circle

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ABSTRACT

We consider taxicab plane using the taxicab metric defined in [1,2] instead of the well-known Euclidean metric for the distance between any two points. The taxicab metric is defined using the following distance function

$$dT(P1,P2)= |x1-x2|+|y1-y2|$$

where any two points $P_1=(x_1,y_1)$ and $P_2=(x_2,y_2)$ in the analytical plane. Since the taxicab plane geometry has a different distance function it seems interesting to study the taxicab analogues of the topics that include the concept of distance in the Euclidean geometry.

In Euclidean plane geometry, Apollonius's circle is the circle that touches all three excircles of a triangle and encompasses them [4], [5]. In taxicab geometry, the shape of a circle changes to a rotated square [3]. Therefore, it is a logical question whether the Apollonius's circle for given any triangle in taxicab plane. In this work, we try to determine under what conditions which Apollonius's circle exists in taxicab plane.

Key Words: Apollonius's circle, Metric Geometry, Distane Geometry, Taxicab Geometry.

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On The Truncated Dodecahedron And Truncated Icosahedron Spaces

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ABSTRACT

Polyhedra have interesting symmetries. Therefore they have attracted the attention of scientists and artists from past to present. Thus polyhedra are discussed in a lot of scientific and artistic works. There are only five regular convex polyhedra known as the platonic solids. Semi-regular convex polyhedron which are composed of two or more types of regular polygons meeting in identical vertices are called Archimedean solids. The duals of the Archimedean solids are known as the Catalan solids.

Minkowski geometry is a non-Euclidean geometry in a finite number of dimensions that is different from elliptic and hyperbolic geometry. Linear structure of Minkowski geometry which is different from Minkowskian geometry of space-time is the same as the Euclidean one. There is only one difference which distance is not uniform in all directions. This difference cause chancing concepts with respect to distance. For example, instead of the usual sphere in Euclidean space, the unit ball is a general symmetric convex set. Unit ball of Minkowski geometries is a general symmetric convex set [6]. Therefore this show that one can find a relation between symmetries convex set and metrics [1,2,3,5]. In [4], we introduce metrics, and show that the spheres of the 3-dimensional analytical space furnished by these metrics are truncated dodecahedron and truncated icosahedron.

One of the fundamental problem in geometry for a space with a metric is to determine the group of isometries. In this work, we show that the group of

isometries of the 3-dimesional space covered dodecahedron and truncated icosahedron metric

is the semi-direct product of octahedral group Oh and T(3), where T(3) is the group of all translations of the 3-dimensional space.

Key Words: Archimedean solids, Minkowski geometry,Normed finite dimensional Banach space, Isometry.

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Projection Area of Orbit Surfaces under Special two Parameter Motions

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ABSTRACT

In this study, we consider special two parameter motions in Euclidean 3-space and compute the projection area of the orbit surface of a fixed point under such motions.

Key Words: Surface, umbilical point, projection area.

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A Characterization Between Null Geodesic Curves and Timelike Ruled Surfaces

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ABSTRACT

In this work, we give a characterization between null geodesic curves and timelike ruled surfaces in dual Lorentzian space D_1^3. We first establish a system of differential equations characterizing timelike ruled surfaces in dual Lorentzian space D_1^3 by using the invariant quantities of null geodesic curves on the given timelike ruled surfaces. We obtain the solutions of these systems for special cases. Regarding to these special solutions, we give some results of relations between null geodesic curves and timelike ruled surfaces in dual Lorentzian space D_1^3.

Key Words: Dual Lorentz space, null geodesic curve, Blaschke frame, Darboux frame.

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New Characterizations Of Spacelike Curves On Timelike Surfaces Through The Link Of Specific Frames

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ABSTRACT

In this work, considering a regular spacelike curve on a smooth timelike surface in Minkowski 3-space, we investigate relations between the mentioned curve's Darboux and Bishop frames on the timelike surface. Next we obtain Darboux vector of the regular spacelike curve in terms of Bishop apparatus. Thereafter, translating the Darboux vector to the center of the unit sphere, we determine aforementioned spacelike curve. Moreover, we investigate this spherical image's Frenet-Serret and Bishop apparatus and illustrate our results with two examples.

Key Words: Spacelike curve, Darboux frame, Darboux vector, Type-2 Bishop frame.

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On Characterizations Of Hyperspherical Curves in Galilean 4-Space G4

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ABSTRACT

In this paper, we first obtain the system of differential equations characterizing hyperspherical curves in Galilean 4-space G_4. Then we give a condition for a curve to be hyperspherical one in Galilean 4-space G_4 by using the system of differential equations.

Key Words: Galilean 4D space, Galilean iner product, hypersphere, hyperspherical curves.

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On Characterization of Integrable Geometric Flows with some Solutions

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ABSTRACT

In this paper, we present a new approach for computing the differential geometry properties of surfaces by using Bäcklund transformations of integrable geometric curve flows. We give some new solutions by using the extended Riccati mapping method. Finally, we obtain figures of this solutions.

Key Words: Riccati mapping method, Bäcklund transformations, curve flows.

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A New Approach on Roller Coaster Surfaces with an Alternative Moving Frame

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ABSTRACT

A circular surface is a map defined

$$V: I \times R/2\pi Z \to R^3$$

by

$$V(t,\vartheta)=\gamma(t)+r(t)(\cos\vartheta a_1(t)+\sin\vartheta a_2(t))$$

where $\gamma, a_1, a_2 : I \to R^3$ and $r \to R_{>0}$. It is assumed that $\langle a_1,a_1\rangle=\langle a_2,a_2\rangle=1$, $\langle a_1,a_2\rangle=0$ for all $t\in I$, where $\langle,\rangle$ denotes the canonical inner product on R^3. γ is called the base curve and a pair of two curves a_1,a_2 is called director frame. The standart circles $\theta\to\gamma(t)+r(t)(\cos\theta a_1(t)+\sin\theta a_2(t))$ are called generating circles. For a circular surface $V(t,\theta)$, vectors $\{a_1(t),a_2(t),a_3(t)=a_1(t)\times a_2(t)\}$ form an orthonormal frame of R^3 which is called a base frame of the circular surface. Roller coaster surfaces are a classification of these surfaces. These surfaces is defined as

$$R(t,\theta)=\gamma(t)+r(t)(\cos\theta T(\theta)+\sin\theta(\cos\phi(t)N(t)+\sin\phi(t)B(t))$$

$\{T,N,B,\tau,\kappa\}$ is the Frenet apparatus and $-\phi(t)$ is a primitive functions of the torsion $\tau(t)$ [1].

In this paper, we give the Roller Coaster Surfaces with an alternative moving frame which first identified by [2]. Also, we give the geometric properties for these surfaces.

Key Words: Circular surfaces, roller coaster surfaces, curvatures, alternative moving frames.

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A New Approach to Weierstrass Representation Formula in Heisenberg Spacetime

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ABSTRACT

In this paper, we describe a method to derive a Weierstrass-type representation formula for simply connected immersed surfaces in Heisenberg spacetime. We consider the left invariant metric and use some results of Levi-Civita connection. Finally, we obtain some new resuts about Weierstrass-type representation.

Key Words: Heisenberg Spacetime, Weierstrass representation, immersed surfaces.

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On Complex Semi-Symmetric Metric F-connection on Anti-Kähler Manifolds

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ABSTRACT

The paper deals with a complex semi-symmetric metric F- connection on an anti-Kähler manifold. We present some results concerning the torsion tensor of the complex semi-symmetric metric F- connection. Also, we calculate expressions of the curvature tensor, the conharmonic curvature tensor and the Weyl projective curvature tensor of such connection, and give some properties of them.

Key Words: Anti-Kähler manifold, complex semi-symmetric metric F-connection, curvature tensors, pure tensor, Tachibana operator.

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Chen Inequalities on a Kaehler Manifold Endowed with Complex Semi-symmetric Metric Connection

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ABSTRACT

We obtain Chen inequalities for a Kaehler manifold endowed with complex semi- symmetric metric connection. Using these inequalities, we prove the relation between scalar and sectional curvatures, Ricci curvatures and the mean curvature associated with the complex semi-symmetric metric connection. The equality cases are considered. Furthermore, we obtain an inequality for k-plane section for a Kaehler manifold endowed with complex semi-symmetric metric connection.

Key Words: Kaehler manifold, Chen inequalities, complex semi-symmetric metric connection.

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Lightlike Hypersurfaces of a Golden Semi-Riemannian Manifold

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ABSTRACT

We introduce lightlike hypersurfaces of a golden semi-Riemannian manifold. We investigate several properties of lightlike hypersurfaces of a golden semi-Riemannian manifold. We prove that there is no radical anti-invariant lightlike hypersurface of a golden semi-Riemannian manifold. In particular, we obtain some results for screen semi-invariant lightlike hypersurfaces of a golden semi-Riemannian manifold.

Key Words: Golden semi-Riemannian manifolds, Golden structures, Lightlike hypersurfaces, Screen semi-invariant lightlike hypersurfaces.

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The Properties of Pasch Geometry

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ABSTRACT

Pasch's postulate says that if a line intersects one side of a triangle then it must intersect one of the other two sides in a metric geometry which satisfies plane separation axiom. If a metric geometry satisfies Pasch's postulate then it also satisfies plane separation axiom. A Pasch geometry is a metric geometry which satisfies plane separation axiom. In this paper, we will give the properties of Pasch geometry.

Key Words: Metric Geometry, Plane Separation Axiom, Pasch Geometry.

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Parallel-Like Surfaces

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ABSTRACT

Let M and M^f be two surfaces in E^3 Euclidean space and N_P be a unit normal vector of M at the point $P \in M$. Let T_PM be tangent space at $P \in M$ and $\{X_P, Y_P\}$ be an orthonormal bases of T_PM. Take a unit vector $Z_P = d_1 X_P + d_2 Y_P + d_3 N_P$, where $d_1, d_2, d_3 \in \mathbb{R}$ are constant numbers and $d_1 + d_2 + d_3 = 1$. If a function f exists and satisfies the condition $f: M \to M^f$, $f(P) = P + rZ_P$, r constant, M^f is called parallel-like surface of M.

In this study, we give some theorems and properties for parallel-like surfaces.

Key Words: Parallel surfaces, Parallel-like surfaces.

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An Example of a Metric Geometry which doesn't Satisfy the Plane Separation Axiom

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ABSTRACT

The importance of the plane separation axiom stems from a remark made by Millman and Parker [1]. According to their idea, the plane separation axiom is a careful statement of the very intuitive idea that every line in a Cartesian (Euclidean) plane has “two sides”. The Einstein Relativisitc Velocity Model of Hyperbolic Geometry and its plane separation axiom is studied by Sönmez and Ungar [2] in terms of inner products of vectors. In this paper, we will give an example of a metric geometry which doesn't satisfy the plane separation axiom.

Key Words: Plane Separation Axiom, Metric Geometry, Missing Strip Plane.

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Some Remarks on *W*-Curves in semi-Euclidan 4-space with index 2

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ABSTRACT

It is well known that all *W*-curves (curves with non-zero constant curvatures) in the Minkowski 3-space are completely classified by Walrave in [1] .For example, the only planar spacelike W-curves are circles and hyperbolas. The characterizations of *W*-curve with respect to their position vectors are given by Ilarslan in [4, 5] . All spacelike *W*-curves, namely all spacelike curves with constant curvatures in the Minkowski space-time are studied by Petrovic-Torgasev and Sucurovic in [3]. Timelike *W*-curves in the same space have been studied by Synge in [2]. In this paper, we classify all spacelike and timelike *W*-curves with non-null normals in 4- dimensional semi-Euclidean space with index 2. Since all three curvatures k_1,k_2 and k_3 are constant, the classification is reduced mainly to differential equations with constant coefficients and a method well developed by B. Y. Chen.

Key Words: *W*-curves, spacelike and timelike curves, curvatures,

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Some New Characterizations of Hasimoto Surfaces with Some Solutions

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ABSTRACT

In this paper, we give a new approach for properties of Hasimoto. We give some new results for this surface by using solutions of partial differential equations.

Key Words: Partial differential equations, Hasimoto surface, position vector.

