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MONTE CARLO INVESTIGATION OF LIGHT-IONS FRAGMENTATION IN WATER TARGETS

J. SOLTANI - NABIPOUR, Maria Anca POPOVICI, Ligia STRASSER, Gheorghe CĂTA - DANIL

The use of ion beams in cancer therapy requires accurate understanding of the complex processes of ion interaction with matter, as it is the production of secondary particles. During irradiation therapy, secondary neutrons, protons and heavier ions contribute to the prompt and delayed dose delivered to tumor and healthy tissues. In this respect production of light fragments is of special interest. These particles are transported through the bio-tissues broadening the irradiation field and increasing the risk of secondary effects. Therefore in this work, isotope yield produced by $^{12}$C, $^{14}$N and $^{16}$O at 400MeV/u in water was studied. The numerical simulations show that the highest yield fragments are the low-charged particles generated in the entrance area of target then propagating behind the Bragg peak.

Keywords: Heavy ions; Isotope yield, Fragmentation

A STUDY OF THE OPTICAL PROPERTIES OF QUANTUM WELL SOLAR CELLS AIMED AT OPTIMIZING THEIR CONFIGURATION

Paul STERIAN, Silvian FARA, Laurentiu FARA, Mihai IANCU

This paper is based on the original contributions developed within the CEEX project Research regarding the efficiency increasing of nanostructured photovoltaic cells –NANO PV (2006-2008) [1] regarding the influence of the optical parameters of the quantum well solar cells, upon conversion efficiency. It was considered optical modelling and simulation for absorption coefficient, refraction index, as well as upon reflectance. It was established the optimized configuration of the Multi – Quantum Wells (MQW).

Key words: quantum well solar cells, optimization, quantum confining, multi-band structure, hybrid model
HYDROSTATIC PRESSURE AND TEMPERATURE EFFECTS ON THE DONOR BINDING ENERGY IN ASYMMETRICAL SQUARE QUANTUM WELLS

Nicoleta ESEANU, Ecaterina C. NICULESCU

We calculated the effects of the hydrostatic pressure and temperature on the binding energy for centric shallow donors in asymmetrical GaAs/AlGaAs quantum wells, within the effective mass approximation and variational approach. We found that the pressure, temperature and asymmetry effects are mainly observed when the quantum confinement due to the barrier potential are stronger.

Keywords: asymmetrical quantum wells, pressure effect, binding energy

PATTERN FORMATION AND SELECTION IN NANOTUBE ARRAYS

Ágnes E. HORVÁTH, Ferenc JÁRAI-SZABÓ, György KAPTAY, Robert VAJTAI, Zoltán NÉDA

Engineering practically interesting spatial patterns on nano- or micron scales is a top priority in modern material sciences. A convenient and relatively easy way to achieve this is through capillary self-organization. In the present work we study and model a nanotube array wetted by a liquid, which self-organizes during drying. As a result of the capillary and adhesion forces acting between the nanotubes puzzling cellular patterns appear, which can be useful for practical applications. Here, the originally three dimensional problem is mapped in a two-dimensional spring-block model. The resulting spring-block model is studied by stochastic cellular-automata like computer simulations.

Keywords: pattern formation, spring-block models, nanotubes

LIVE/DEAD CELL ASSAY BASED ON DIELECTROPHORESIS-ON-A-CHIP

Ciprian ILIESCU, Guillaume TRESSET Florina S. ILIESCU, Paul E. STERIAN

The paper presents a field-flow separation method of particle populations in a dielectrophoretic (DEP) chip with asymmetric electrodes under continuous flow. The structure of the DEP device (with one thick electrode that defines the walls of
the microfluidic channel and one thin electrode), as well as the fabrication and characterization of the device were previous described. A characteristic of this structure is that it generates an increased gradient of electric field in the vertical plane that can levitate the particles experiencing negative DEP. The separation method consists of trapping one population to the bottom of the microfluidic channel using positive DEP, while the other population that exhibits negative DEP is levitated and flowed out. Viable and nonviable yeast cells were used for testing the separation method.

