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EUCLIDEAN GEOMETRY OF FINSLER WAVEFRONTS THROUGH GAUSSIAN CURVATURE

Vladimir BALAN, Mircea CRASMAREANU

The present paper deals with the Gaussian curvature K of a particular indicatrix in a general Finsler manifold. A formula for K similar to the one obtained by M. Hashiguchi ([2], [3]), is derived for (α, β) -metrics and then specialized to Randers, Kropina, Matsumoto and Riemann-type metrics. For the Funk two-dimensional case the class of Randers surfaces is detailed, and the Randers-Funk metric on the unit disk is investigated. Alternative expressions for K are provided, in terms of Finslerian metric and angular metric, and in terms of Berwald frame for $n = 2$. It is shown that K is h -covariant constant with respect to the Cartan and Chern-Rund connections. The last section describes the pseudo-Finsler locally-Minkowski Berwald-Moor case.

Keywords: Finsler spaces, Gauss curvature, indicatrix, hypersurface, (α, β) -metric, Randers metric, Funk metric, Finsler connection.

MSC2000: 53C60, 53B40.

SUFFICIENT EFFICIENCY CONDITIONS FOR A MINIMIZING FRACTIONAL PROGRAM

Ariana Pitea, Constantin Udriste

We consider the minimizing fractional program (MFP), where the objective is a vector of functionals quotients of paths integrals and the constraints are partial differential inequations (PDI) and partial differential equations (PDE). The aim of this work is to introduce and study sufficient conditions for the efficiency of a feasible solution of the problem (MFP). The results discussed in x2 are new and finalize a recent research initiated in [7] and [8].

Keywords: Efficient solution, PDE, PDI, normal efficient solution.

MSC2000: primary 49J40, 49K20; secondary 58E17, 65K10, 53C65.

A PROPERTY OF LOGARITHMICALLY ABSOLUTELY MONOTONIC FUNCTIONS AND THE LOGARITHMICALLY COMPLETE MONOTONICITY OF A POWER-EXPONENTIAL FUNCTION

Bai-Ni Guo, Feng Qi

In this work, the notion of a "logarithmically absolutely monotonic function" is introduced, the inclusion that a logarithmically absolutely monotonic function is also absolutely monotonic is revealed, the logarithmically complete monotonicity and the logarithmically absolute monotonicity of the function $(1+\alpha/x)^{x+\beta}$ are proved, where α and β are given real parameters. A new proof for the inclusion that a logarithmically completely monotonic function is also completely monotonic is given, and an open problem is posed.

Keywords: absolutely monotonic function, completely monotonic function, Faá di Bruno's formula, logarithmically absolutely monotonic function, logarithmically completely monotonic function, open problem, property

MSC2000: Primary 26A48, 26A51; Secondary 44A10

QUASI-ANALYTIC SOLUTIONS OF FIRST-ORDER PARTIAL DIFFERENTIAL EQUATIONS USING THE ACCURATE ELEMENT METHOD

Maty BLUMENFELD

*It is usually considered that a PDE can have on a two-dimensional integration domain either an **analytic solution** $\phi(x,t)$ (which replaced in the PDE leads to an identity) or a **numeric solution** (represented by a string of numerical values whose accuracy is more difficult to quantify). The integration of a PDE by the Accurate Element Method leads to **Piecewise Polynomial Solutions** represented by a small number of polynomials, each one valid on a single sub-domain (element); they can be considered as **quasi-analytic solutions**. A quasi-analytic solution is suitable for **direct verification by replacing it in the PDE** that leads not to identities but*

*to a quantifiable residual. Based on the value of the residual one can decide either to accept the solution or to resume the computation with modified parameters until an imposed allowable precision is reached. The numerical test introduced by the Accurate Element Method represent a direct and global verification of $\phi(x,t)$ on each element, **being independent on the various steps (the integration history) covered in order to obtain it.***

The goal of this introductory paper is to present the method and some examples. Consequently it is restricted only to the first order PDEs with constant coefficients and to quasi-analytic solutions represented by a 5th degree polynomial with 21 terms and by a 7th degree polynomial with 36 terms