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On Fermi-Walker Derivative with Ribbon Frame

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ABSTRACT

In this paper, we study a new construction of curves by Fermi-Walker parallelism and derivative with Ribbon frame. Finally, we give some characterizations according to Ribbon frame.

Key Words: Ribbon frame, Fermi Walker derivative-parallelism, Frenet frame.

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A New Approach to Roller Coaster Surface with Bishop Frame

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ABSTRACT

In this paper, Roller Coaster surfaces with Bishop frame is introduced in Euclidean space 3-space. The Gaussian curvature, mean curvature, first and second fundamental form of coefficients of Roller Coaster surfaces of are examined. We characterize Roller Coaster surfaces in the Euclidean space 3-space.

Key Words: Euclidean space, Roller Coaster surfaces, Bishop frame.

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A New Method for Designing a Developable Surface Using Bishop Frame in Minkowski 3-Space

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ABSTRACT

A developable surface is a ruled surface having Gaussian curvature K=0 everywhere. Developable surfaces therefore include the cone, cylinder, elliptic cone, hyperbolic cylinder, and plane. By utilizing the Bishop frame, this paper proposes a new method to construct a developable surface possessing a given curve as the line of curvature of it. By using Bishop frame to express the surface, we derive the necessary and sufficient conditions when the resulting spacelike developable surface is cylinder, cone or tangent surface.

Key Words: Minkowski space, Spacelike developable surfaces, Bishop frame.

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Magnetic Curves According to the Modified Orthogonal Frame with Curvature and Torsion in Euclidean 3-Space

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ABSTRACT

In this paper, it is investigated Lorentz force equations for magnetic curves by using in 3-dimensional Euclidean space. Firstly, we give the Lorentz force according to the modified orthogonal frame with curvature in E^3. Then, we give the Lorentz force according to the modified orthogonal frame with torsion in E^3. Finally, we obtain a new characterization for a magnetic field V.

Key Words: Magnetic curve, Modified frame, Killing vector field.

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Bochner, Conformal and Conharmonic Flatness of Complex (κ, μ)-Spaces

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ABSTRACT

In this talk which consists of the results of [1], I answer the questions of Bochner, conformal and conharmonic flatness of complex (κ, μ)- spaces when $\kappa > 1$ and prove that such kind of spaces cannot be Bochner flat, conformally flat or conharmonically flat. Moreover, I give some corollaries for $\kappa \leq 1$, taking into account the answers of these questions for $\kappa = 1$ (normal complex contact metric manifolds), by means of [2]. Thus, it can be deduced from [2] that the only complete and simply connected complex (κ, μ)- spaces which are Bochner flat are locally isometric to $\mathbb{C}P^{2n+1}(4)$ with the Fubini-Study metric and $\kappa = 1$and that there do not exist any conformally flat nor any conharmonically flat complex (κ, μ) -spaces.

Key Words: Bochner flatness, conformal flatness, conharmonic flatness, complex (κ, μ)- spaces

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Stationary Acceleration Curves Geometry

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ABSTRACT

In this study, we will introduce stationary curves. We will mention about the studies in recent years on this subject. In addition, we will give the stationary hypotheses of the curve when different frames are taken on the curve.

Key Words: Stationary Curves, stationary accelerations, rigid body motion

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On the Spinors, Quaternions and Rotations

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ABSTRACT

In [1], the relationships between quaternions and spinors with complex components and the kinematics of quaternion and spinor were given by J. Kronsbein. In addition, Vivarelli offered a new approach to quaternions and spinors in the Euclidean 3-space deriving from the vector formulation of the Euler's theorem on the general displacement of a rigid body with a fixed point in [2]. Moreover, the spinor model of generalized rotations in Euclidean 3-space were given in [3].

In this study, considering the studies mentioned above, firstly, we have introduced spinors with two complex components and quaternions. Then, we have given the spinor representation of the rotations can be expressed with quaternions in Euclidean 4-space. Finally, we have showed the spinor model of the some characterizations of the rotations E^4 with the aid of quaternions.

Key Words: Spinors, quaternions, rotations.

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Two Special Linear Connections on a Differentiable Manifold Admits a Golden Structure

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ABSTRACT

The purpose of this present paper is to study two special linear connections, which named Schouten and Vrănceanu connections, defined by a fixed linear connection on a differentiable manifold which admits a golden structure. The golden structure defines naturally two complementary and orthogonal distributions of the tangent bundle, so there are two complementary projector operators split the tangent bundle into two complementary parts. We investigate integrability of the golden structure and parallelism, half parallelism and anti half parallelism of the distributions with respect to Schouten and Vrănceanu connections. We also analyze the notion of the geodesic on the manifold endowed with the golden structure in terms of Schouten and Vrănceanu connections. First of all, we give the basic definitions, concepts and formulas which will be used throughout the paper. We get a condition for Vrănceanu connection to be symmetric. We find a necessary and sufficient condition for Schouten connection to be equal to the fixed linear connection. We prove that the golden structure is integrable when one of Schouten and Vrănceanu connections is symmetric. We show that the distributions are parallel with respect to Schouten and Vrănceanu connections. Moreover, we demonstrate that the projector operators corresponding to the distributions are parallel with respect to Schouten and Vrănceanu connections. We obtain separately a necessary and sufficient condition for each of the distributions to be half parallel with respect to Schouten connection (respectively, Vrănceanu

connection). We show that the distributions are anti half parallel with respect to Schouten and Vrănceanu connections. Finally, we find a condition for a curve on the manifold with the golden structure to be geodesic with respect to Schouten connection (respectively, Vrănceanu connection).

Key Words: Golden structure, Schouten connection, Vrănceanu connection, integrability, parallelism, half parallelism, anti half parallelism, geodesic.

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On the Position Vector of Space-Like Surfaces In 3-Dimensional Minkowski Space

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ABSTRACT

A surface M in Minkowski space is said to be a generalized constant ratio (GCR) if the tangential part of its position vector is one of its canonical principal direction. On the other hand, if the tangential part of the fixed direction in tangent plane of M is one of its canonical principal direction, then in case this surface is called as surfaces endowed with canonical principal direction (CPD). In this talk, first, we will present a short survey on CPD and GCR surfaces in semi-Euclidean spaces. Then, we will give some of classification results for space-like CPD and GCR surfaces that we have obtained recently.

Key Words: Minkowski space,Space-like surface, Canonical principal direction, Angle function.

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Generalized Helicoidal 3-Surface in 4-Space

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ABSTRACT

We introduce the generalized helicoidal hypersurface in the four dimensional Euclidean space. We obtain the mean curvature and the Gaussian curvature formulas. In addition, we find some differential equations to the helicoidal hypersurface.

Key Words: 4-space, helicoidal hypersurface, mean curvature, Gaussian curvature.

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On the Gauss Map of the Rotational 3-Surface in 4-Space

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ABSTRACT

We consider the Gauss map of the rotational hypersurface in the four dimensional Euclidean space. We define the mean curvature and the Gaussian curvature formulas. We also find some geometric properties to the rotational hypersurface.

Key Words: 4-space, rotational hypersurface, Gauss map, mean curvature, Gaussian curvature.

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RPPPT$_i$ Mechanism with Matlab Applications

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ABSTRACT

We define a new mechanism RPPPT$_i$. The mechanism RPPPT$_i$ has two functional parts. The first part is RPPP mechanism which makes pressure. The second part is that the mechanism RPPPT$_i$ repeats the RPPP's motion i times along the fixed line which we define. Finally, we give some Matlab applications.

Key Words: Matlab, mechanism, prismatic joint, revolute joint.

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An Equivalence Relation on Control Points of a Bezier Curve

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ABSTRACT

A Bezier curve with n-control points is defined as $B(n,z)=\sum B_i^n P_i$, $i=0,\ldots,n$. Also a Bezier curve is a polynomial curve and coefficients belong to the coordinate of the control points. This state gives us a linear equation system. We define an equivalence relation using the solution of this linear equation system and give a characterization of the n-control points which define the same Bezier curve.

Key Words: Bezier, control points, equivalence class.

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Dimensions of the Attractors of a Graph-Directed IFS with Condensation*

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ABSTRACT

Graph-directed iterated function systems (GIFS) can be considered as a generalization of the notion of classical iterated function systems (IFS) which is one of the most important tools in fractal geometry (see [1, 2]). On the other hand, an IFS with condensation is another important generalization which consists of finite contractions and a condensation map. In [3] and [4], the authors present some useful results to compute the Hausdorff dimension of the attractor of an IFS with condensation.

In this work, we define the notion of graph-directed iterated function system with condensation and then obtain similar results (as given in [3]) for the Hausdorff dimensions of the attractors of this new graph-directed system.

Keywords: Iterated function systems (IFS), condensation, graph-directed IFS, Hausdorff dimension.

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Geometric Kinematics of Sliding-Rolling Contact in Minkowski Space

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ABSTRACT

Geometric kinematics studies the time-independent kinematics. The freedom to choose parameters results in a simplified analytic description of the motion. That is, the arc lengths of the contact loci are chosen as the parameters to study the geometrical properties of the motion. This work aims to investigate geometric kinematics in Minkowski 3-space. As a result, we obtain the fixed-point conditions, which provides the geometric kinematics of an arbitrary point on the moving surface in Minkowski space.

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Ruled Surface Pair Generated by Darboux Vectors of a Curve and Its Natural Lift in IR^3

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ABSTRACT

In this study,firstly, the darboux vector $\overline{W}$ of the natural lift $\overline{\alpha}$ of the curve α are calculated in terms of those of α in IR^3. Secondly, we obtained striction lines and distribution parameters of ruled surface pair generated by Darboux Vectors of the curve and its natural lift $\overline{\alpha}$. Finally, for α and $\overline{\alpha}$ those notions are compared with each other.

Key Words: Natural Lift, ruled surface, striction line, distribution parameter.

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Intrınsıc Equatıons for a Relaxed Elastıc Lıne on an Orıented Surface ın the Pseudo-Galılean Space

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ABSTRACT

In this paper, we derive the intrinsic equations for a relaxed elastic line on an oriented surface in the pseudo-Galilean 3-dimensional space. We also investigate the relationship between relaxed elastic lines and some special curves on surfaces such as geodesics, curvature of line, etc, with the help of the intrinsic equations

Key words: Galilean space; Relaxed elastic line; Variational problem; Intrinsic formulation; Geodesic

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Abstracts of Geometry Education

Identifying Teacher Canditates' Geometry Content Knowledge: The Example of Angle-Height-Diagonal and Quadrilateral

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ABSTRACT

Geometry has a significant place in mathematics curricula. NCTM points out the importance of students knowing the properties of two and three dimensional geometric objects as well as the definitions of geometric concepts, and developing arguments about geometric relationships (NCTM, 2000, p.41). To date, Turkey has not been successful in the geometry sections of international exams. According to the results of the latest international mathematics and science study (TIMSS), Turkey ranked 22 among 39 countries in geometry, thus remaining below the international mean (Mullis, I. V. S., Martin, M. O., Foy, P., & Hooper, M, 2016). This failure may be attributed to various reasons. However, it is a known fact that the most influential factor in student success is the teacher (Mewborn, 2003) and that the depth of teacher knowledge in mathematics is a critical factor for students' mathematical success (Hill et al., 2005).

This study aims to identify the geometry content knowledge of teacher candidates in an elementary mathematics education program. The study was run with 52 teacher candidates attending the first year of a Turkish state university. Data were collected with a five-item written form distributed during the first week of the Geometry class offered in the second term of the freshman year of the elementary mathematics education program. The first item asked the teacher candidates to define the terms of angle, height and diagonal (Gutierrez and Jaime, 1999; Cunnigham and Roberts 2010), while the second item, a short response one, asked them to fill in the blank with the right word by using the relationships between quadrilaterals. This second question was designed to identify teacher candidates' level of identifying relationships between quadrilaterals by using Usiskin et al.'s (2008) hierarchical classification. The third, fourth and fifth items, on the other hand, attempted to identify teacher candidates' performance in measuring angles, drawing diagonals and drawing heights, respectively.