**Keywords:** BioMEMS; dielectrophoresis; cell separation; microfluidics

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**MODELING WITH THE CHAOS GAME (II). A CRITERION TO DEFINE THE RELEVANT TRANSITION PERIODS IN ROMANIA**

Eugen I. SCARLAT, Constantin P. CRISTESCU, Cristina STAN, Mona MIHAILESCU

The paper is focusing on a new partition method of the transition époque suffered by the Romanian economic system in the last two decades as revealed by the Romanian Leu-United States Dollar exchange rate time series. By extending the results of a previous work, the method is considering the time evolution of the quartiles and the extent to what the real sub-series could generate the fractal self-similar structure “Sierpinski gasket” by using the iterative procedure of Chaos Game type. The method is supported by the historical evolution of the events.

**Keywords:** Chaos game, time series, partition criterion, Romanian transition.

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**STUDY OF THE SOLITONS PROPAGATION THROUGH OPTICAL FIBERS**

Dan Alexandru IORDACHE, Andrei PETRESCU, Viorica IORDACHE

The specific features: a) non-linearity type, b) dispersive properties of the propagation medium, c) pulses coherence features, d) propagation equations, e) maintenance procedures, f) technical applications, etc. were studied both for some typical optical [e.g. the: (i) quadratic (QNLS), (ii) Kerr (cubic, CNLS), (iii) saturable (SNLS), (iv) discretized (DNLS), Schrödinger non-linear kind solitons] and for some acoustic [e.g.: (i) Korteweg-de Vries, (ii) Boussinesq, (iii) Burgers, (iv) sine-Gordon] solitary pulses. A detailed study of the discretizations used by the different numerical
simulations and a comparison of the solitary pulses of the “bell” (breather) and “kink” types was also achieved.

**Keywords:** Non-linearity, dispersive properties, pulses coherence, optical (NLS) solitons, acoustic solitary waves, solitons propagation simulations

**SOME RESULTS IN ALIGNING LONG RANGE AREA OF SENSORS**

Romeo IONICA

Silicon microstrip detectors represent principal detection elements of particle trajectories in many of particle physics experiments. In the last decade they are used in a very large scale. The main detection unit in the AMS tracker is the silicon sensor. A fast and precise mechanical alignment method of silicon sensors by using alignment pins will be detailed in this paper. The results show that the pin alignment method is fast and precise, and is preferred for assembly of a large area of silicon sensors.

Keywords: **silicon microstrip detector, alignment, AMS, metrology.**

**CORRELATION OF OPTICAL METHODS AND BIOCHEMICAL MEASUREMENTS FOR INVESTIGATION MEMBRANE CHANGES OF NORMAL AND MALIGN TISSUES**

Teodora STEFANESCU, Ion GRUIA, Iuliana-Maria GRUIA, Cornelia MOTOC

The aim of this paper is to join together the opportunities of Mueller optical-coherent tomography for bio-tissues, named MOCT (Mueller optical coherent tomography), with the techniques for polarization, correlation and fractals of MMI (Mueller matrix images) for early diagnosis of cancerous and degenerative pathology of BT (bio tissues). This was realized as a complex analysis of optical and geometrical structures, and of their architecture referring to different levels of hierarchy- fractals and multi-fractals. To attest the validity of the optical method, biochemical measurements (oxidative stress) of experimentally induced tumors were performed.
THE EVALUATION OF SOME PARAMETERS WHICH CHARACTERIZE THE ER\(^{3+}\)-DOPED Ti:LiNbO\(_3\) OPTICAL WAVEGUIDE COUPLERS

Dragos DINU and Niculae N. PUSCAS

In this paper we report some experimental and theoretical results concerning the characterization of a directional coupler in Er\(^{3+}\) :Ti:LiNbO\(_3\) optical waveguides. Based on the mode coupling theory we evaluated the coupling coefficient between two adjacent waveguides of the directional coupler.

The experimental IR transmission spectra of an Er\(^{3+}\) :Ti:LiNbO\(_3\) directional coupler around 1530 nm (which is widely used in optical telecommunications) and the least-square method were used for the evaluation of some other parameters which define the above mentioned device (e.g. the power coupling ratio, the perfect coupling length, the effective interaction length increment and the effective refractive indices, respectively) was performed.

