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MATHEMATICS

PHYSICS

CLASSIFICATION OF NON STATIC SPHERICALLY SYMMETRIC SPACE-TIMES ACCORDING TO THEIR PROPER CONFORMAL VECTOR FIELDS

Ghulam SHABBIR, M. RAMZAN, Amjad ALI

Direct integration technique is used to study proper conformal vector field in non conformally flat spherically symmetric non static space-times. Using the above mentioned technique we show that there exist two possibilities when the above space-times admit proper conformal vector fields.

Keywords: Direct integration technique; proper conformal vector field; Killing vector fields.

ON THE MEDIAN OF A JUMP TYPE DISTRIBUTION

Ştefan V. STEFĂNESCU

In the molecular biology as well as for modeling the social and economical processes it is necessary to determine the change point θ, $a<\theta<b$, of the frequence response from a random variable X. We'll suppose that the variable X has a constant probability density function on the subdomains $[a , \theta]$, respectively $(\theta , b]$ and more, these both constants are inverse proportional with the lengths of the mentioned intervals.

Respecting these restrictions we proved that the estimator W of θ, based on the median index of the random variable X , is biased. The running outputs of a stochastic simulation Monte Carlo procedure confirms the theoretical results.

Keywords : change point, estimation, Monte Carlo simulation, median index, probability density function.

MSC2000 primary : 62F10 ; secondary : 62F12, 65C10, 62P10, 62P20, 62P25.

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BINARY RELATIONS – ADDENDA 2

(SECTIONS, COMPOSABILITIES)

Mihai REBENCIUC

The first addendum from this part of the paper refers to the generalized section of a binary relation - in connection with some properties relative to Boolean algebra relations and operations and generalized categorical operations, respectively with the restrictions and the induced relation of a binary relation. The last addendum is dedicated to the composabilities – equivalent conditions of w-composability [1] and the stronger notion of (dualized) composability with the unification of some known and functional properties; the main results are relative to a hierarchy of the (dualized) recurrent self-composability - useful in different approaches of non- deterministic automata.

Keywords: category of relations, relational systems, category of sets.

MSC2000: Primary18B10, 08A02; Secondary 18B05.

EXPERIMENT FOR THE REDISCOVERY OF THE PERFECT PROPORTION OF RECTANGLES

Andrei DUMITRESCU

The paper presents an experiment carried out for the rediscovery of the perfect proportion of rectangles and for evaluation of the parameters that might influence the perception of this perfect proportion. The evaluated parameters were colour, size and connection radius of rectangles. There were considered several levels of variation for each parameter. It was also analysed the influence of the

subject's gender upon the perception of proportion. The experiment results confirmed the ancient mathematical theory of golden ratio.

Keywords: visual perception, perfect proportion, golden section

RING LASER RESONATOR WITH STIMULATED BRILLOUIN SCATTERING MIRROR

Simona DONȚU, Niculae N. PUȘCAȘ, Vasile BABIN

The results of an theoretical and experimental study of the properties of a ring resonator used with a Nd:YAG laser operating at 1.06 μm are presented. The rates equations arepresented in a rotative system for an optical field distribution and inversion population obtaining the oscillation conditions of a ring laser resonator. With this model a kinetic model for a ring laser resonator with stimulated Brillouin scattering mirror (SBS) was developed. The ring laser resonator contains four plane mirrors and a Nd:YAG rod with a small signal single pass gain. A Brillouin mirror contains a cell with CS_2 is put behind of a lens in exterior of ring resonator. The laser works in free regime with a low coefficient laser resonator. When the intensity of laser radiation increases in the resonator, barrier of the stimulated Brillouin diffusion grows out of and the reflectivity of cell increase, so that the coefficient of resonator is switched.

Using a fast photodiode and a digital oscilloscope (2GHz) we measured the duration of the laser pulse and the energy with a Mollectron detector. The transversal structure of output radiation intensity was monitorised usinga CCD camera and a SPIRICON system.