It was found in the study that almost all teacher candidates defined the geometric concepts of "angle", "height" and "diagonal" either in a wrong or incomplete way. Findings from the second item revealed that 9 (17%) teacher candidates believed that a parallelogram was always a trapezoid, 16 (31%) believed that a square was always a deltoid and a rectangle always a parallelogram. The number of teacher candidates who thought a parallelogram would sometimes be a rectangle, and a rhombus would sometimes be a square

was 24 (46%). In light of these findings, it was concluded that most teacher candidates were not aware of the relationships between quadrilaterals.

Findings from the third question showed that all teacher candidates responded to item d correctly, while almost all responded to items a, b and c correctly. However, the same performance was not true for item e. Eighteen (35%) teacher candidates believed that two coincident beams with the same starting point and in the same direction would not make an angle. Only 11 of the 34 teacher candidates who believed MXW to be an angle reported this angle to be 0 degrees. Therefore, the percentage of correct responses to item e was 21 and rather low.

In their diagonal drawings, all teacher candidates stated that a triangle did not have a diagonal and could accurately draw all diagonals of a convex quadrilateral. However, no teacher candidate could draw all diagonals of a concave pentagon, thinking that the diagonals of a concave pentagon only pass through its inner area.

In sum, it was found that the content knowledge of teacher candidates related to these concepts was low. The results suggest that the geometry courses offered in education faculties should emphasize “geometric concepts and relationships” and the education given to these teacher candidates should be planned to reflect this.

Keywords: Teacher candidates, content knowledge, angle, diagonal, height, rectangle

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Pre-school Age Children's Strategies of Recognizing Two Dimensioned Shapes

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ABSTRACT

The aim of this study is to investigate preschool age children's recognition strategies of two dimensioned shapes. For this purpose, 24 preschool children aged between 56 to 66 months (12 girls -12 boys) were interviewed. *Clinical Interview* which ensures us to modify interview questions according to motivation-related status of each children, was performed (Ginsburg, 1997). *Descriptive Method* which is one of *Qualitative* Research Methods was used. *Convenience Sampling Method* was used to determine the participants. It was so practical and accessible to study with relevant participants, because of teachers' being volunteer or not (Creswell, 2012). Children were offered examples of two dimensioned shapes as Circle, Hoop, Square, Triangle and Rectangle made of wood, respectively. They were asked some questions as "How can you understand the shape this wood has?", "How can you describe the edges of this shape? Can you show me?", "How can you describe the angles of this shape? Can you show me?", "Which one of the other shapes look like this shape? And why?", "Which object or tool in our daily life looks like this shape?". Data obtained by interviews were descriptively analysed. According to the results of this study; Children most think that, a circle shaped object is a circle because of its being filled and being round and some children think that, a circle has several edges; children most think that, a circle looks like a hoop, because of its being round. And, also they think that, it looks like a wheel or a dish, most. Children most think

that, a hoop shaped object is a hoop because of its not being filled and being round. And some children think that, a hoop has several edges; children most think that, a hoop looks like a circle because of its being round. And, also they think that, it looks like a hole or bracelet, most. Children most think that, a square shaped object is a square because of its having equal sized edges and being a square. And children most think that, square looks like a rectangle, because of its being similar and having same numbers of edges. And, also they think that, it looks like a box or table, most. Children most think that, a triangle shaped object is a triangle because of its having three edges and angle. And children most think that, a triangle doesn't look like any of other shapes, because of its not being similar. And, also they think that, it looks like a roof or ray, most. Children most think that, a rectangle shaped object is a rectangle, because of its having un equal sized edges and having four edges. And children most think that, a rectangle looks like a square, because of its having the same number of edges and angles. And, also they think that, it looks like a mobile phone or a picture, most. Considering to the results of this study, we may take children's thoughts about shapes into account, while planning or implementing educational procedures.

Key Words: Preschool, shapes, geometry, recognition strategy.

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Preschool Age Children's Strategies of Composing Two Dimensioned Shapes: In the Context of Creativity

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ABSTRACT

It is not quite possible to identify "Creativity". There are many different identification of creativity but also common facts. We may describe a creative process that has imagination, being original, producing an original product, solving problems by using different ways (Sharp, 2004).

The aim of this study is to investigate preschool age children's strategies of composing two dimensioned shapes, in the context of creativity. For this purpose, 18 preschool age children aged between 58 to 71 months (10 girls and 8 boys) were offered an interview session. *Criterion Sampling* method was used because of its allowing us to select the participants according to some criteria determined by researchers. In this study, 25 preschool age children were offered an inventory which ensures us to determine children who can exactly distinguish the two dimensioned shapes, before. As the results of this procedures 18 children were selected who can exactly distinguish two dimensioned shapes as circle, hoop, square, triangle and rectangle (Büyüköztürk, Kılıç-Çakmak, Akgün, Karadeniz ve Demirel, 2011). *Clinical Interview* was used to obtain the data. We may slightly modify the questions according to children's responds or situations, to sustain children's attention (Ginsburg, 1997). Children were given a wire, a paper sized A4, two strip shaped papers and a square shaped paper, respectively for them to create relevant shapes. Children were expected to create a hoop by using a wire; to create a circle by using a A4 sized paper; to create a square by using two strip shaped papers and finally to create a rectangle by using a square shaped paper.

Firstly, children were asked if it is possible to create the expected shapes for them to create and how, by using the materials offered. Secondly, they were expected to create the shapes. As results of this study; most children think that a hoop may be created by using a wire; a circle may be created by using a paper; a square may be created by using only two strip shaped papers and a rectangle may be created by using a square shaped paper. Some children think that it is not possible to create a hoop by using a wire because of its being straight; to create a circle by using a paper because of its not being round; to create a square by using only two strip shaped papers because of square's having four edges and to create a rectangle by using a square shaped paper because of its being a square. Children most curled the wire to create a hoop; draw a circle on paper to create a circle; cut the pieces of two strip shaped papers to create a square and folded square shaped paper to create a rectangle, as strategies of composing shapes. We may consider curling the wire to create a hoop, rolling the paper to create a circle, adding two imaginary edges to create a square and adding another imaginary square next to square shaped paper to create a rectangle are some of creative strategies, children revealed.

Key Words: Preschool, geometry, shape, strategy, creativity.

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The Investigation of Prospective Primary Mathematics Teachers' Efficacy Belief Levels Regarding Using of Geometrical Language

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ABSTRACT

Geometry is the branch or mathematics dealing with point, line, plane, plane figure, space, space figures and the relationship between them, and the measures of geometric shapes (Erol, 2008). Geometrical language is one type of mathematical language. Usage of correct mathematical language is really important to eliminate the misconceptions which occur in students' minds. If the mathematical language is used correctly, it is obtained that abstract concepts can be visualized in students' mind easily; students can reach new concepts and information themselves (Yeşildere, 2007).

The purpose of this study is to determine the prospective primary mathematics teachers' efficacy belief levels regarding using of geometrical language, analyze the factors from the point of gender, grade level, and the type of high school which is graduated, and to investigate the links amongst them. The study group of this research consists of 329 prospective teachers who are in their first, second, third, or fourth year at the Faculty of Education, Primary School Mathematics Teaching at a university which is located in the West side of Turkey, between 2015 and 2016 teaching period. "Using of Geometrical Language Efficacy Belief Instrument" which were improved by researchers have been used. Using of Geometrical Language Efficacy Belief Instrument is a measurement in a five Likert type scale. The reliability coefficient of the scale consists of 22 items has been calculated as 0.943. Also, at the end of the factor analysis the items were clustered around two factors; and, it was showed that the total variance explained by these two factors was 55.27%. Consequently, the levels of efficacy beliefs of prospective teachers were found high.

In accordance with the results of the research, it has been found out that the prospective teachers' efficacy belief levels does not show a meaningful difference according to the gender, grade level and the type of high school which is graduated.

Key Words: Geometry, geometrical language, efficacy-belief.

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An Example Geometry Course Taught in the Elementary Schools and Comparison to Today's

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ABSTRACT

Mathematics has had an important place in Turkish educational history for long. Philosophy, mathematics, geometry, astronomy etc. collectively known as the rational sciences had been taught in the madrasahs, which were the most important institutions for the educational system of Classical Ottoman Period, beginning from the reign of Mehmed the Conqueror, as well as the traditional/religious subjects. However, with madrasahs getting corrupted during the mid-17th century, besides other rational sciences, geometry was also abandoned.

19th century is when the Ottoman Empire had started a reformation and transition, implementing western models in military, politics and administration. This is also the period, during which the most significant improvements in education and science were observed. Transferred from the western civilization, course books on fundamental sciences that were taught only in higher at the beginning, were also published and used in primary and secondary education as well, in the following years.

Educational Statute 1869, involved geometry in educational system. Following this Statute, whereas in the elementary schools, only calculus was taught, geometry took its place in the curriculums of junior high schools (rüştiye), high schools (idadi), and higher education (sultani).In those elementary schools, *called "Mekatib-iptidâiye" and today known as "secondary school"*, formed in 1870, there were no geometry courses in the beginning, however in the following years,

geometry was attached to the curriculum. This research studies the articles, “An Example Geometry Course in Elementary Schools” by Ali Haydar on the issue 32 of Teaching Journal in 1922. This articles define the stages of course planning in geometry, and the equipment required, and present an example course. This research aims to introduce how geometry (back then hendese) was taught in the period mentioned and how it is taught today, comparatively.

This is a descriptive research, conducted using screening model in order to introduce textual contents of example geometry courses in 1922. The research uses document review method.

The text reviewed exhibits preparation phases, review of the previous courses, introduction of new concepts, and association of those concepts with real-life and exercises for students. All stages presented as teacher-student dialog, it allows identifying the teacher-student interaction of that period. This research, raising awareness on the historical development of geometry education in terms of how the courses were conducted, is expected to contribute to the studies of educators of this field.

Key Words: Geometry course, Turkish educational history, Secondary school, Planning in geometry.

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Teaching In the Dynamic Environment Effects on Academic Success and Retention Levels

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ABSTRACT

The purpose of the study is to investigate out the effects of teaching in the dynamic environment of the subject of lines, angles and circle which are parts of secondary school seventh grade math class, on student's achievement and retention levels.

This is an experimental study in which pre-test and post-test group have been conducted. The experimental group and the control group have not been formed or chosen randomly, which may be considered a limitation of the study.

The study was conducted in Spring Term of 2016-2017 academic year. This study group consists of 7th and 8th grade students who are studying at Kozlu Secondary School in Kozlu district of Zonguldak. The participants of the study are 55 seventh grade students divided into two classrooms.

To find out the effects of teaching in the dynamic environment supported by GeoGebra on student's achievement and retention levels, an experimental group consisting of 27 students and a control group consisting of 28 students have been assigned. In the experimental group, students were provided with GeoGebra construction activities involving active use of GeoGebra. Meanwhile, control group was taught the same units only in accordance with the curriculum of Ministry of National Education.

Achievement tests, which were prepared for particular units were administered to both groups as pre-test, post test before and after the activities. After the post test, the retention tests were applied to both groups after 1 month in class.

The analysis of the data was conducted in computer environment using ITEMAN and SPSS programs. Independent sample t-test and paired sample t-test have been used in order to find out the difference among the achievement levels of the groups.

As a result of the comparisons between groups, it might be inferred that GeoGebra positively influences academic achievements and retention levels of the students.

Key Words: Teaching in the Dynamic Environment, GeoGebra, Lines, Angles, Circle

Determining 4th Class Students Using Goniometer about Determining of Students Conceptual Failures

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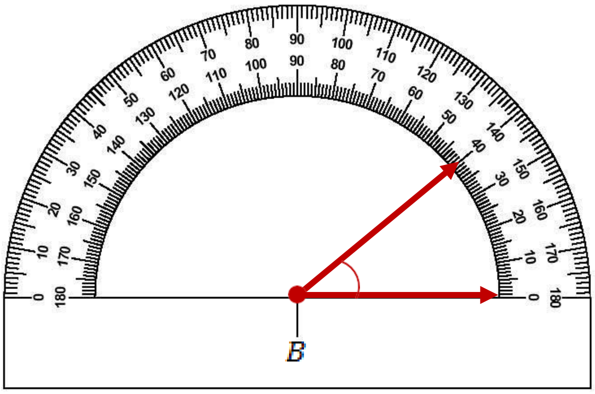
ABSTRACT

The works that have been done about teaching geometry showing remarkable increase last years. Not to be fixed main terms and conceptual failure at geometry, an important part of maths, will cause to increase these mistakes in next levels of technology. (Şenyurt and Karakuyu, 2015). The purpose of this work is to determine that 4th class student's difficulties at measuring angle by using goniometer and conceptual failure. This work was actualized with 25 students educated at a primary school in Amasya. In this work 12 questions had been asked to the students.