**Keywords:** Er\(^{3+}\) :Ti: LiNbO\(_3\) optical waveguides, directional couplers, power coupling ratio, the perfect coupling length

OPTICAL COMMUNICATION METHODS BASED ON CHAOTIC LASER SIGNALS

Paul STERIAN, Valerică NINULESCU, Andreea-Rodica STERIAN, Bogdan LAZĂR

Numerical investigations of two methods for the information transmission based on a chaotic deterministic carrier are performed. The first is represented by a ring optical cavity with a nonlinear medium inside, while the second refers to the synchronization of two laser diodes. These methods can be used for the transmission on a classical or quantum channel with a high level of information masking.
MULTI-VARIABLE PREDICTION OF PHYSICAL DATA

Dan STEFANOIU, Janetta CULITA

The paper aims to present a comparative study related to different approaches regarding prediction of multi-variable physical data. Data are provided by natural phenomena with geographical distribution (especially ecological and meteorological) and are stored as blocks of time series. Simulations have shown that the prediction accuracy of data increased with their correlation. Three modeling approaches of data are considered: MIMO-ARMA type, a state representation of Kalman-Bucy type and MIMO-ARMAX type. The performance of modeling and prediction algorithms is demonstrated on a meteorological case study.

Keywords: distributed time series, prediction, Kalman-Bucy filter, ARMAX.

UNCERTAINTY ESTIMATION FOR SDAR-OES INTERNAL STANDARD METHOD

Ion PENCEA, Catalin Eugen SFAT, Violeta Florina ANGHELINA

The spark discharge in argon optical emission spectrometry (SDARis theOES) is the most used technique for elemental analysis of metallic alloys due to its highest efficiency/cost ratio. In this field the SR EN 13005/2005 standard and other European documents as EA 4/16 is the EA guidelines on the expression of uncertainty in quantitative testing, EURACHEM /CITAC Guide CG 4, Quantifying Uncertainty in Analytical Measurement (second edition) 2000, etc. require that the uncertainty estimation to be done on the fundamental basics as much as possible. In this sense, the paper addresses mainly an advanced theoretical model for estimation of SDARis theOES internal standard method contribution to the spectrochemical uncertainty budget. In this regard, the authors have introduced new ways of estimation of the standard deviations of the spectral line intensity ratios, mass concentration ratios...
and finally were given a route of computation of compound standard uncertainties for dozed concentrations.

Keywords: uncertainty, standard deviations, SDARis theOES, spectrochemical analysis, internal standard method

ON A PEANO - TYPE AXIOMATICATION FOR FREE MONOIDS

Alina PETRESCU - NIŢĂ, Ana NIŢĂ

It is well-known the Peano axiomatization for the set $\mathbb{N}$ of natural numbers.

If $X$ is a nonempty set and $X^*$ is the monoid of the words over $X$, $X^*$ can be characterized up to an isomorphism by an universality property and also by some internal properties. If $X = \{1\}$ hence a singleton, then $X^*$ is practically $\mathbb{N}$. In this paper, we give an extension of the Peano axioms (from $\mathbb{N}$ to $X^*$) and also a generalization to free small categories.

Keywords: Peano axioms, free monoids, X-dynamics, free categories

MS classification: 03G99; 18D15

A NOTE ON PROPER AFFINE SYMMETRY IN BIANCHI TYPES VIII AND IX SPACE-TIMES

Ghulam SHABBIR, M. RAFIQ

We consider the most general form of Bianchi types VIII and IX space-times for studying proper affine symmetry by using holonomy and decomposability, the rank of the $6 \times 6$ Riemann matrix and direct integration techniques. While studying proper affine symmetry in the above space-times it is shown that there exists only one possibility when the above space-times admit proper affine vector fields.

Keywords: Proper affine vector field; Direct integration techniques.

2000 Mathematics Subject Classification: 83C15, 83C20.
CREDIBILITY FORMULAS ALLOWING EFFECTS LIKE INFLATION

Virginia ATANASIU

In this article we will obtain, just like in the case of classical credibility model, a credibility solution in the form of a linear combination of the individual estimate (based on the data of a particular state) and the collective estimate (based on aggregate USA data).