HYSTERESIS MODELING WITH PRANDTL-ISHLINSKII OPERATORS FOR LINEARIZATION OF A (BA/SR)TiO₃ BASED ACTUATOR

Andreea Ioana UDREA, Alexandru COSTINOAIA, Ciprian LUPU, Dumitru POPESCU

The paper presents an experimental study on (Ba,Sr)TiO₃ based actuators hysteretic compartment. The purpose of the study is to model the nonlinearity introduced by the actuator in a positioning system. The classic and modified Prandtl – Ishlinskii technique is used such that the numerical control of the positioning system could also be achieved, by using the inverse model of the actuator. The hysteretic compartment of the actuator was modeled for the normal and extended functioning domain. In both cases the models are accurate and the inverted model based compensators provide good linearization of the effect introduced by the actuator.

Keywords: hysteretic nonlinearity model, numerical compensator

ON THE LAGRANGE COMPLEX INTERPOLATION

Adrian NEAGOE

In this work, I present some results regarding the Lagrange interpolation in the complex domain (cor. prop. 1 and prop. 2). Formula (6) is an extension of the well-known Shannon's sampling formula (7), for sampling equidistant moments. In §2 I present a simple result regarding the sampling in frequency. In §3 I give a multidimensional extension, which does not use the Lagrange interpolation but a distributional approach.

Key words: Lagrange interpolation in the complex domain, sampling theorem, multidimensional sampling theorem.

A METHOD TO COMPARE TWO COMPLEXITY FUNCTIONS USING COMPLEXITY CLASSES

Andrei-Horia MOGOS, Adina Magda FLOREA

The complexity of an algorithm can be expressed as a function, called complexity function. In this paper we study the comparison of two complexity functions using complexity classes. After defining the set of all complexity functions comparable with a given function, we give some properties of this set. The most important results of our paper are some sufficient criteria for two complexity functions to be comparable and some sufficient criteria for two complexity functions to be incomparable.

Keywords: algorithm, complexity function, complexity class, complexity functions comparison

HOMOGENIZATION RESULTS FOR A NONLINEAR WAVE EQUATION IN A PERFORATED DOMAIN

Claudia TIMOFTE

The effective behavior of the solution of a nonlinear wave equation in a periodic perforated domain is analyzed. We consider, at the microscale, a wave equation, with nonlinear sources and suitable initial and boundary conditions. We focus on the case in which the perforations are of the so-called critical size and we prove that the solution of this problem converges, as the small parameter characterizing the size of the holes tends to zero, to the solution of a new problem, containing extra zero order terms. Our paper generalizes some of the results contained in [3], by considering nonlinear sources.

Keywords: homogenization, wave equation, critical holes.

SPECTRAL METHOD FOR SOLVING THE DIFFERENTIAL EQUATIONS INVOLVED IN AB-INITIO TREATMENT OF TUNNEL TRANSISTORS STRUCTURES

Sever SPANULESCU

A new variant of the spectral method for solving the boundary conditions ordinary differential equations, suited to the ab-initio tunneling calculus is presented. By expanding the total potential expression in a series in a Hilbert space, the linear equations derived with the collocation method may admit an initial analytical quadrature for certain basis sets. Our numerical experiments showed an important improvement of the precision due to this supplementary analytical treatment which, combined with the evanescence of the method may be a good advantage for ab-initio calculations

Keywords: spectral methods, evanescence, boundary conditions, ab-initio, tunneling transistors.

MULTIPLE (n,m) -HYBRID LAPLACE TRANSFORMATION AND APPLICATIONS TO MULTIDIMENSIONAL HYBRID SYSTEMS. PART I

Valeriu PREPELIȚĂ

A space of original functions which are continuous with respect to n variables and discrete with respect to m variables is presented. A multiple hybrid Laplace and z type transformation is defined on this set. Its main properties are studied, including linearity, time-delay, translation, differentiation and difference of the original, differentiation of the image. Other theorems such as integration and sum of the original, convolution, initial and final values etc. will be presented in a subsequent paper, as well as some methods to determine the originals.

These properties will be used to solve multiple differential-difference and multiple integral equations and to obtain the frequency-domain representations of multidimensional hybrid control systems.