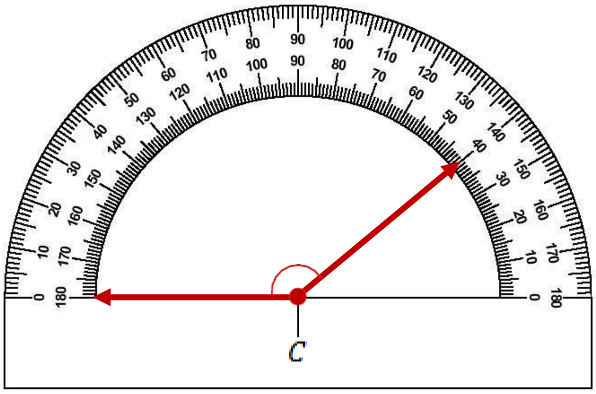
Concepts of angle is central to the development of geometric. (Clements & Burns, 2000: 31). When we ask students, drawing wide, acute and right angle, usually, they all say that the angle is right or acute or wide.

When we want them to draw angle with protractor and know the degree, some students get wrong. There are angle degrees on the right and left sides, beginning 0° degrees to 180° degrees on the protractor. Although we remark that borders of the angle are called 'ray' and they should read the numeric values that 0° degrees on the direction of ray is the beginning, some students confound the numeric degree on the top or at the bottom when they say the degree of the angle. For example, they might say that 40° degrees acute angle is 140° degrees, 140° degrees wide angle is 40° degrees, as we see on the degrees beam.



Shape 1. $s(\widehat{B}) = 40°$

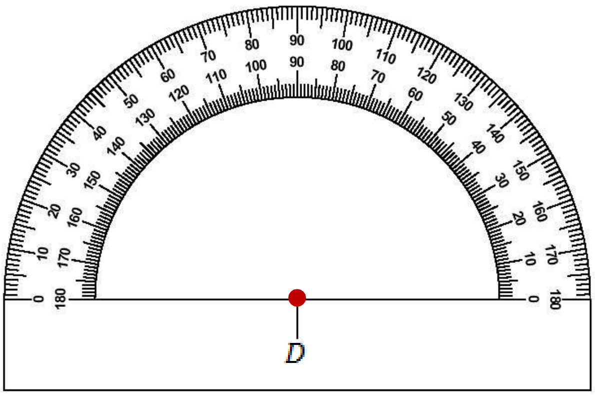
Acute angle



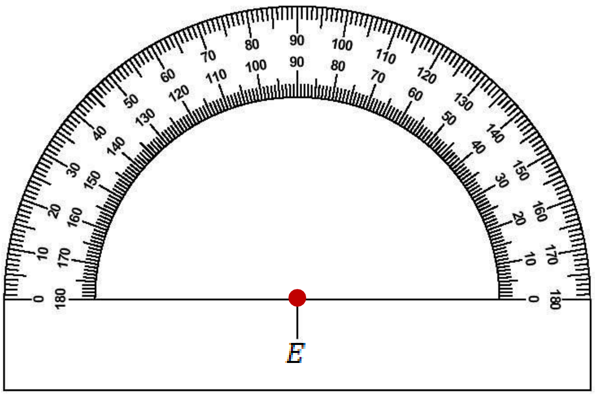
Shape 2. $s(\widehat{C}) = 140°$

Wide angle

As we remarked at upper part, in an application made in a class with 25 students. All students have declared that C angle in shape 2 is a wide-angle meter laving been asked to say the degree of angle on the protractor, 8 students declared 140° instead of 40°. As for careful students decided that wide angle can't be 40° by thinking about it.



Shape 3. $s(\widehat{D}) = 120°$



Shape 4. $s(\widehat{E}) = 150°$

9 students couldn't draw angles which are given sizes with help a ruler upper shape 3 and shape 4. They couldn't tend setting corners of angles above

protractor. They slog on using protractor. They are making a mistake while they are drawing and reading. Due to two row angle degree.

Study shown that students slog on while they are measuring angle. Students have mistaken about using protractor. Well-documented that learners experience ‘difficulty with angle, angle measure concept. (Lindquist and Kouba, 1989; Mantaon Et Al, 1993; Simmons and Cope, 1990).

Key Words: Geometry, Angle, Size, Goniometer.

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The Mistakes and The Misconceptions of The Forth Grade Students on The Subject of Angles in Triangles

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ABSTRACT

Concept which includes the common features of events and objects and collect them under a certain name is an abstract and common idea. The knowledge geometry is one of the important secondary branches of maths. Geometry is a branch of mathematics concerned with point, straight line, plane, circle, spatial figures, and the relations between them besides the measures of geometric figures including length, angle, area, volume, etc. (Baykul, 1999). The research purpose is that of discovering the student's misconception on the triangle. Triangle introduction which is the subject of geometry teaching is given for students from 4th grade in elementary education.

Concepts of angle is central to the development of geometric. (Clements & Burns, 2000: 31). Well-documented that learners experience 'difficulty with angle, angle measure concept. (Lindquist And Kouba, 1989; Mantaon Et Al, 1993; Simmons And Cope, 1990).

Misconceptions about triangle knowledge have the quality which affects directly to the geometric knowledge. So, the realization concept of angles was chosen. In this research, primary school students' concepts of angles in triangle in geometry lesson according to their errors and misconceptions and some suggestions have been offered to the teachers. The purpose of this research is to examine the sample includes 24 students that is one 4th grade selected from the primary school in Amasya 2017-2018 academic year. Questionnaire of the test were prepared by considering the acquisitions (sub problems). teachers

were asked their opinion about the questions as well. Data are collected through a test including 15 open-ended questions. The results indicate that the students have some misconceptions about triangle and angle. The reason of the errors can be summarized as follows: students can not make contact with the concepts of interior angles in a triangle, students are forced themselves to practice some properties in angle concepts of triangle. Data with questions of angle are not analyzed well. Based on the examination of the answers given by students to these questions, it was seen that the same students repeated similar mistakes.

Having students experiment with drawing triangles and attempting to draw a triangle with more than one obtuse angle could eliminate this misconception. Geometry should not be taught as stand-alone subject matter. Good teaching practice exposes misconceptions, not hide them.

Key Words: Triangle, Misconception, Angle, Geometry.

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An Investigation of Pre-School Teacher Candidates' Spatial Thinking Skills

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ABSTRACT

Spatial thinking skills refer to objects locations, shapes, movements, their directions of moving and interactions and relations between other objects. Spatial thinking skills are widely being used in our daily lives even if we are not aware of it. These skills arise when we decorate a room or a place, order the books on a shelf, try to find our way according to a plan or a map and try to explain various situations. Pre-school years are important for acquiring and improving spatial thinking skills. Children's early experiences of spatial relations predict and provide their developing spatial thinking skills and future success on math, science and engineering (Newcombe, 2010; Newcombe & Frick, 2010).

The aim of this study is to investigate whether pre-school teacher candidates' spatial thinking skills are associated with the type of high school they graduated from, gender, grade and their taking a course on math education which is being offered to teacher candidates, before. Totally 132 pre-school teacher candidates who are attending pre-school teacher training program at one of a state university in Turkey, participated the study. 34 of them were 1st, 36 of them were 2nd, 35 of them were 3rd and finally 27 of them were 4th graders. Only 12 of them were male. 45 of them were graduated from vocational high school. 34 of them haven't attended any math education course which is being offered to teacher candidates, before. Age wasn't taken into consideration because of their being almost at the same age level. Participants were decided according to convenience sampling method. They were already accessible because of their being close to the institution (Creswell, 2012). Teacher candidates were free to participate. Participants were offered two different assessment scale as they were, “Spatial Ability Self-Report Scala” (Cronbach’s alpha of entire scale was found as ,88) which was developed by Turgut (2015) and “Santa Barbara Sense of Direction Scala” which was adopted to Turkish Language and culture by Turgut (2014). Data obtained by offering these two different scales was analysed by the help of a statistics software. Independent Samples T-test was performed in order to understand whether difference between the scores according to the type of high school they graduated from, gender and their taking a course on math education which is being offered to teacher candidates before, is statistically significant, but ANOVA for grade, because of its having 4 different subgroups. Correlation between the results of two different scale was found as it is statistically significant. Difference between Teacher candidates’ scores of two different scale for the type of high school they graduated from, gender, grade and their taking a course on math education which is being offered to teacher candidates before, are not statistically significant, as other results of this study. Results were concluded and discussed with other related studies’ results. Some recommendations were made according to the results.

Key Words: Pre-school, teacher candidate, spatial thinking

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Investigating 7th Grade Students' Proof Levels About Quadrilaterals

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ABSTRACT

Proof is considered to be among the most significant elements of mathematics education (Schoenfeld, 2009). The importance of mathematical proofs has been emphasized in recent educational reforms. In particular, The National Council of Teachers of Mathematics (NTCM) highlighted the importance of mathematical proofs as a significant part of mathematics curriculum from kindergarten through high school. Through new curriculum in Turkey, the significance of the concept of proof has also been emphasized (Ministry of Education, 2013).

Cognitive processes that students use while justifying the correctness of a mathematical statement have attracted the interests of many researchers (Balacheff, 1988; Harel and Sowder, 1998a). One of the most detailed proof schemes brought up to identify these cognitive processes students have exposed is proposed by Harel and Sowder. Harel and Sowder (1998a) categorize students' proof schemes in three categories with several sub-categories as: (1) externally based proof schemes, (2) empirical proof schemes and (3) analytic proof schemes. These proof schemes guided not only the design of the study, but also the data collection and analysis processes.

The aim of this study is to analyze the proof schemes of 7th grade students on the topic of quadrilaterals. Since this study focuses on one particular 7th grade class, it is designed as a case study. The participants consist of six 7th grade students who attends at Kizik Secondary School in Tokat. The participants are selected to exemplify different levels as low, intermediate and upper-intermediate, in a way of placing two students in each category. To identify

participants' proof schemes, individual interview forms are developed by using the proof schemes suggested by Harel and Sowder (1998a). Individual interview forms are composed of three correct and one incorrect mathematical statement on the topic of quadrilateral. For each correct statement, four arguments at different proof schemes (externally, experimental, analytic) are developed.. For the incorrect statement, no argument is provided to the participants, but they are expected to construct a justification by themselves. In the process of data collection, participants are interviewed individually and these interviews are video-recorded. In the process of data analysis, the interview videos are watched and analyzed by using content analysis methods.

According to the findings of this study, the participants have difficulty in proving and they demonstrated several misconceptions regarding the concept of proving. For instance, nearly all of the participants chose the validation method done by exemplifying as mathematical proof. This finding is consistent with the results of the study conducted by Ozer and Arikan (2000). As for the comments on proof, the participants are observed that they classify the proving as to mostly either they comprehend it or not. Additionally, the participants ignored the fact that mathematical proofs should be general, which shows that the statement is true for all cases. This result aligns well with the results of other studies in the literature. For instance, Stylianides (2007), Harel and Sowder (1998b) and Balacheff (1988) stated that students tend to ignore the fact that mathematical proofs should be general.

Key Words : Geometry, Proof, Proof Schemes, Reasoning

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The Relationship Between Van-Hiele Geometric Thinking Levels And Geometric Participations Of Secondary School Students

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ABSTRACT

Studies in the field of geometry, which has an important place in mathematics education, show that students are very difficult to learn geometry. (Kılıç, 2003; Ubuz & Üstün, 2003; Yenilmez & Korkmaz,2013). One of these difficulties is the problems in the sense of geometry. One of the important reasons for the problems in the sense of geometry is that geometric thinking levels are not taken into consideration in geometry teaching. (Fidan & Türnüklü, 2010).

Because of the lack of consideration of the students' level of geometric thinking, students have difficulties in encountering a concept that they are not ready. For this reason, much of the research on understanding geometry has been based on Van Hiele levels. (Turgut & Yilmaz, 2008, Gül, 2014).