Keywords: linearized regression credibility premium, the structural parameters, unbiased estimators.

Mathematics Subject Classifications: 62P05.

APPLICATION OF GREEN’S FUNCTIONS IN ANALYSIS OF THE RESPONSE OF AN INFINITE HOMOGENOUS STRUCTURE TO MOVING LOAD

Traian MAZILU

The aim of this paper is to present a numerical method based on the Green’s functions to calculate the response of an infinite homogenous structure to moving load. The structure has two beams continuously supported by elastic layers and represents the common model of the slab track. The high accuracy of the method is proved. The structure response due to stationary and moving harmonic loads is analyzed for both frequency and time domains.

Keywords: Green’s functions, Fourier transform, slab track PDE

Classif: 35C15, 35Q72, 65M99

NONHOLONOMIC GEOMETRY OF GIBBS CONTACT STRUCTURE

Cristina Stamin, Constantin Udriște

The paper connects the Vrânceanu congruence theory with our theory of odd-dimensional nonholonomic thermodynamic systems. To build the Riemannian metric, the authors use certain congruences with thermodynamical meaning. Based on this metric, the differential invariants of the Gibbs-Vrânceanu-Riemann nonholonomic space are built. Further, it is proved that the coefficients of bilinear
covariants and the coefficients of Ricci (with three and four indexes) are signomials, and the tangent vectors to the geodesics are rational functions. As a novelty, one introduces and studies also the submanifold of coefficients of bilinear covariants, the submanifold of Ricci rotation coefficients and the submanifold of Ricci coefficients with four indexes.

**Keywords:** Vrânceanu congruences, nonholonomic thermodynamic system, contact structure, geodesics, Ricci coefficients.

**AMS Subject Classification:** 53D35, 57R15, 74A15.

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**ON UDRISTE ODE AND A PROBLEM OF JIANG**

Gabriel BERCU, Claudiu CORCODEL, Mihai POSTOLACHE

In our paper [1], we introduced a new class of self-concordant functions, defined on Riemannian manifolds endowed with metrics of diagonal type. The aim of this note is twofold. First we introduce a class of self-concordant functions which generate the given metric. Then we give positive answer to an open problem by Prof. Danchi Jiang giving a motivation to the study of self-concordant functions on manifolds. This finalizes some recent results due to the first and to the third author, published in Balkan J.Geom. Appl., 2009.

**Keywords:** self-concordant function, Riemannian manifold, Udriste ODE.

**MSC2000:** 53C 05.

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**SOME NEW TYPES OF VERTICAL 2-JETS ON THE TANGENT BUNDLE OF A FINSLER MANIFOLD**

Adelina Manea

We provide a basis of the vertical bundle of a Finsler manifold, adapted to the Liouville foliation $F_L$. We define the vertical 2-jet bundle $J^2(TM^0)$ and the leafwise, transversal and mixed vertical 2-jet bundles with respect to $F_L$. The main result is the existence of a diffeomorphism between the total space $J^2(TM^0)$ and the total space of the fiber product of the bundles of the leafwise, transversal and mixed vertical 2-jet bundles.
Γ-SEMIHYPERGROUPS AND THEIR PROPERTIES

D. Heidari, S. O. Dehkordi, B. Davvaz

Algebraic hyperstructures are a suitable generalization of classical algebraic structures. In a classical algebraic structure, the composition of two elements is an element, while in an algebraic hyperstructure, the composition of two elements is a set. The concept of Γ-semihypergroups is a generalization of semigroups, a generalization of semihypergroups and a generalization of Γ-semigroups. In this paper, we define the notion of ideal, prime ideal, extension of an ideal in Γ-semihypergroups then we prove some results in respect and present many examples of Γ-semihypergroup. Also, we introduce the notions of quotient Γ-semihypergroup by using a congruence relation, and introduce the notion of right Noetherian Γ-semihypergroups. Finally, we study some properties of fundamental relations on a special kind of Γ-semihypergroups.