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[The celebration of the 75-th anniversary of Prof. Emeritus Dr. Constantin Udrişte]

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Abstracts [13 October 2015]

K-groups and their isomorphisms

Adrian Constantinescu, Constantin Udrişte and Steluța Pricopie

Short abstract. *K*-groups and their isomorphisms are the best ingredients to describe families of group laws on Descartes Folium. This new point of view was discovered in the attempt to describe properly the genome of Descartes Folium.

Motion of charged particle in magnetic field created by centered pairs of coplanar rectilinear electrical circuits

Adriana Calotă and Nona Crăciun

Short abstract. In this paper we compare two motions of charged particle in a magnetic field: (i) movement governed by Lorentz Law and (ii) movement as geometric dynamics.

A group arising from fractional calculus and discrete delta potential

Akira Asada

Short abstract. This is a refinement of my previous work "Lie algebra generated by logarithm of differentiation and logarithm [Balkan J. Geom. and Its Appl. 16(2011)]. In this talk, we show this Lie algebra can be thought as the Lie algebra of a group arising from fractional calculus. Moreover it gives relation between these Lie algebra and group, and the Abelian group generated by discrete delta potentials. This is an unexpected result and may shed a light to search physical meanings of above Lie algebra and group.

Spherical product surfaces in Galilean 3-space

Alper Osman Ogrenmis and Muhittin Evren Aydin

Short abstract. In this talk, we introduce the spherical product surfaces of the Galilean plane curves in the Galilean 3-space G_3. We classify such surfaces in G_3 with null curvature. Furthermore, we characterize some special curves on these surfaces in G_3.

The hyperbolic median and its applications

Anastasios Zachos

Short abstract. The hyperbolic median (or weighted Fermat-Torricelli point) is the point which minimizes the weighted sum of the geodesic distances to the given points on the hyperbolic plane $\mathbf{H}^2$. We analyze the existence and uniqueness of the hyperbolic median. Furthermore, we derive three important properties of the hyperbolic median which are the geometric plasticity of geodesic polygons, the dynamic plasticity and the generalized plasticity of geodesic quadrilaterals in $\mathbf{H}^2$.

Transfer matrix scattering theory for optimization of plasmonic nanostructured organic solar cells

Carmen Breazu and Daniela Dragoman

Short abstract. The transfer matrix scattering theory is a suitable mathematical tool for studying the reflection coefficient of a two-dimensional nanostructured solar cell consisting of an array of holes in a metallic surface. Our simulation results, revealing the spectral dependence of this parameter on the geometry of the hole array and on the organic materials, can be used to optimize the performances of organic solar cells.

An anti self dual *SU*(3) Gauge theory on a six dimensional manifold

Cenap Ozel, Ibrahim Sener, Hishamuddin Zauniddin and Adem Kilicman

Short abstract. The bundle of the 2-forms over a 6-dimensional base manifold decomposes to three subbundles such that $\Lambda^2(R^6) \equiv \Lambda_1^2 \oplus \Lambda_6^2 \oplus \Lambda_8^2$ with dimensions 1, 6 and 8, respectively. A duality notion for the 2-forms called Φ-duality is given by the equation $\eta = \lambda_{*_\Phi}(\eta \wedge \Phi)$ and an anti self dual *SU*(3) Yang-Mills theory is studied on the subbundle Λ_6^2.

Presentation of "Treatise on Differential Calculus and Integral Calculus for mathematicians, physicists, chemists and engineers in ten volumes"

Irina Meghea

Abstract. This treatise is jointly written by Constantin and Irina Meghea, and appeared in Old City Publishing, Philadelphia, Editions des Archives Contemporaines, Paris, vol. 1-3 (2013), vol. 4-8 (2014), vol. 9-10 (2015). Its 10 volumes originate from the course of "Mathematical Analysis" delivered by Constantin Meghea along 10 years at the University Politehnica of Bucharest and from his scientific seminar "Functional Analysis and Applied Mathematics" held for teachers and engineers at the same university. Based on the Zermelo - Fraenkel axiom system while the natural numbers are defined by Peano axioms, this treatise represents a modern, rigorous and unitary exposure of differential and integral calculus in $\mathbf{R}^n$ and in $\mathbf{C}$, with extensions to general topology and functional analysis, massively implemented, and to integration on ı-σ-algebras as well. The treatise is self-contained: except for the chapter O and for some isolated cases, every concept used is defined, every proposition used is proven. A special and continuous attention is paid to the concepts, propositions and methods which are at the basis of applied mathematics in natural sciences and engineering. The Lebesgue measure and integral are, probably, the most important creation in the mathematics of the XX-th