The purpose of this research is to determine the relationship between the Van Hiele Geometric Thinking Levels of secondary school 8th graders and the achievements of geometric objects in terms of geometric objects. The research also aimed to determine whether the students' geometric thinking levels differed in terms of gender, pre-school education status and Teog placement score variables. The study group of the study consists of 60 students who are studying in the 8th Grades of Tokat / Pazar Üzümören Middle School in 2016-2017 Academic Year. The research is a study in the screening model. "Van Hiele Geometric Thinking Test" developed by Usiskin (1982) and translated into

Turkish by Duatepe (2000) was use to determine geometric thinking levels of students as data collection tool. Other data collection tools are Geometrical Objects Success Test and Personal Information form. The data were analyzed using the SPSS program.

Van Hiele is expected to correspond to the second level of junior high school years according to the geometric thinking model. However, when the data were analyzed, it was found that the middle school students participating in the research had a relatively low level of geometric thinking. It is very difficult for students at this level to understand the 8th grade geometry topics. This result, which is related to the students' level of geometric thinking, is in parallel with the results of Duatepe (2000), Coskun (2009), Duatepe Paksu (2013), and Bal (2014). No significant difference was observed between the students' geometrical thinking levels and gender and pre- school education variables. There was a significant correlation between the scores of the students obtained from the Van Hiele test and the scores of the Geometric Objects Achievement test.

Key Words: Geometry, Van Hiele Geometric Thinking, Geometric Objects

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Research Trends on Vectors in Turkey: A Content Analysis of Articles Published between 2011 & 2016, Dissertations and Master Theses

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ABSTRACT

Vector is an important tool in mathematics. According to Szabo (1966) "*vector is a beautiful and useful bridge between algebra and geometry*". In fact, it is a way of relating algebra with geometry. Moreover, for the field of mathematics, vector is a facilitator and can be used as a conceptual tool in school mathematics including analytic geometry, algebra, trigonometry and Euclidean geometry (Copeland, 1962; Hausner, 1998; Barbeau, 1988; Bundrick, 1968 & Nissen, 2000). Besides, when it is desired to solve a geometric problem via analytical and/or vectorial approaches, vectors are the key components of these solutions. In fact, vector-approach solutions are qualified as **"royal road"** by Choquet (1969), and Robinson (2011) accepts vectors as having a central significance in Euclidean geometry.

Vectors are beneficial tools for the topics in the other disciplines, in addition to mathematics and geometry. To illustrate, vectors have an important role and place in various courses at university levels such as linear algebra, calculus, physics and engineering etc., as it is known. Specifically, vector is an indispensable part of the units in secondary school and undergraduate physics courses such as Kinematics (*velocity, acceleration*), Dynamics (*mechanical force, torque, impulse and momentum*) and Electromagnetism (*electric force, magnetic force*) (Nguyen & Meltzer, 2003). Because of the importance of vectors for many aspects, it is important to examine the research studies focused on "*vectors, the teaching of vectors and vector approach*" and there is a need to determine the current situation for these contexts in academic studies.

The purpose of this study is to examine dissertations and master theses, completed in Turkey and the articles published in Turkey addressed journals, which are in the scope of SSCI and SCI in the context of vectors and to reveal and report the current situation in these studies. In order to realize this aim, all of the doctoral and master theses, registered in Turkish National Higher Education Council (YÖK) National Thesis Center and the articles published between the years 2011-2016 in Turkish journals, which are in the scope of 2016 SSCI and SCI in mathematics and physics education fields were examined. The academic studies were investigated through content analysis method, the data were collected through Vector Related Studies Classification Form (VRSCF) and the obtained data were analyzed by means of descriptive statistical methods. The results of the study are thought to be helpful and will be light for the future studies focused on vectors.

Key Words: Vectors, Teaching vectors, Vector approach, Research Trends, Content Analysis

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Using Cabri 3D to Teach Cross-Sections: Teachers' Views

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ABSTRACT

According to National Council of Teachers of Mathematics (NCTM 2000), using technology in teaching and learning mathematics is essential because it enhances students' learning. Parallel to this perspective, the use of Information and Communication Technology is recommended in High School Mathematics Curricula while teaching geometry (MoNE, 2013). This is also the case for the teaching of solids. While teaching this subject, cross-sections can be presented to the students to improve their imagination in space, as an activity. However, because of the requirement of thinking in 3D and spatial visualization skills, the teachers and the students have troubles when teaching and learning these subjects. Actually, there is a considerable evidence that learners develop their own interpretations of the images they see and they hear (Jones, 1999). It can be expected that the conceptual understanding of teachers for solids and space geometry improves as they engage with Dynamic Geometry Environment (DGE) programs. Therefore, it would be valuable to supply an alternative to the teachers and students to overcome these difficulties, to yield a better teaching-learning environment and to reply the requirements of teaching program.

A module containing cross-sections was developed by the author to teach solids by means of Cabri 3D, one of the DGE software. Specific to teaching of cross sections, there are 34 activities in this module, to find out cross-section of a solid (*right triangular prism, cube, right hexagonal prism, cylinder, cone and sphere*) when it is intersected with a plane. To illustrate, students had opportunities to construct "*a pentagon*" from the intersection of right triangular prism with a plane or "*a trapezoid*"

from the intersection of cube with a plane. In these activities, the students have possibilities to observe the resulting objects from different perspectives.

It is inevitable to consider teaching-learning process focused on teachers because they take an important place in classes. A study without taking into account of teachers cannot be accepted as complete. Therefore, the purpose of the study is to determine teachers' views about the use of Cabri 3D while teaching cross-sections in the context of "Solid Geometry" in high school levels. In order to realize the aims of the study, five mathematics teachers from different schools in Diyarbakır were included to the study to learn their reflections by means of semi-conducted interviews related to this module.

Key Words: Dynamic Geometry Environment, Cabri 3D, Solids, Cross Sections and Teachers' View

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Relationship between Attitudes towards Mathematics and Geometry among Primary School Teacher Candidates

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ABSTRACT

Affective variables are important factors that influences students' learning. The attitude towards mathematics which is one of the affective factors, have been studied since 1970s in mathematics education (Dede, 2015). It can be considered as a factor affecting students' mathematical learning especially mathematical achievements (Duatepe-Paksu & Ubuz, 2007). It is stated that most of the students who failed in the mathematics courses taught at the first grade of the universities have negative thoughts about this course (Duatepe & Çilesiz, 1999). In mathematics courses, some reactions are observed regarding the topics that are discussed in the speeches made by the students from time to time. It is not surprising to hear the reaction of "I do not like geometry", "I hate geometry", "I fail geometry" or understand this from facial expressions in some of these reactions when students are dealing with geometry issues (Utley, 2007). This is remarkable in that it shows that there may not be a parallel between students' attitudes towards mathematics in general and their attitudes towards other sub-branches of mathematics (Avcu & Avcu, 2015).

While there have been various researches on the attitude towards mathematics and the attitude towards geometry, no studies have been found that deal with the relation between the two. This study is important in terms of comparing the attitudes of prospective teachers towards mathematics and geometry, and in this way initiating attempts to eliminate the negative effects of their approach towards their students. The main purpose of the study in this context is to determine the relationship between the attitudes of primary school teacher candidates towards geometry and towards mathematics.

In this research, students' attitudes towards mathematics and attitudes towards geometry were accepted as variables and the model of the research was determined as correlational research model because the relationship between these variables was examined. The sample of the study is composed of 96 students who study in the first class of Manisa Celal Bayar University Primary School Teacher Department. In the study, mathematical attitude scale and geometrical attitude scale were used. Descriptive statistics and simple correlation analysis were used in the analysis of the data.

Findings show that, students' geometry attitudes correspond to "undecided" category and this points out that primary school teacher candidates' attitudes towards geometry were medium level. On the other hand, students' mathematics attitudes correspond to "agree" category and this points out that primary school teacher candidates have positive attitudes towards mathematics. The relationship between mathematics attitude scores and geometry attitude scores was investigated by using Pearson product-moment correlation coefficient. There was a moderate positive correlation between the two variables.

Based on the results of this study, it is suggested that the teaching methods and techniques used in the basic mathematics and mathematics teaching courses taken by the classroom teacher candidates should be reviewed, the weights of the geometry topics in these courses should be increased, the hours of mathematics lessons should be increased and the compulsory geometry course should be added.

Key Words: Geometry, Mathematics, Attitude, Teacher Candidates.

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Mathematics Teachers' Views on Distribution of Geometry Topics in Secondary School Mathematics Curriculum

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ABSTRACT

Since the topics in mathematics are hierarchical, abstract and cumulative, the ways which teachers follow during this course can lead to a relational understanding of the subjects or to their meaning within their own boundaries. Secondary school mathematics curriculums of Turkey have been based on radical or partial changes or/and revisions several times over the past decade, so that the subjects of geometry were aimed to be able to be taught better. Within the academic year 2016-2017, proposals from stakeholders (academicians, teachers, parents, curriculum developers, etc.) started to be collected for updating the curriculum (MEB, 2017). It is important to take into account the teaching cycle models and the hierarchy of subject ordering proposed by teachers in the teaching of geometry subjects in order to improve the efficiency in the process from development to implementation of the curriculum. In this study, the opinions and suggestions of mathematics teachers regarding the teaching order of the secondary school geometry topics in the curriculum were determined and evaluated.

The case study was used as a research design in this research, since it is aimed to examine a particular situation (*geometry topics*) deeply (*via teachers' views*) within its boundaries (*in secondary school curriculum*). Participants of the study are six elementary school mathematics teachers who are actively teaching and continuing graduate education. These teachers were selected according to a

purposeful sampling method; In the selection criteria, attention has been paid that they have 3-10 years of teaching experience, have taken graduate courses in textbook review and curriculum development, and participate in the research as a volunteer. Within the scope of the research, interview protocols using semi-structured interview forms were recorded and firstly these data were transcribed, then coded under the themes pre-determined by the researchers. Descriptive statistics were used in the analysis, and the results were presented comparatively in the context of the tables and graphics.

When study findings were examined under the theme of "the distribution of subjects according to class level ", participants indicated that the transformation geometry was very abstract for the students and that those students had difficulty in perceiving this subject (four of six participants). In the context of the "distribution of topics within units" theme, the participants all indicated that there was no integrity between the subjects and that there was a disconnection between the units. Another situation that all the participants criticize is that the topics of geometry are predominantly given at the end of the semester. In the last weeks of the school, it has been criticized for having geometry subjects in the last units due to the reasons such as low student motivation, the disinterest of students in subjects, low participation in classes. In addition, while four of six participants suggested that geometry should be given under a different course heading, the two participants indicated that it would be better to stay on the same course provided the geometry was more integrated with mathematics.

Key Words: Teaching sequence, Geometry topics, Teachers’ views.

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Investigation of Geometric Study Skills of 7th Grade Students

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ABSTRACT

In school curricula students are introduced to the concept of mathematical proofs only in secondary education (MoEd,2013). Whereas, studies show that students can develop ability of reasoning and proving when given the necessary support (Stylianides, 2007; Aylar & Şahiner, 2016). Moreover, it has been eveidenced that the students who are confronted with the concept of proof in secondary education struggle with mathematical proofs and demonstrate several misconceptions (Kılıç, 2013; Özer & Arıkan, 2001). The fact that students are introduced with the concept of mathematical proofs at a very late stage of their education could be one of the possible reasons fort his issue (Dreyfus, 1999). The purpose of this study is to investigate how the 7th grade students are able to use their reasoning and proving skills effectively in one week of geometry unit. In the study; "*Explains the edge and angle properties of regular polygons*" and "*Determines the diagonals of polygons, internal and external angles, calculates the sum of measures of internal angles and external angles*" achievements are chosen as the standards to be focused on. The participants of this study consist of a total of 9 students who are attending at the 7th grade at a public school. The research is designed by using the action research method and the lesson plans that are consisted of 5 lessons per week are planned accordingly. A pre and post-tests consists of 10 questions are applied before and after the geometry unit implementation. After the post- test, 5 students, who demonstrated variety of answers, were chosen to be interviewed individually. In the interviews, students were asked to further explain their answers to the pre and post test questions, and these interviews were voice recorded. Students' answers to the pre-test and post-test were examined by using the document analysis method. According to the pre-test and post-test results, it is observed that there is an increase in the students' ability of reasoning and proving It has been seen that students can determine the number of diagonals of a polygon, can support their answers by using reasoning skills such as telling the diagonal which can be drawn from a corner of the polygon divide the polygon into several triangular regions,can find the sum of the interior and exterior angles of polygons and can find the interior

angles of regular polygons. Another finding of this study is that students hold a belief that they can learn mathematical concepts more effectively and profoundly by proving. This finding is compatible with the study that a large majority of primary school mathematics teacher candidates believe that proving will contribute positively to teaching and learning mathematics (Köğce, 2012).