Keywords: stimulated Brillouin scattering, ring laser resonator, SBS mirror

TWO SPECTRAL SHAPING METHODS OF A BROADBAND FIBRE SOURCE FOR BIOMEDICAL OCT IMAGING

Ramona CERNAT, George M. DOBRE, Adrian Gh. PODOLEANU

The authors report two investigation methods into the spectral shaping of an optical broadband source (BBS) to be used in Optical Coherence Tomography (OCT). The BBS spectrum extends from 450 nm to 1750 nm and is selectively used

in multiple spectral wavebands. Spectral shaping is performed with: (i) an optical filter unit (a combination of dichroic and bandpass filters at different incident angles) and (ii) a double-pass prism sequence (a cube beam splitter, two equilateral prisms and a metallic mirror) which allow the freedom to select the characteristics of the spectrum (central wavelength, spectral bandwidth). BBS can allow imaging with a depth resolution of 2 μm or better. Such a high depth resolution makes BBS suitable for OCT imaging in embryology, cells culture and eye imaging, investigations which will complement the more traditional fluorescence labelling and confocal imaging.

Keywords: Optical coherence tomography, spectral shaping, multiple spectral wavebands, depth resolved imaging

RESULTS AND DISCUSSIONS ON LENGTH INM KEY COMPARISONS

Alexandru DUȚĂ, Gabriela MOCANU

At a meeting held in Paris on 14 October 1999, the directors of the national metrology institutes (NMIs) of thirty-eight Member States of the ***Metre Convention*** *and representatives of two international organizations signed a* ***Mutual Recognition Arrangement*** *(****CIPM MRA****) for national measurement standards and for calibration and measurement certificates issued by NMIs. The technical basis of this arrangement is the set of results obtained in the course of time through key comparisons carried out by the* ***Consultative Committees*** *of the International Committee for Weights and Measures CIPM, the Bureau International des Poids et Mesures BIPM and the regional metrology organizations (****RMOs****), and published by the BIPM in the* ***key comparison database****. This paper presents Results and discussion on INM Length key comparisons for gauge block.*

Keywords: length, key comparisons, gauge blocks

TWO BOUNDARY ELEMENT APPROACHES FOR THE COMPRESSIBLE FLUID FLOW AROUND A NON-LIFTING BODY

Luminița GRECU, Gabriela DEMIAN, Mihai DEMIAN

In the paper there are presented two variants of application of the boundary element method for solving the compressible fluid flow around bodies, one using a distribution of sources on the boundary and the other a vortex distribution. There are obtained numerical results for a particular case- the elliptical obstacle-and a comparison study between these numerical results and the exact solution of the problem is also done. The numerical solutions are in good agreement with the exact solution of the problem in both cases, but, for this particular case, the solution that uses the vortex distribution better fits.

Keywords: indirect boundary element method, integral equation, sources distribution, vortex distribution, compressible fluid flow, elliptical obstacle.

TERNARY SOLUTIONS OF THE CARBANION MONOSUBSTITUTED PYRIDAZINIUM YLIDS IN BINARY PROTIC SOLVENTS

Mihaela DULCESCU, Dana-Ortansa DOROHOI

Carbanion-monosubstituted pyridazinium ylids are relatively stable compounds with potential pharmacological importance. So, their interactions with non-toxic solvents such as water and ethanol must be known when they are used in situ. In water-ethanol mixtures of various concentrations, the spectral shifts are due to the global influence of the solvent mixture on the hydrogen bonded complexes of the type water-pyridazinium ylid or ethanol-pyridazinium ylid. The spectral shifts measured in binary solvent are linearly dependent on the ethanol molar fraction in solution. For the small ethanol molar fractions in binary solvent water+ethanol, the complexes of the type water-pyridazinium ylid are predominant, while for the high ethanol

concentrations there are insufficient water molecules and only complexes of the type ethanol-pyridazinium ylid can be formed.