century. Together with their axiomatization – the integration with respect to a measure on a σ-algebra, they have directly, and indirectly through integration on differential submanifolds of $\mathbf{R}^n$, a huge impact on natural sciences. Thus, presentation of these theories takes into account for this impact. Moreover, we note that "integration on differential manifolds" has been a ticklish problem. To get together rigor, intuition and at all simple possible proofs and to balance them within the above mentioned subject is a difficult task. Finally, the abstract character of the treatise is strongly tempered on one hand by a torrent of solved exercises and also by figures, these clarifying the concepts and being their intuitive support, and, on the other hand, by numerous applications. To some of them the functional analysis itself offers simple and powerful techniques.

Needle variation techniques for multitime maximum principle

Constantin Udrişte and Ionel Ţevy

Short abstract. Our aim is to justify the strong multitime maximum principle for a multiple integral cost and a controlled *m*-ow constraint using the *m*-needle variations. In return, the weak multitime maximum principle was established by us, for interior multitime optimal control, using variational techniques similar to those in variational calculus. Though the foregoing techniques are not related, the solutions via strong maximum principle are found among solutions via weak maximum principle.

New results in nonholonomic optimization

Constantin Udrişte, Ionel Ţevy, Oltin Dogaru and Mădălina Constantinescu

Short abstract. The geometric topology of Lagrange multipliers is our news for holonomic or noholonomic optimization theory. In this context there are involved the interpretation of Lagrange multiplier as the rate of change of the optimal value with respect to changes in the constraint and PDEs reflecting this fact.

Genesis of heat

Constantin Udrişte, Dorel Zugrăvescu and Florin Munteanu

Short abstract. The heat PDE governs heat diffusion, as well as other diffusive processes, such as particle diffusion or the propagation of action potential in nerve cells. Here we prove that the time heat is born on a bed of standing heat. For that we follow two steps: (i) from time heat to steady-state heat, (ii) from harmonic functions to time heat.

Confromrality in semi-Riemannian context

Cornelia-Livia Bejan and Semsi Elan

Short abstract. Let M be a manifold endowed with a symmetric linear connection. Then on the total space of its cotangent bundle Sekizawa introduced the natural Riemann extension studied by both Sekizawa and Kowalski. On T^*M endowed with the natural Riemann extension, we investigate the harmonicity of several geometric objects.

Multitime recurrences of Samuelson-Hicks type

Cristian Ghiu, Constantin Udrişte and Raluca Tuligă

Abstract. The discrete multitime recurrences of Samuleson-Hicks type were introduce recently by our papers. Originally, Samuelson model marks the first attempt to integrate the multipliers and acceleration principles, in time that Hicks model is considered as an improvement and integration of the earlier models in economics. Our multitime recurrence version give extra math and economic information. The work has been funded by the Sectorial Operational Programme *Human Resources Development* 2007-2013 of the Ministry of European Funds through the Financial Agreement POSDRU/159/1.5/S/132395.

Multitime nonlinear Schrodinger PDE

Cristian Ghiu, Laura Petrescu and Constantin Udrişte

Short abstract. This kind of equation was stated for the first time in our research group. Now we exploit some hypothesis in order to find important explicit solutions. Particularly, we discovered a family of ODEs and a family of PDEs whose solutions generate solutions of multitime nonlinear Schrodinger equation. The work has been funded by the Sectorial Operational Programme *Human Resources Development* 2007-2013 of the Ministry of European Funds through the Financial Agreement POSDRU/159/1.5/S/132395.