Keywords: Argumentation, geometry, polygons, proof, reasoning.

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Examination of Middle School Mathematics Teachers' Mathematical Content Knowledge: the Sample of Pyramid*

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ABSTRACT

It is important for the students to learn and define the solid objects with respect to the basis of it since the development of geometric thinking and geometric thinking at higher level necessitates understanding the definition. Therefore, it is necessary to understand the concept definitions and explain them appropriately. Teachers' content knowledge is very important in the understanding of geometrical objects by students. The students' understanding solid geometric objects is related to teachers' knowledge of content knowledge. The purpose of the present study was to examine the Mathematical Content Knowledge (MCK) of Middle School Mathematics Teachers (MSMT) on pyramid subject. For this purpose, six mathematics teachers actively working at a public secondary school constituted the study group of the research. The purposeful sampling method was used in the selection of the participants. The case study method based on the qualitative approach was used in the study. The triangulation was made by using the techniques of semi-structured interviews, semi-structured observation and document analysis. In the data collection process, the interviews and observations were recorded by audio recordings and the lessons of three teachers were recorded by video camera. The data were analyzed by the techniques of qualitative data. The packet program of Nvivo 8 was used in the analysis of data. In this context, voice and video recordings were primarily transferred to the computer environment. Participants' voice dumps that were transferred to the computer environment were separated into significance units, and categories and codes were created from these significance units. Furthermore, the thematic framework of Zazkis and Leiken (2008) and Tsamir et al. (2008) was taken into account while encoding the data. At the end of the study, it was determined that most of the teachers did not have difficulty in describing and drawing the concept of the pyramid but the pyramid examples they drew were limited to the prototype examples. It was found out that two teachers had difficulty in giving an answer to the calculation of the surface area and volume of the pyramid.

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Key words: Mathematical content knowledge, pyramid, middle school mathematics teachers

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Examination of Middle School Mathematics Teachers' Pedagogical Content Knowledge in Terms of two Components: the Subject of Pyramid*

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ABSTRACT

Teacher qualities are one of the important factors affecting the efficiency of the education system. In this regard, it can be said that the teaching strategies chosen in the learning environments by teachers, who are one of the important components of the teaching process, are important. Furthermore, the fact that they are informed about the mistakes students make on the subject taught and about the reasons for these mistakes can prevent students from making probable mistakes or having misconceptions. One of the learning domains in which students have difficulty is the field of learning geometry. Students have many difficulties especially in geometrical solids, one of the geometry subjects. Accordingly, in this study, pedagogical content knowledge of middle school mathematics teachers' on pyramid was examined in line with the components of knowledge of student, and knowledge of instructional strategies. The purposive sampling strategy was used in the study with the design of case study. The participants of the study consisted of 6 (4 Male, 2 Female) middle school mathematics teachers with different periods of service. In the study, data triangulation was made using different data collection methods (interviews, observation and document analysis). Voice and video recordings were taken while collecting the interview and observation data. The data were analyzed by the techniques of qualitative data. At the end of the study, it was determined that most of the teachers performed teaching in the teacher-centered role and that only one teacher benefited from the strategies based on the constructivist approach that actively involves the student in the process. Based on the results on knowledge of student, it was found out that teachers were generally able to identify students' mistakes, but they preferred the strategies based on the traditional approach regarding the elimination of the students' mistakes. In line with these results, suggestions were made for teacher training.

Key words: Pedagogical content knowledge, knowledge of

instructionalstrategies, knowledge of student, pyramid.

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The Examination of the Knowledge of Teaching Strategies of Preservice Mathematics Teachers about Geometric Shapes: Example of Teaching Practice

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ABSTRACT

Geometry is an important sub-learning of mathematics and includes more abstract structures when compared to mathematical subjects (Gökbulut, 2010). Especially the subject of mathematical shapes is indicated among the subjects in the understanding of which students experience most difficulties (Battista & Clements 1996, Gökkurt, 2014). The teacher's knowledge of teaching strategies is important in terms of eliminating these difficulties which students experience and comprehending the subject cognitively (Fernandez, Balboa,& Stiehl, 1995). Accordingly, in this study, it is aimed to examine the knowledge of teaching strategies of preservice mathematics teachers about geometrical shapes. In the study, the lectures of the preservice teachers at the schools affiliated to the Ministry of National Education were observed. As a result of the fact that preservice teachers teach lessons in the real school environment with real secondary school students, it is considered that the data collected in the subjects such as making students participate in the lesson, teaching according to the level of the student, attracting the student's interest to the lesson, changing strategy in response to the reaction of the student are more realistic and including such studies in the literature is important in terms of teaching mathematics and geometry. In the study, the qualitative research approach was adopted, and the case study method was used. The participants of the study consist of seven preservice primary mathematics teachers studying at a state university in Turkey. These preservice teachers included in the study were selected from 4th- grade students, and they are suitable for the aim of the study because these preservice teachers have taken all educational courses which are effective in the development of the knowledge of teaching strategies playing a role in conveying the knowledge they have to students. While collecting the data of the study, the interview and observation techniques were used together. By this means, rich and comprehensive data were collected in accordance with the nature of the case study method. While analysing the data of the study, the content and descriptive analysis techniques were used together and the findings obtained were made meaningful to the reader. In the light of the findings obtained from the study, it is possible to say that preservice teachers prefer ordinary and regular teaching

methods in the subject of the definition and characteristics of geometric shapes and their knowledge of teaching strategies in this subject is insufficient. Similarly, it is observed that most of the preservice teachers adopt a rote teaching in the subject of the surface areas and volumes of geometric shapes, which is one of the most difficult subjects for students to learn and which they generally learn by rote, and these teachers do not perform teaching that forms a basis for effective and permanent learning. In this respect, it is observed that preservice teachers cannot use the knowledge of teaching strategies effectively and sufficiently and their knowledge in this subject is insufficient.

Key Words: Preservice Mathematics Teachers, Knowledge of Teaching Strategies, Geometric Shapes.

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Examination of Primary School Teachers' Knowledge of Students' in the Field of Learning Geometry

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ABSTRACT

The memorization of the features of shapes and giving inadequate examples in teaching geometry cause students to create limited structures related to geometric concepts and thus to have difficulties in learning geometric concepts. In this direction, students are afraid of geometry-related subjects and make many mistakes in the field of learning geometry. One of the important components affecting the geometry teaching process and playing a role in this process is the teacher factor. The fact that teachers are informed about students' mistakes or misconceptions can prevent students from making probable mistakes or having misconceptions. The purpose of the study was to examine primary school teachers' knowledge of students in the field of learning geometry. In this context, primary school teachers' abilities to identify student mistakes and misconceptions related to the field of learning geometry were examined in this study. The case study method based on the qualitative approach was used in the study. The participants of the study consisted of 10 (5 Female, 5 Male) primary school teachers with different periods of service. The interview form consisting of eight questions was used as the data collection tool. The questions in the interview form consisted of teaching scenarios containing mistakes or misconceptions in different subjects of geometry. Interviews were held by taking sound recording with a semi-structured interview technique. The data were analyzed by the techniques of qualitative data. At the end of the study, it was observed that most of the teachers were able to identify students' mistakes and misconceptions in teaching scenarios, but their explanations on these mistakes and misconceptions were superficial. In particular, it was found out that most of the teachers had difficulty in giving an answer to the questions containing overspecialization, which is one of the types of misconceptions.

Key words: Teaching geometry, mistake, misconception, knowledge of students

The Investigation of the Process of Solving a Geometrical Construction Problem of Eighth Grade Students

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ABSTRACT

Geometrical construction refers to the standard procedures required to construct geometric structures by using a compass-ruler and is thought to play an important role in the development of geometric thinking. Geometrical construction activities are important because they provide a deep insight into the properties of the geometric structure created. In this study, the authentic attempts of the eighth grade students in solving the problem of a geometrical construction by means of compass and ruler were investigated. The purpose of study is to reveal the thinking models which have been used by students to solve geometrical construction problems. This research used a qualitative case study approach in order to enable the in-depth analysis of problem-solving processes. Eight students working in pairs constitute the participants of this study. Participants were selected from eighth grade students who know the basic drawing rules and interested in the subject. The data collection tools of the study were video recordings taken during drawing, documents (reports and drafts which the solutions are detailed) and unstructured interviews after problem solving. The data were analysed according to an analysis framework which was developed by the researchers based on the literature (Polya, 1957; Smart, 1998; Verschaffel, De Corte, Lasure, Van Vaerenbergh, Bogaerts & Ratinckx, 1999) and the problem-solving processes studied in depth. First of all, it is seen that the school are about telling the basic drawings of the geometrical construction and the

problem solving dimension is not exist. In result of analysis made, it has been seen that in-group discussions contribute to the solution. It has also been determined that all participants are primarily concerned with drawing a draft and re-expressing the problem situation. It has been seen that students solve the problem with interest, and they cannot do effective work at the stages of proof and discussion.

Key Words: Compass-ruler use, geometrical construction, problem solving

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Learning to Solve Mathematical Application Problems: A Design Experiment with Fifth Graders, *Mathematical Thinking & Learning, 1*(1), 195-229.

The Effects of Teaching Circle Subject with Geogebra on Creative Thinking Skills of 7th Grade Students

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ABSTRACT

Nowadays, technology is being used in every area of our lives and it makes our lives significantly easier. It can be said that technology provides so much free time and liberates people besides, it makes our lives easier (Turan and Esenoglu,2006). We live in an era that the learners require to demonstrate the power of their mental design, technology is used in many areas of our daily life and information constantly changes and increases (Erdem and Akkoyunlu,2002). As a requirement of this era that we live in, we interact with technology in all areas. Today, the development levels of societies can be measured by the number of individuals who can use the computer (Aktumen and Kacar, 2003). This situation shows the importance of technology in the world. As technology evolves, the need for pen and paper decreases, blackboard gives the place to the smart board. Thus, the processing load of students and teachers was reduced. The use of material in education has great importance in terms of teaching to be more meaningful and enduring (Kaya and Aydın,2011). It can be said that the education system increasingly concentrates on problem solving and reasoning. And this is required to give attention to process instead of result. The abstraction of Mathematics course causes students to be prejudiced against the course. The prejudice that is created as a result of this attitude in math class may cause students to have a negative attitude towards future math success (Yenilmez, 2010). This case can lead students to focus on only passing the course. However, to pass the course should not only be a success indicator. In addition, the success is not simple thing that is measured with just grade. The creative thinking and to develop this should be accepted as a success indicator. Therefore, methods and techniques that are used during the handling of course must be taken into consideration whether these methods and techniques have an effect on not only the students' success but also creativity levels or not. In this context, the aim of this study is to examine the effects of teaching circle subject with GeoGebra on creative thinking skills of 7th grade students. The sample of the study included 18 7th grade of Secondary Education students studying at Education in Bayburt in 2015- 2016 academic year. In this study quantitative methods was used and pretest- posttest experimental design was adopted. As a data collection tool Torrance Test of Creativity Thinking Verbal-Figural Form A was used and the collected data were evaluated by using SPSS program

(Statistical Packagefor the Social Sciences). While evaluating data, t-test was used for the lower dimensions with normal distribution, whereas Wilcoxon test was used for the lower dimensions not with normal distribution.

The results of this study showed that teaching with GeoGebra has a positive effect on creative thinking skills of students'. Furthermore, according to the lower dimensions of Torrance Test of Creativity Thinking Verbal Form A, significant differences were found for all dimensions. According to the results obtained from Figural Form A, while significant differences were not found between pretest and posttest results for the dimensions of abstractness of titles, elaboration, resistance to premature closure, storytelling and synthesis of incomplete figures, significant differences were found for the rest of dimensions in favor of the posttest.