Keywords: original functions, multiple hybrid Laplace transformation, continuous-discrete (nD) systems

ARC DISCHARGE ION SOURCE DEVELOPMENT AT CERN ISOLDE

Liviu PENESCU¹, Thierry STORA, Jacques LETTRY, Gheorghe CATA-DANIL,
Richard CATHERALL

Within a Marie Curie Early Stage Training project at CERN, a detailed study (experimental, analytical and numerical) of the standard ISOLDE FEBIAD ion sources has been done. A new theoretical model of the global source behavior could be inferred, based on the acquired experimental data. The source model already served to the development of two FEBIAD prototypes which improved the $1+$ ionization efficiencies for the noble gases by 5 to 20 times (depending on element) This development can now serve to future ion

source optimizations, for specific user or facility requirements around the world, especially for the production of high intensity radioactive beams.

Keywords: ion sources, arc discharge, modeling, plasma, CERN, ISOLDE.

EVALUATION OF BIOCOMPATIBILITY AND BIOACTIVITY FOR POLYMETHYL METHACRYLATE – BIOACTIVE GLASS NANOCOMPOSITE FILMS OBTAINED BY MATRIX ASSISTED PULSED LASER EVAPORATION

Laura FLOROIAN, Ion MIHAILESCU, Felix SIMA, Gheorghe STANCIU, Bogdan SAVU

We evaluated the scratch resistance, adherence and hardness for novel polymethyl methacrylate-bioglass (PMMA+BG) composites deposited by matrix assisted pulsed laser evaporation technique on medical titanium substrate, for applications in implantology. The bioactivity of the films was assessed in vitro by soaking the composite material films into simulated body fluid (SBF) followed by Fourier transform infrared spectrometry and confocal scanning laser microscopy analysis to determine the extent of hydroxyapatite formation on the bioactive surface. Interaction between human osteoblasts and tested material was studied by fluorescent mark of cellular proteins: actin and vinculin. The human osteoblasts were shown to cover the entirely structures with which they strongly interact and this is an evidence of the PMMA+BG films biocompatibility.

Key words: bioactive glass, matrix assisted pulsed levaporation, confocal scanning laser microscopy

OIL SPILLS DETECTION FROM FLUORESCENCE LIDAR MEASUREMENTS

Jeni VASILESCU, Luminita MARMUREANU, Emil CARSTEA, Constantin P. CRISTESCU

Fluorescence LIDAR is a useful tool in water pollution monitoring, based on the fluorescence signature of each contaminant. The main goal of this study is to analyze the oil spills detected in late 2007 summer campaign on the Romanian side of Black Sea. Artificial neural network (ANN), linear regression and channels relationship (CRM) methods are evaluated in order to identify the best option for oil spills detection and characterization. It was found that linear regression or channels relationship are suitable to use in order to reveal the distribution of oils on a sea path while ANN is suitable for identifying the type of oils.

Keywords: fluorescence Lidar, oil spills, CRM, ANN

THE MO-SCF QUANTUM APPROACH OF THE 4-BUTYL-OXY-BENZAL-4 ETHYL-ANILINE (BBEA) MOLECULE. (I) QUANTUM ENERGETIC MOLECULAR CHARACTERISTICS

Valer SCRIDONESI-CĂLIN

The liquid crystal (LC) molecule of the smectic type (SLC) 4-butyl-oxy-benzal-4-ethyl-aniline (BBEA) is approached by means of the nonrelativistic molecular quantum mechanics for the first time in literature of the liquid crystals (LC). The BBEA molecule/C₁₉H₂₃ON [44 nuclei, 152 electrons (110 of valence)] from its structural complexity as quantum molecular system imposes a MO-SCF-LCAO/CNDO quantum approach, in its theoretical basis the Hartree-Fock-Roothaan eqs. with LCAO expansion of the molecular orbitals (MO) and with PPP parameters. Using a computing program of MO-SCF type the quantum computations have been performed in the

CNDO-2 approximation. The following quantum energetic MO-SCF characteristics have been obtained for BBEA: the orbital energies, the total electronic energy, the total molecular energy, the bonding energy, the ionization potential, the reduction potential and the width of the forbidden interorbital zone. In present paper the quantum results are interpreted and discussed for BBEA molecule.