Food-chain dynamics in a mangrove ecosystem with harvesting

Cristina Bercia and Romeo Bercia

Abstract. In this paper we have considered a three dimensional ordinary differential system which models a food-chain in a mangrove ecosystem. The important characteristics of the model are the phenomenon of group defense between the populations of level 1 and 2 and harvesting with a constant rate on the top-predator. We establish the domains in the parameters space where the equilibrium points exist and also those that ensure their local stability. We find numerically a point of supercritical Hopf bifurcation as the value of the harvesting rate parameter is varied and in consequence the system admits a stable limit cycle. We deduce the important types of dynamics of the system and by numerical integration, we obtain the phase portraits for these dynamics and plots of time course for the corresponding solutions.

Submanifolds in metallic Riemannian manifold

Cristina-Elena Hreţcanu and Mircea Crâşmăreanu

Abstract. In this paper we focus on the properties of structures induced on submanifolds in metallic Riemannian manifolds, due to an analogy with the theory of submanifolds in almost product manifolds. The notion of metallic structure on a Riemannian manifold was introduced by the authors of this paper as a generalization of the golden structure defined and studied in previous papers. A metallic structure on a Riemannian manifold is a structure defined as a polynomial structure determined by an (1,1)- tensor field J which satisfies the equation $J^2 - pJ - q = 0$ (where the parameters p and q are positive integer values) and the metric g is J-compatible (i.e., $g(JX,Y)=g(X,JY)$).

Space-time quantile surfaces of non-stationary random fields: a comparison study

Dana Sylvan, Constantin Tarcolea and Adrian Paris

Short abstract. We present statistical methodology for estimation and prediction of quantile fields in flexible settings. Specifically, we compare and contrast quantiles of space-time separable and non-separable processes, and illustrate the findings through Monte Carlo simulations. These quantile estimates make a versatile exploratory tool that may be used to describe various distributional characteristics for data with complex spatial and temporal dependencies and have countless applications in many disciplines.

Measures of noncompactness and their applications in FK spaces and fixed point theory

Eberhard Malkowsky

Short abstract. We give an axiomatic introduction of measures of non-compactness in complete metric spaces, and a survey of their most important properties. Furthermore we consider the most popular measures of non-compactness, in particular, the Kuratowski and Hausdorff measures of non-compactness. Finally we demonstrate how they can be applied in the characterization of classes of compact operators between FK spaces, and in fixed point theory.

New aspects of Ionescu-Weitzenbock's inequality

Emil Stoica, Nicuşor Minculete and Cătălin Barbu

Short abstract. In this paper we obtain the Ionescu-Weitzenbock inequality, using the circumcircle mid-arc triangle and we present an improvement of the Finsler-Hadwiger inequality. Also we provide several refinements and some applications of this inequality. Finally, a version of the Ionescu-Weitzenbock inequality in the general case of an Euclidean vector space, is determined.

The Dirac equation in parabolic cylindrical coordinates and possible effects of the spinor structures in quantum physics

Elena Ovsiyuk, Anastasia Red'ko, Vladimir Balan and Viktor Red'kov

Abstract. The Physics of spinor Lorentz group significantly differs from the one based on the orthogonal Lorentz group $L_{+-}^{\uparrow\downarrow}$, and only experiments may decide on this problem. In this context, the study of the fermion parity problem based on investigating possible single-valued representations of spinor coverings of the extended Lorentz group shows that P-parity and T-parity for a do not exist as separate concepts. Instead of this, only some unified concept of (*PT*)-parity can be determined in group-theoretical terms. The extension procedure which describes a space with spinor structure is performed by relying on cylindrical parabolic coordinates. This is done by expanding the region $G(t,u,v,z) \mapsto \widetilde{G}(t,u,v,z)$, so that instead of the half-plane (u,v>0) the entire plane (u,v) is used, while considering new identification rules for the boundary points. In the Cartesian picture, this procedure corresponds to taking the two-sheet surface $(x',y') \oplus (x'',y'')$ instead of the one-sheet surface (x,y). The solutions of the Klein-Fock-Gordon equation include four types of possible solutions: $\Psi_{++}, \Psi_{--}, \Psi_{+-}, \Psi_{-+}$. The first two ones, Ψ_{++} and Ψ_{--}, provide single-valued functions of the vector space points, whereas the last two, Ψ_{+-}, Ψ_{-+}, have discontinuities in the frame of vector spaces, and therefore they are be discarded in this model. However, all the four types of functions are continuous ones, while regarded in the spinor space. It is established that all the solutions $\Psi_{++}, \Psi_{--}, \Psi_{+-}$ and Ψ_{-+} are orthogonal to each other, provided that integration is done over the extended region of integration which covers the spinor space. Similar results are obtained for the Dirac equation. The solutions of the type $(--),(++)$ are single-valued in the space with vector structure, whereas the solutions of the types $(-+),(+-)$ are not single-valued in the space with vector structure, so the solutions of types (-+) and (+-) must be discarded. However, they are valid solutions in the space with spinor structure.