Key Words: Geometry, geogebra, creative thinking

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Determining Elementary Mathematics Teacher Candidates' Geometric Thinking Levels

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ABSTRACT

The main aim of this study was to determine elementary mathematics teacher candidates' geometric thinking levels. Other aim of this study was to investigate whether gender, geometry scores and basic mathematics scores affect elementary mathematics teacher candidates' geometric thinking levels and scores. *Descriptive Method* which is one of *Qualitative Research Methods*, was used in this study. This method ensures us to collect, describe and to present numerical values of a current or past situation, variables (Karasar, 1995) and also describe the common thought and structure (Büyüköztürk, 2003; Wellington, 2006). Totally 55 (11 male and 44 female) elementary mathematics teacher candidates participated the study. They were 2nd grade bachelor degree students of an elementary mathematics teacher training program at a college of education, in Turkey. *Convenience Sampling* method was used to determine the participants. Teacher candidates were so close to institution, they were accessible and also volunteers (Creswell, 2012). Van Hiele Geometry Test which is developed by Usiskin (1982) and adopted into Turkish language and culture by Duatepe (2000) was used to obtain data. Date were descriptively analysed in order to determine that, at which level of Van Hiele's geometric thought elementary mathematics teacher candidates are. Results of descriptive analysis were presented as frequencies and percentiles. *Correlation* analysis was used to determine the corelation between elementary mathematics teacher candidates' scores of basic mathematics, geometry and scores of Van Hiele Geometry Test, levels of Van Hiele geometric thought. *Mann-Whitney U* test was used to determine whether gender affect elementary mathematics teachers' geometric thinking levels and scores. According to the results of this study, most elementary mathematics teacher candidates are at 2nd level of geometric thinking. Effect of gender, basic mathematic scores and geometry scores on elementary teacher candidates' scores of Van Hiele Geometry Test, are not statistically significant. Beside, effect of gender and geometry scores on elementary teacher candidates' levels of geometric thought, are not statistically significant, but for basic mathematics scores. Some recommendations could be done as; longitudinal studies should be done, other studies should be done according to some variables as age, gender, grade and branch, assessment scales of space geometry should be developed, geometry curriculums and programs should be reviewed and educational programs should be prepared according to learners' levels of geometric thought.

Key Words: Van Hiele geometric thinking levels, mathematics education, teaching geometry, geometry education

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The Guiding Role of Dynamic Mathematics Software to Solve a Real-Life Problem: Tea Cup Problem

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ABSTRACT

This paper illustrates the authors' efforts in the solution process of a real–life problem and the facilitating role of dynamic geometry software. As known, computer technology, especially mathematics software, has been an alluring tool among mathematicians and mathematics educators while struggling with a mathematical problem in the last quarter century. Dynamic mathematics software (DMS) emerged in recent years brought innovative approaches to the solution of non-routine problems such as testing assumptions, controlling interim solutions etc. This study presents the solution of a daily life problem with the help of mathematical modelling. The problem is *"There is some water in a cylindrical cup with radius r and height h. How much do we have to tilt the glass to start the discharge of the water inside glass?"* First, the problem state is modelled in DMS environment to solve the problem. When the problem was solved by researches, a new problem has arisen. What if the glass is tea cup? A special case of the second problem is also solved by using DMS. The general equation of hyperbola, translation and rotation transformations were used in the second problem's solution. The solutions and the modelling process will be presented in the symposium.

Key Words: Dynamic mathematics software, modelling, problem solving.

What Happens If A, B, C and D Changes? An Investigation on Parameters of the Plane Equation

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ABSTRACT

The aim of the study is to find out the effects of the changes of the constants of the plane equation on plane equation. The equation Ax+By+Cz+D=0 expresses the general equation of plane in space. When you write this equation on the blackboard, one of the first possible problem that comes to mind is what happens if A, B, C and D changes? It is quite difficult to answer to this problem with traditional teaching tools such as papers and pencils. Dynamic mathematics software was used the solution of this problem to provide a prediction to researcher.

Dynamic mathematics software has emerged as a revolution compared to traditional teaching tools, especially in the last 20 years. One of the most salient software is GeoGebra. Algebra and Graphics windows in GeoGebra interface provide users to see together the geometric shapes forms. In this study, the geometric constructions were created with the help of Slider tool on 3D screen and some investigations were done. With the help of the GeoGebra, it is determined how the plane equation is affected by each constant change.

Key Words: Plane equation, dynamic mathematics software, problem solving

Investigation of Teacher Candidates' Ability to Establish Relations Between Quadrilaterals

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ABSTRACT

The aim of geometry is to provide an opportunity for the students in order to have critical thinking and problem solving ability and better understanding ability of mathematic topics by gaining high level of geometric thinking ability (MEB, 2000). Despite the geometry is so important, a large part of the students have a low success in geometry and they don't understand geometry subjects. The results of international exams such as TIMSS and PISA show that Turkey has under achievement about geometric topics (Eşme, 2008; Yayan & Berberoğlu, 2009; Hurma 2011). One of the main reasons for this failure is that it is not give much importance to relation of the shapes in geometry teaching. In particular, it is known that the relation between the quadrilaterals and the hierarchical classification is increasing the level of students' geometric thinking (Fujita & Jones, 2007; Kaleli-Yılmaz & Koparan, 2016). So, it is important to question the relationship between geometric shapes in geometry teaching.

In this context, it is aimed to examine the ability of teacher candidates to establish relations between quadrilaterals in this study. For this purpose, 50 mathematics teacher candidates have been studied. In this study, where the case study method is used, interview and open-ended form were used as data collection tool. In the open-ended interview form, prospective teachers were asked the following questions: “Is every trapezoid a parallelogram? Is every square an equilateral quadrangle? Is every deltoid a parallelogram?” By examining the answers given by the teacher candidates, 3 correct, 3 semi-correct and 3 incorrect responsive teacher candidates were selected. These teacher candidates were

asked the same questions again and conducted detailed interviews. The obtained data were analyzed by qualitative data analysis method.

When the findings are examined, it is seen that the teacher candidates have difficulties in establishing relations between the quadrangles although they know the properties of the quadrangles. This finding also suggests that the geometric thinking levels of the teacher candidates are not very high. The main reason for this is that many educational institutions do not teach geometry information by questioning. This leads to the formation of a line of knowledge that has too much geometric knowledge but is not capable of geometric questioning and which cannot relate to geometric concepts. This can be corrected by well-designed geometry activities.

Key Words: Geometry, Prospective teachers, Quadrilaterals

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A Worksheet for Finding the Intersection Face of a Surface by Usıng a Regular Hexagonal Prısm

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ABSTRACT

Geometric objects is one of the geometric subject which is difficult to understand by using two dimensional areas such as books and boards. (Tutak, 2008; Özen, 2009, Topaloğlu, 2011). The use of technology in geometry education seems to be widespread. It is considered that the correct use of technology in the education of the topic of geometric objects is particularly useful in education. The use of technology makes it easier to demonstrate to the students and grasp the third dimension, as well as enable the student to make application on his/her own. GeoGebra is one of the technologies used in geometry education as well. GeoGebra prepared by Markus Hohenwarter as a project of master thezis. The aim of GeoGebra was combine the geometry software, calculator and computer assisted learning systems (Hohenwarter and Lavicza, 2007). The dynamic materials prepared with GeoGebra enable the student to construct knowledge, to test it, to make trials and applications. With the dynamism feature, changes can be made in the material and these changes can be observed. It also makes it possible to move objects and examine their appearance from different directions thanks to this feature.

The aim of this work is to develop a worksheet for a dynamic material that is prepared for a intersection with a regular hexagonal prism and surface in a dynamic environment (GeoGebra 3D). By this means, it is foreseened that it would be possible to ensure that the students see the surface intersection more easily and applied, which they had trouble to see and imagine. For this purpose, a dynamic material was prepared by using GeoGebra 3D in the direction of parallel with learning outcomes. Following the preparation of the

material, three experts (two specialists in the field of the mathematics education and one visual arts expert) were consulted. A feedback was received from the mathematics education experts on the appropriateness of the material on the topic, the sufficiency of the ability of giving learning outcomes, and the points of practicability. Information was taken from the visual arts expert on the colour and the style of the material. The reorganized material was put into its final form as the result of taking the expert opinions. Following the preparation of the material, the worksheet has been prepared. The moving of the slide, the image the regular hexagonal prism and the surface intersection will be asked on the worksheet. They will be asked to draw this intersection. Following the drawing of the intersections, the students will be asked to check their answers by clicking on the relevant point in the software. It is foreseened that the use of this worksheet will allow the students to see that the intersection has changed as a result of the surface change.

Key Words: Worksheet, Geogebra 3D, intersection face of a regular prism

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Abstract of Poster Presentaions

Dual and Complex Fibonacci and Lucas Numbers

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ABSTRACT

In this study, we define the dual-complex Fibonacci and Lucas numbers. We give the generating functions and Binnet formulas for these numbers. Moreover, the well-known properties e.g. Cassini and Catalan formulas have been obtained.

Key Words: Fibonacci numbers, Lucas numbers, Binnet formula, Catalan formula.

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On The Transversal Intersection Of Special Surfaces Of Timelike Mannheim Curve Pair

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ABSTRACT

In this work, we study the local properties of the intersection curve of the tangent, rectifying developable and Darboux developable surfaces of a timelike Mannheim curve pair. We derive the curvature vector and curvature for the transversal intersection problem. Furthermore, we investigate some characteristic features of the intersection curve for all three cases and give some important results.

Key Words: Mannheim Curve Pair, Rectifying Developable Surface, transversal intersection.

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Notes on Quarter-Symmetric Non-Metric Connection

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ABSTRACT

In this paper, we obtain results on Lorentzian Para-Sasakian manifolds with respect to quarter-symmetric non-metric connection. We deduce ξ-conharmonicly flat and Gauss equations according to quarter-symmetric non-metric connection.

Key Words: LP-Sasakian manifold, ξ-conharmonicly flat, Gauss equation, Quarter symmetric non-metric connection.

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Space-Like Surfaces in 3-Dimensional Minkowski Space

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ABSTRACT

A surface M in Minkowski space is said to be a generalized constant ratio (GCR) if the tangential part of its position vector is one of its canonical principal direction. On the other hand, if the tangential part of the fixed direction in tangent plane of M is one of its canonical principal direction, then in case this surface is called as surfaces endowed with canonical principal direction (CPD). In this talk, first, we will present a short survey on CPD and GCR surfaces in semi-Euclidean spaces. Then, we will give some of classification results for space-like CPD and GCR surfaces that we have obtained recently.

Key Words: Minkowski space, Space-like surface, Canonical principal direction, Angle function.

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Null Mannheim curves with modified Darboux frame lying on surfaces in Minkowski 3-Space

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ABSTRACT

A pair of space curve is called as Mannheim curves, if these space curves whose principal normals are the binormals of another curve. The notion of Mannheim curves was discovered by A. Mannheim in 1878. Also, R. Blum studied a remarkable class of Mannheim curves in [7]. O. Tigano obtained general Mannheim curves in the Euclidean 3-space in [8]. Recently, H. Liu and F. Wang studied the Mannheim partner curves in Euclidean 3-space and Minkowski 3-space. They obtained the necessary and sufficient conditions for the Mannheim partner curves in [9]. This work is motivated by [6].

In that paper, we give some new characterizations for null Mannheim curves related with modified Darboux frame with time-like (space-like) Mannheim partner curves lying on surfaces in Minkowski 3-spaces. Also, we obtain some new characterization for these curves.

Key Words: Mannheim partner curve, Null curve, Space-like surface, Lorentzian surface, Minkowski space.

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New frame for null curves in Minkowski 3-Space

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ABSTRACT

In a semi-Riemannian manifold, there exist three families of curves, that is, space-like, time-like, and null or light-like curves, according to their causal characters. In the case of null curves, many different situations appear compared with the cases of space-like and time-like curves. The theory of Frenet frames for a null curve has been studied and developed by several researchers in this field (cf. [5] - [10]). In [10] Ferrandez, Gimenez and Lucas introduced a Frenet frame with curvature functions for a null curve in a Lorentzian manifold, and studied null helices in Lorentzian space forms.