Keywords: carbanion mono-substituted pyridazinium ylids, water, ethanol, electronic absorption spectra, hydrogen bond complexes

POLYMERIC FILMS PROPERTIES OF POLY (VINYL ALCOHOL) AND POLY (HYDROXY URETHANE) IN DIFFERENT CONCENTRATIONS

Cristina – Delia Nechifor, Catalina Liana Ciobanu, Dana- Ortansa Dorohoi, Constantin Ciobanu

In this paper we analyzed the properties of polymeric films obtained by alloying poly (vinyl alcohol) (PVA) and poly (hydroxy urethane) (PHU) in different concentrations. We obtained the polymeric films and we analyzed them energetically (contact angle of water), morphologically (AFM), spectrally (FTIR- ATR) and mechanically (strength tests). The aim of this study is to identify the optimal concentrations for which a new material obtained by mixing PVA and PHU polymers can be used in medical field. We expect that this new polymer will merge the PVA and PHU properties.

Keywords: PVA, PHU, contact angle, hardness, resilience, rughness.

BOOK REVIEW

Alexandru I. NICOLIN

Physics of Continuous Matter: Exotic and Everyday Phenomena in the Macroscopic World by Benny Lautrup (610 pages, Institute of Physics Publishing, Bristol and Philadelphia) is a modern, rigorous and unusually comprehensive introduction into the physics of continua. The book is structured into 32 chapters, divided into five parts (i.e., Introduction, Fluids at rest, Deformable solids, Basic hydrodynamics and Special topics), addressing both the prevalent

university syllabus and more exotic topics such as gravity waves, dynamics of vortices, self-similar boundary layers, subsonic flights, etc. Furthermore, the book has three appendices dedicated to Newtonian particle mechanics, curvilinear coordinates and thermodynamics of ideal gases, and additional material can be found on the book's home-page at <http://www.lautrup.nbi.dk/continuum>. All the above along with an extensive index and an annotated bibliography make the book an invaluable tool for both graduate and under-graduate students.

A common misconception of most physics students is that physics of continuous matter is a very mathematical subject. Lautrup's book, however, gives an excellent account of all major topics on the subject starting only from the most elementary mathematics and introducing the rest on a need-to-know basis. Most chapters have a light commencement which appeals to our everyday experience with the macroscopic world, and then slowly introduce the key physical concepts. Short historical notes, sketchy micro-biographies of great scientists, marvelous graphical side-notes along with a few tables of constants make the text a gratifying reading. All chapters end with a few problems some of which are theoretical side-issues of the main text. Among the many qualities of this book there are five that deserve special attention. First, equations are dealt with in a very scholastic manner, the most important ones being placed in a box. Second, the author took great care in marking the sections and the problems which either fall slightly outside the main line of the text or they require more advanced mathematics. Third, there are quite a number of footnotes which give valuable up-to-date references to many of the subjects dealt with in the main text. This particular feature makes it perfect for readers just starting their graduate studies who desire also a glimpse at the current research. Fourth, and rather rare for textbooks on this subject, the book gives a balanced view on mechanics of continua by accompanying well-known analytical methods with various numerical techniques. For this reason two chapters have been dedicated to computational aspects of elastostatics and fluid dynamics and a number of Mathematica codes are freely available on the book's home-page. Fifth, and foremost important, the chapters can be used to some extent independent of one another and, of course, this was done with the cost of some repetitions. However, when reading the book in full these repetitions come as a welcomed and sometimes necessary refresher on previously discussed subjects, only to underline its pedagogic nature.

At first glance the book stems out of a set of lectures delivered by the author for a number of years at Copenhagen University, Denmark. More intimately however, this almost encyclopedic book is due to the author's joy of doing physics, no matter its flavor. A high energy physicist by training Benny Lautrup has written a magnificent book on one of the oldest subjects in science, a book that I wholeheartedly recommend to any student with a keen interest in physics. This is a book written by an impassioned physicist for impassioned students.