Contact structures on the indicatrix of a complex Finsler space

Elena Popovici and Nicoleta Aldea

Abstract. By considering the complex indicatrix as an embedded CR-hypersurface of the holomorphic tangent bundle in a fixed point, we discuss some aspects of the relation of its CR structure and the contact structure introduced on it. The integrability of CR-distributions defined on the complex indicatrix determine the normality of the contact metric structure. Also, we describe almost contact structures subordonated to the indicatrix CR-structure, then different associated linear connections and with their help we define geometric invariants related to CR structure.

About the Hamilton-Poisson structures of the Kermack-McKendrick SIR model

Florian Munteanu

Short abstract. Using the geometric methods of the Hamilton-Poisson mechanics and appropriate numeric tools we will made a study of the classical Kermack-McKendrick model of evolution of epidemics. This three dimensional dynamical system is also known as the SIR model, where *S* is the number of individuals suspected of being infected, *I* is the number of infected individuals and *R* denotes the number of individuals removed.

A special relativistic approach of non equilibrium thermodynamic with internal variables

Francesco Farsaci and Patrizia Rogolino (communicated by prof.dr. Constantin Udrişte)

Abstract. The extension of the Kluitenberg's theory to the special relativistic case for thermo-mechanical model with internal variables is presented. In particular, as in the classical scheme, it is assumed that the entropy density in an inertial frame of reference will depend on the density of internal energy, on the total strain tensor and on a tensorial internal variables. After having indroduced the relativistic equilibrium stress tensor, the relativistic viscous stress tensor and the relativistic memory stress tensor, the expression for the entropy production is obtained.

Finslerian mathematical models in Physics

Francisc Klepp

Short abstract. The Finslerian approach leads to an extension of the Riemannian general or special theory of relativity and brings forth new concepts of space-times. In this talk we shall present applications of Finsler geometry in Physics. We describe the Rund equivalence of variational problems in Lagrange and Hamilton spaces and analyze a mathematical model in Optics. The internal symmetries of physical fields and their invariance are described in terms of the invariance properties of the indicatrix.

On a family of curves

Gabriel-Teodor Pripoae

Short abstract. We study some differential geometric invariants associated to a family of plane curves.

On a Lichnerowicz type cohomology attached to a function

Ida Cristian

Abstract. In this paper we define a new cohomology of a smooth manifold called Lichnerowicz type cohomology attached to a function. Firstly, we study some basic properties of this cohomology as dependence on the function, singular forms, relative cohomology, Mayer-Vietoris sequence, homotopy invariance and next a regular case is considered. The notions are introduced using techniques from the study of two cohomologies of a smooth manifold: the Lichnerowicz cohomology and the cohomology attached to a function.

Riemann solitons on some classes of Riemannian manifolds

Iulia Elena Hirică

Abstract. Geometric flows, as a class of important geometric partial differential equations, have been highlighted in many fields of theoretical research and practical applications. The Ricci flow has proven to be a very useful tool in understanding the topology of arbitrary Riemannian manifolds. A large number of innovations that originated in Hamilton's 1982 and subsequent papers have had a profound influence on modern geometric analysis. Ricci solitons are natural generalizations of Einstein metrics. They can be viewed as fixed points of the Ricci flow, as dynamical system on the space of Riemannian metrics modulo difeomorphisms and scalings. Motivated by these ideas, along the line of constant sectional curvature manifolds, we extend this concept and consider on Kahler and Sasaki manifolds the notion of Kahler-Riemann solitons and Sasaki-Riemann solitons as fixed points of Kahler-Riemann flow and Sasaki-Riemann flow, respectively. The aim of this paper is to classify the gradient Kahler-Riemann solitons. We characterize the gradient Sasaki-Riemann solitons with harmonic potential function. One considers also the Sasaki-Riemann solitons, when the associated vector field is generated by the Reeb vector field.