In that paper, we defined new frame as modified Darboux frame for null curves lying on surfaces in Minkowski 3-spaces.

Key Words: Null curve, Space-like surface, Darboux Frame, Minkowski space.

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Congruence Equations Related to Suborbital Graphs

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ABSTRACT

This work combine different fields of mathematics such as algebra, geometry, group theory and number theory, it can be seen as an example of multidisciplinary approach which offer a new understanding of some situations. We consider the action of a permutation group on a set in the spirit of the theory of permutation groups, and graph arising from this action in hyperbolic geometric terms [1,3]. In this study, we take the normalizer of $\Gamma_0(N)$ in

$$PSL_2(\mathbb{R}) = \left\{T: z \mapsto \frac{az+b}{cz+d} : a,b,c,d \in \mathbb{R} \ and \ ad-bc=1\right\}$$

as an object of this topic. Clearly, whether the graph contain a circuit or not depends on the choice of N. We note that some subgraph family has just the hyperbolic paths. All these subgraphs are worthwhile to investigate, because it is well-known that some number theoretical results arise from the action of some Fuchsian groups. With this motivation, examining the suborbital graphs of the normalizer, we obtained some results about the solution of the some congruence equations and the sizes of the circuits in the suborbital graphs [2].

Key Words: Möbiüs transformations, Modular group, Fundamental domain.

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Some Properties of Rotational Surfaces via Generalized Quaternions

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ABSTRACT

In this paper, by means of generalized quaternions we determine rotational surfaces and obtain a characterization of these rotational surfaces in four dimensional generalized space $E^4_{\alpha\beta}$.

Key Words: Generalized Quaternions, Rotational Surface, Gauss map.

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On Fibonacci Commutative Quaternions

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ABSTRACT

In this study, the Fibonacci commutative quaternions are introduced. We use the well known identities related to the Fibonacci and Lucas numbers to obtain the relations regarding these quaternions. Furthermore, the Fibonacci commutative quaternions are classified by considering the special cases (elliptic, parabolic and hyperbolic units) of quaternionic units.

Key Words: Fibonacci and Lucas numbers, Commutative quaternions, Fibonacci commutative quaternions.

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On Almost α-Cosymplectic Manifolds with some Tensor Fields

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ABSTRACT

In this presentation, the geometry of almost α-cosymplectic manifolds when they satisfy some certain semi-symmetric conditions are studied. The results related to the effects of semi-symmetric conditions with respect to η-parallelism are given. Finally, illustrating examples on almost α-cosymplectic manifolds depending on α are constructed.

Key Words: Almost α-cosymplectic manifold, Semi-symmetry, Projectively flat, Conformally flat, Concircularly flat, η-parallelity.

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On Three Dimensional Almost α-Cosymplectic Manifolds

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ABSTRACT

In this presentation, we have studied some certain tensor fields on almost α-cosymplectic manifolds of dimension 3. In particular, semi-symmetric, locally symmetric and some pseudo symmetric conditions are examined. Finally, some examples on almost α-cosymplectic manifolds depending on α are given.

Key Words: *Almost α-cosymplectic manifold, Semi-symmetry, Local symmetry, Pseudo symmetry, Conformally flat, η-parallelity.*

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Generalized Fermi-Walker Derivative and Bishop Frame

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ABSTRACT

In this study generalized Fermi-Walker derivative, generalized Fermi-Walker parallelism and generalized non-rotating frame are investigated along any curve in Euclidean space. Initially we investigate the conditions of the generalized Fermi-Walker paralellism of any vector field along any curve in Euclidean space by considering the Bishop frame. Then we show that Bishop frame is generalized non-rotating frame along planar curves with the choice of tensor field.

Key Words: Generalized Fermi-Walker derivative, generalized Fermi-Walker parallelism, generalized non-rotating frame, Bishop frame

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The Fermi-Walker Derivative On The Tangent Indicatrix in Euclid Space

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ABSTRACT

In this study we explained the Fermi-Walker derivative along the tangent indicatrix of a curve in Euclid space. We get a unit speed curve in Euclid space. The concepts of Fermi-Walker derivative, Fermi-Walker parallelism, non-rotating frame and Fermi-Walker termed Darboux vector are analyzed along the tangent indicatrix of any curve in Euclid space. We proved along the tangent indicatrix the Frenet frame is a non-rotating frame.

Key Words: Fermi-Walker derivative, Fermi-Walker parallelism, Non-rotating frame, Fermi-Walker termed Darboux vector, Tangent indicatrix.

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The Fermi-Walker Derivative On The Binormal Indicatrix in Euclid Space

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ABSTRACT

In this study we investigated the Fermi-Walker derivative along the binormal indicatrix of a curve in Euclid space. A unit speed curve is considered in Euclid space and analyzed its Fermi-Walker derivative. Then Fermi-Walker parallelism, non-rotating frame and Fermi-Walker termed Darboux vector are given along the binormal indicatrix of any curve in Euclid space. And then we proved along the binormal indicatrix the Frenet frame is a non-rotating frame.

Key Words: Fermi-Walker derivative, Fermi-Walker parallelism, Non-rotating frame, Fermi-Walker termed Darboux vector, Binormal indicatrix.

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Bertrand-B Curves in 3-Dimensional Minkowski Space

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ABSTRACT

In this work, we study timelike Bertrand-B curves having timelike-Bertrand-B mates in three dimensional Minkowski space. Meantime, we use type-2 Bishop frame to define this curves and its mates. We give a lemma which presents the conditions of existence of timelike Bertrand-B curve and within this period, state the fact that the curve to be the Bertrand-B curve is possible only if there exists a mate of it. In addition, we also obtain the some significant results.

Key Words: Bertrand-B curve, Type-2 Bishop frame, 3-dimensional Minkowski space.

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Some Properties of Neutrosophic continuity

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ABSTRACT

In this study, we define the neutrosophic continuous function, neutrosophic open function, neutrosophic closed function and neutrosophic homeomorphism on neutrosophic topological spaces. Then, we introduce some properties of these functions.

Key Words: Neutrosophic set, neutrosophic topological space, neutrosophic continuous function, neutrosophic open function, neutrosophic homeomorphism.

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A New Perspective to the Fundamental Theorem of Non-null Curves in 3-Dimensional Minkowski Space

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ABSTRACT

We deal with the problem of constructing the general equations including curvature functions (i.e. and) of non-null curves in 3-dimensional Minkowski space. While doing this, we reconstitute the fundamental theorem of curves by means of a new local coordinate system described such that there exists 'steady' solutions for non-null curves, that is, there exists vector fields (i.e. T,N,B) for each given differentiable the curvature κ and the torsion τ functions.

Key Words: Frenet frame, Local coordinate system, Minkowski space.

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Determination of Bertrand Curves in 3-Dimensional Minkowski Space E_3^1

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ABSTRACT

In this study, we examined the Bertrand curves and Bartrand curve pairs in 3- dimensional Minkowski space. A method to construct Bertrand curves and Bertrand curve pairs with the help of both timelike and spacelike curves is presented in 3- dimensional Minkowski space. Finally, some examples are given to illustrate our method.

Key Words: Bertrand curve, Minkowski space.

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On the geometry of *f*-Kenmotsu manifols with respect to the Schouten-van Kampen connection

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ABSTRACT

In this paper we classify 3-dimensional f-Kenmotsu manifolds with respect to the Schouten-van Kampen connection.

Key Words: Almost contact metric manifolds, the Schouten-van Kampen connection, semisymmetry, Ricci solitons.

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Developed Motion of Robot End-Effector of Spacelike Ruled Surfaces (The Second Case)

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ABSTRACT

The trajectory of a robot end effector is described by a ruled surface and a spin angle about the ruling of the ruled surface. In this paper, we analyzed the problem of describing trajectory of a robot end-effector by a spacelike ruled surface with spacelike ruling. We obtained the developed frame $\{k_1, r_1, t_1\}$ by rotating the generator frame $\{r, t, k\}$ at an Darboux angle $\theta = \theta(s)$ in the plane $\{r, k\}$, which is on the striction curve β of the spacelike ruled surface X. Afterword, natural frame, tool frame and surface frame which is necessary for the movements of robot are defined derivative formulas of the frames are founded by calculating the Darboux vectors. Tool frame $\{O, A, N\}$ are constituted by means of this developed frame. Thus, robot end effector motion is defined for the spacelike ruled surface φ generated by the orientation vector $k_1 = O$. Also, by using Lancret curvature of the surface and Darboux angle in the developed frame the robot end-effector motion is developed. Therefore, differential properties and movements an different surfaces in Minkowski space is analyzed by getting the relations for curvature functions which are characterized a spacelike ruled surface with spacelike directix. Finally, to be able to get a member of trajectory surface family which has the same trajectory curve is shown with the examples in every different choice of the Darboux angle which is used to described the developed frame.

Key Words: Curvature theory, Darboux angle, Developed frame, Robot end-effector, Trajectory curve.

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Invariant Submanifolds of f Kenmotsu Manifolds Given with Quarter Symmetric Non-Metric Connection

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ABSTRACT

Firstly we define a special quarter symmetric non-metric connection on f Kenmotsu manifold. We consider invariant submanifolds of f Kenmotsu manifold given with quarter symmetric non-metric connection and we give an example for invariant submanifolds of f Kenmotsu manifold. given with quarter symmetric non-metric connection.

Key Words: Invariant submanifold , f Kenmotsu manifold, Quarter symmetric non-metric connection.

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On Inextensible Flow of a Semi-real Quaternionic Curve in R_2^4

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ABSTRACT

The aim of this study is to obtain a general formulation for inextensible flows of a semi-real quaternionic curve in R_2^4. Necessary and sufficient conditions are provided for flows of a semi-real quaternionic curve. Also, the evolution equations of curvatures are given as a partial differential equation.

Key Words: Curvature flows, inextensible flow, semi-real quaternionic curve.

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On Technological Applications of the Conics

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ABSTRACT

Throughout history, mankind has been influenced by the visibility of geometric shapes such as circle, ellipse, parabola, and hyperbola. Therefore, geometric shapes have been a source of inspiration in the formation of the civilizations and the objects, apparatus and objects that it invented by mankind. The conics were first studied in the B.C. 3rd century by Apollonius, who was a student of Platon. In his first work, Apollonius, Conics, he defined the circular ellipse, parabola and hyperbolic curves as the intersection of any plane of a circular perpendicular cone [1].

In this study, it is aimed to give the daily applications (Fig. 1.) of conics in technology and architecture.

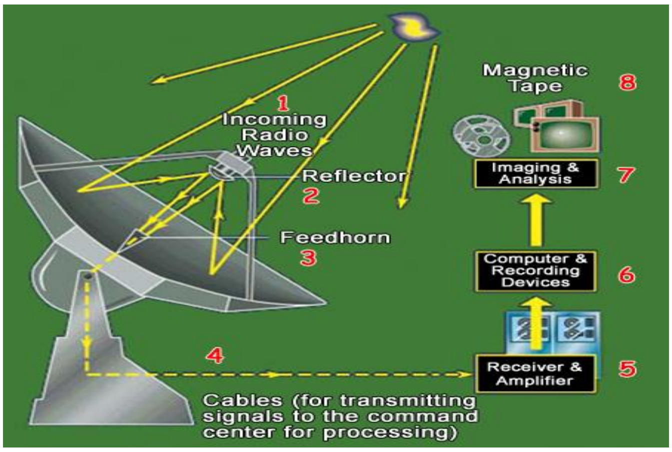

Figure 1. Parabolic antenna application.

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New Representation of The Surface Pencil According to The Modified Orthogonal Frame with Curvature in Euclidean 3-Space

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ABSTRACT

In this paper, we study line of curvature on a surface in E3. By using the Modified frame with curvature, we show that the surface pencil can be expressed as a linear combination of the components of the Modified frame in Euclidean 3-space. Then, we derive the necessary and sufficient condition for the given curve to be the line of curvature on the surface.

Key Words: Surface Pencil, Modified frame, Euclidean space.

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