Keywords: liquid crystal, smectic liquid crystal molecule, HFR eqs., BBEA molecule, quantum SCF energetic characteristics

LASER FIELD EFFECT ON THE ANOMALOUS POLARIZATION IN SQUARE QUANTUM WELL UNDER HYDROSTATIC PRESSURE

Ecaterina C. NICULESCU, Iulia G. CÂRJEU, Radu C. IONESCU

The polarization of the carriers in an electric field in GaAs/AlGaAs quantum well under the simultaneous action of the high-frequency laser field and the hydrostatic pressure is investigated. The results show that the anomalous polarization of the first excited level is partially compensated by the presence of the laser radiation. The intersubband transition energy can be tuned by changing laser field intensity and hydrostatic pressure.

Keywords: Square quantum well, anomalous polarization, laser field radiation

SURVEY OF HEAVY METAL DEPOSITION IN ROMANIA: TRANSYLVANIAN PLATEAU AND WESTERN CARPATHIANS MOUNTAINS

Adriana LUCACIU, Cornelia MOȚOC, Marian JELEA, Stela Gabriela JELEA

This study is connected to an earlier survey of atmospheric heavy metal deposition started in 1995, for the first time, in Romania. In this paper the results obtained after collecting in 1999 and 2007

(during the summer) 64 moss samples from highly polluted area of some regions of Romania are reported. The aim of this study consists in obtaining the atmospheric deposition patterns of heavy metals trace elements and to reveal air pollution sources affecting the western regions of our country. The heavy metals were determined by using nuclear and non-nuclear methods, such as ENAA and FAAS. To ensure the quality of the measurements we used IAEA certified materials.

CHAOTIC BEHAVIOR OF IDEAL FOUR-LEVEL LASER WITH PERIODIC PUMP MODULATION: II

Mihai CIOBANU, Dan SAVASTRU, S. MICLOS, Marina TAUTAN, Madalin RUSU, Simona DONTU

A predictability investigation using the Grassberger-Proccaccia algorithm is performed for the ideal four - level laser in the case of periodic pump term, continuing a previous research. In addition, maximum Lyapunov exponents are calculated, and chaos is evidenced at the same threshold value of pump frequency by two ways, namely by a sudden decrease in the error-doubling time (computed via the Kolmogorov entropy) and by the change in sign of the maximum Lyapunov exponents. Results are in very good agreement with those obtained in classical literature.

Key words: predictability, chaos, error doubling time, Lyapunov exponents.

PIEZOCERAMICS UNDER ELECTRON IRRADIATION

Irinela CHILIBON

Paper presents aspects concerning the behaviour of PZT piezoceramics at low power electron irradiation. The PZT samples were irradiated into a linear accelerator of electrons with different electron doses, namely: 10 kGy; 15 kGy; 20 kGy; 25 kGy. These

ceramics change slightly their performances after low power electron irradiation, but at 25kGy the piezoelectric charge and voltage constants increase more. However, PZT partial decomposition could occur at high power electron irradiation doses and consequently the loosing coefficients enhance. As remark, the experimental irradiated PZT samples present piezoelectric and dielectric properties with small variations, and the coupling coefficients decrease even at small irradiation doses (below 25 kGy). The obtained results could be an excellent starting point in designing superior ceramic materials with improved parameters, suitable for various piezoelectric transducers applications.

Keywords: piezoceramic, PZT, electron irradiation, electron Accelerator

INFORMING SCIENCE AS CONCEPTUAL FRAMEWORK FOR DEVELOPING INFORMATION SYSTEMS

Radu DOBRESCU

The extensive use of the Information Systems (IS), whose meaning has been growing in diversity and complexity, lead to considerate a new conceptual framework for their development, defined as Informing Science (InfoS). The paper examines the limitations of existing frameworks for defining IS and introduces a new evolutionary approach to state the InfoS definition. To understand InfoS role, the paper analyses the relation between „knowledge” and „information” as these notions appear in the field of Information Technology. Finally some suggestions for the placement of the Informing Science in university study curricula are discussed, as well as its method of segmenting knowledge creation and dissemination.

Keywords: information, knowledge, Information Systems, Informing Science