Multitime nonlinear evolutions and soliton solutions (outline of the PhD Thesis)

Lavinia Laura Petrescu

Abstract. The PhD Thesis "*Multitime Nonlinear Evolutions and Soliton Solutions*" unifies the scientific results achieved in the study of certain NLPDEs, such as the sine-cosine-Gordon PDE, the reaction-diffusion PDE, the KdV equation and the nonlinear Schrödinger equation, in the following directions: the obtaining of the linearized and adjoint equations and the test of the nonlinear self-adjointness; the construction of some conservation laws of a certain version of the KdV equation, which proved to be nonlinearly self-adjoint; the application of the geometric multitime formalism to create multitime NLPDEs, as geometrical prolongations of the corresponding single-time equations; the finding of the multitime solutions of the multitime PDEs considered, of the form of the multitime solitons and, in particular, of the *multitime spatial solitons*; the obtaining of some special and nonclassical multitime solutions of the multitime nonlinear Schrödinger equation.

Symmetries of second order differential equations on Lie algebroids

Liviu Popescu

Short abstract. In this paper we investigate the relations between semispray, nonlinear connection, dynamical covariant derivative and Jacobi endomorphism on Lie algebroids. Using these geometric structures, we study the symmetries of second order differential equations in the general framework of Lie algebroids.

On some variations related to jerk motions

Marcela Popescu and Paul Popescu

Short abstract. The purpose of this paper is to study some jerk motions considering some dynamic cases, other than the classical ones and extending the setting. We consider a special set of variations, finding a set of jerk motions, extending some cases known only in some particular forms till now. Finally we give a simple mechanical interpretation of these ideas. The subject is topical because we model a less studied type of movements that can lead to interesting new developments.

A dynamic game on green supply chain management. Advances on optimal control and its applications

Massimiliano Ferrara

Abstract. We establish a dynamic game to allocate Corporate Social Responsability (CSR) to the members of a supply chain. We propose a model of three-tier supply chain in decentralized state that is including supplier, manufacturer and retailer. For analyzing supply chain performance in decentralized state and the relationships between the members of supply chain, we use Stackelberg game and a hierarchical equilibrium solution for a two-level game. Specially, we formulate a model that crosses through multi-periods by a dynamic discreet Stackelberg game. We obtain an equilibrium point at where both the profits of members and the level of CSR taken by supply chains are maximized.

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Topological and differential invariants of singularities of 3-webs

Mikhail Malakhaltsev

Short abstract. A 3-web with singularities is an ordered collection of three one-dimensional distributions L_1, L_2, L_3 on a 2-dimensional manifold M. The subset Σ where these distributions are not pairwise transversal is called the singularity set Σ. Under some conditions on Σ, we

find the topological and differential invariants of the 3-web with singularities at the points of Σ. Also we provide examples of calculations of these invariants.

Homothetical and translation hypersurfaces with constant curvature in the isotropic space

Muhittin Evren Aydin and Alper Osman Ogrenmis

Short abstract. In addition Euclidean geometry on Cartesian n-space $\boldsymbol{R}^n$, there is another important geometry on $\boldsymbol{R}^n$, called isotropic geometry. It provides one of the Cayley-Klein geometries on $\boldsymbol{R}^3$. In this talk, we completely classify the homothetical and translation hypersurfaces in the isotropic (n+1)-space with constant curvature.

Biot-Savart-Laplace operator in 4-space

Nona Crăciun, Adriana Calotă, Constantin Udrişte and Ionel Ţevy

Short abstract. Let Ω be a compact domain in a 4-space and VF(Ω) be the space of smooth vector fields on Ω with the L^2 scalar product. We analyze some properties of the Biot-Savart-Laplace operator

$$BSL(V,W):\mathrm{VF}(\Omega)\times\mathrm{VF}(\Omega)\to\mathrm{VF}(\Omega),\quad BSL(V,W)(y)=\frac{1}{4\pi^2}\int_\Omega V(x)\times W(x)\times\frac{y-x}{\|y-x\|^4}\,d(vol_x).$$

Inverse problems and approximation related to the Markov moment problem

Octav Olteanu

Abstract. One approximates geometrically the solutions of nonlinear systems with infinitely many nonlinear equations and unknowns (inverse problems solved starting from the moments), by means of a solution of a Markov moment problem. Thus, one solves and generalizes problems studied in the literature by some other methods. The results on this subject are stated and proved in arbitrary several dimensions. On the other hand, one applies polynomial approximation on special closed unbounded subsets, to the real multidimensional moment problem. One considers also moment problems not necessarily involving polynomials.

Higher order nonholonomic constraints

Paul Popescu and Cristian Ida

Short abstract. The dynamics governed by higher order Lagrangians and Hamiltonians, in the presence of nonholonomic higher order constraints adapted to foliations, are studied. Some regularity conditions are considered. Some examples, especially based on a particle dynamics, are given.

On Randers geodesic-based computational model and river-type perturbation with application to navigation

Piotr Kopacz

Short abstract. We consider the Finslerian approach to the solution of Zermelo's navigation problem with application of Randers metric under river-type perturbation versus the variational solution via Euler-Lagrange equations stated in [P. Kopacz, Application of codimension one foliation in Zermelo's problem on Riemannian manifolds, Diff. Geom. Appl. 35 (2014), 334-349] in the context of the real application in the navigational Spatial Information Systems.

Semigroup theory applied to a differential equation considered by Datko

Sânziana Caraman

Short abstract. The present work deals with a class of neutral functional differential equations with finite delays. Semigroup theory and linear operators results are used to establish sufficient conditions for the exponential stability of the differential equation.

Geometry associated to relevant PDEs

Teodor Ţurcanu and Constantin Udrişte

Short abstract. Differential geometry of the graphs of solutions of partial differential equations (PDEs) produce surprising information for specific events described by the equations. In this paper, we develop geometries for some relevant PDEs.

Structural properties of multidimensional continuous-discrete systems in the geometric approach

Tiberiu Vasilache, Valeriu Prepeliţă and Mona Doroftei

Abstract. A class of (q,r)-D multidimensional continuous-discrete control systems is considered, where the formulae of the state and of the input-output map are obtained and the structural properties of controllability and observability are studied. Within the Geometric Approach, the space of all controllable states of a system is characterized as the minimal subspace of the state space, which is invariant with respect to the drift matrices and which includes the image of the input matrix. Similarly, the space of all unobservable states is characterized as the maximal subspace of the state space which is invariant with respect to the drift matrices and which is included in the kernel of the output matrix. Two algorithms are provided which compute theses subspace and suitable *Matlab* programs are given. An example illustrates the behavior of the proposed methods.

Windows application for visualization of potential surfaces

Vesna Velickovic, Zeynep Odemis Ozgur and Faruk Ozgur

Short abstract. We give an overview of our Windows application for potential surfaces and the appropriate Wulff's crystals. We explain the user interface as well as some technical details of implementation of programs.

Jet prolongations of the projectable characteristic vector fields of a commutative and characteristic deformation algebra

Valentin Gabriel Cristea

Short abstract. Our purpose is to develop the jet prolongations of the projectable characteristic vector fields of a commutative and characteristic deformation algebra.

A mathematical model for the general ridged waveguide for electromagnetic field

Valerică Costin, Romeo Bercia and Dorel Homentcovschi

Short abstract. We propose a method for analyzing the waveguides with many ridges along the propagation direction and/or with the cross section in steps. Asymmetric waveguides can be analyzed.

Convex mappings between Riemannian manifolds

Vasile Arsinte and Andreea Bejenaru

Abstract. Starting from the second fundamental form of a differential mapping between arbitrary dimensioned Riemannian manifolds, this paper defines, in a natural way, their convexity. The classical concept of geodesic and the new concept of convex (concave) curve on a Riemannian manifold are expressed in relation to convex mappings. Some analytical and geometric descriptions are given in order to establish the position of convex mappings in the context of other remarkable applications, such as harmonic, subharmonic, superharmonic and totally geodesic ones.

3D face analysis from digital camera images

Vic Patrangenaru, David Yao and Vladimir Balan

Abstract. The 3D face analysis we are conducting is a landmark based uncalibrated digital camera images. The data points are recorded using MATLAB and a recent computer vision software. Our statistical analysis is done on a 3D projective shape space $P\Sigma_3^k$ of k landmarks including a projective frame at specified landmark indices. This space has a manifold structure of product of k-5 copies of $\boldsymbol{R}P^3$, thus allowing for the use of asymptotic theory for Veronese-Whitney means on projective shape manifolds. Furthermore this space has an additional structure of Lie group, which is of great use when dealing with unmatched pairs of data.

On holomorphic jets bundle $J(2,0)(M)$ with Randers metric

Violeta Zalutchi

Short abstract. Using the theory of the jet bundle $J(2,0)(M)$, we define and study the geometrical theory of a Randers space of order two.

Multi-time geometrodynamics of compressed Langmuir monolayer: the Finsler - Lagrange approach

Vladimir Balan, Galina Grushevskaya, Nina Krylova and Mircea Neagu

Abstract. A geometro-thermodynamical approach is proposed for the description of the two-dimensional (2d) first-order phase transition in monomolecular layers (monolayers) of amphiphilic molecules on air/water subphase interphase boundary. The electro-capillary forces are considered as informational constraints on a statistical manifold. The proposed approach allows us to describe the structurization of the considered 2d-system with large numbers of relaxation times for statistical microscopic states. The relaxation times are determined from the 2-nd order differential equations which describe the Jacobi fields. At such times, the compression of congruence of geodesic trajectories changes by expansion and conversely. It is shown that the geometro-dynamics of the 1-st order phase transition in Langmuir monolayers is appropriately modeled by the constructed Finsler-Lagrange structure.

MKdV equations related to the $D_4^{(1)}$ and $D_4^{(2)}$ algebras

Vladimir Gerdjikov

Short abstract. We analyze the hierarchy of soliton equations associated with the untwisted affine Kac-Moody algebras $D_4^{(1)}$ and $D_4^{(2)}$ by calculating the corresponding recursion operators. The Hamiltonian formulation of the equations from the hierarchy is also considered. As an example we have explicitly presented the first non-trivial member of the hierarchy, which is an one-parameter family of mKdV equations related to $D_4^{(1)}$. We also consider the spectral properties of the Lax operator and introduce a minimal set of scattering data.

Integral formulae for codimension-one foliated Finsler manifolds

Vladimir Rovenski and Pawel Walczak

Abstract. We consider a closed codimension-one foliated Randers manifold (M, F, α, β), α being the norm of a Riemannian structure a and β a 1-form of α-norm smaller than 1 on M. Using a unit vector field ν orthogonal (in the Finsler sense) to the leaves we define a new Riemannian metric g on M which depends nicely on (α,β). For that g, under natural assumptions on β which simplify derivations, we calculate several geometric invariants of F, express them in terms of the corresponding invariants arising from α and some quantities related to β. Then, using the integral formulae from [V. Rovenski and P. Walczak, *Integral formulae on foliated symmetric spaces*, Math. Ann. 352 (2012), 223--237] for F on (M, g), we produce the integral formulae for F on (M, α, β). They generalize the formulae in [F. Brito, R. Langevin and H. Rosenberg, *Intégrales de courbure sur des variétés feuilletées,* J. Diff. Geom. 16 (1981), 19--50], which show that integrals of mean curvatures (of arbitrary order k) for codimension-one foliations on closed manifolds of constant sectional curvature K depend only on K, k, dim M and the volume of the manifold, not on a foliation.

Applicability of Geometry to reliability models

Zaher Abdul Haddi Hassan and Constantin Udrişte

Short abstract. In this paper we evaluate reliability polynomial of a complex system (power plant, circuit etc.) by using Boolean truth table method. Than we analyze this polynomial by geometrical ingredients in order to understand the behavior of the complex system.