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PREIMPRESOS

1. *Carlos E. Rodríguez, Gabriel Núñez and Gabriel Escalera. A bayesian mixture model for clustering circular data*, 28 pp.

P. No. 173 . . . . . **$32.00**

Abstract

Clustering complex circular phenomena is a common problem in different scientific disciplines. For instance, the clustering of both departure directions and patterns of animals in the wild, the classification of changes in the timing of seasonal events into a changing climate frame and the grouping of observed X-ray positions form patients with radiation therapy represent challenging opportunities for different areas of research. The difficult aspect for the clustering of circular data can be seen from the non-parametric perspective of from the model-based approach. On the one hand, following a non-parametric approach, coherent measures of distance that allows the grouping of circular data are needed, and circular data naturally exhibits a periodic behavior. On the other hand, adopting a model-based framework, distributions defined over the unit circle must be used, and these always come with a challenge. In this paper, we propose a clustering and classification methodology for circular data under a Bayesian mixture modeling framework. The mixture model is defined assuming the number of components is finite, but unknown, and each component follows a projected normal distribution. Model selection is carried out by jointly making inferences about the parameters in the mixture model and the number of components, choosing the model with the highest posterior probability. A deterministic relabeling strategy is used to recover identifiability for the components in the chosen model. Estimates of both the posterior classification probabilities and the scaled densities are approximated via the relabeled MCMC output. Our proposal is illustrated using simulated and real data sets; comparisons with alternative strategies are also given. The results suggest that our proposal is a robust alternative for the clustering and classification of circular data.

2. *José M. González-Barrios and Raúl Rueda. A note on proof of Georg Cantor*, 10 pp.

P. No. 172 . . . . . **$14.00**

Abstract

In this note we study a binary version of the proof of the fact, first proved by Georg Cantor, that the unit closed interval **I** = [0, 1] has the same cardinality as the unit box I^2 = [0, 1] x = [0, 1].

We will use, the well-known result, that the dyadic rational numbers are the only numbers of the unit closed interval **I** with two different binary expansions. We will find a surjective function $c : \mathbf{I} \to I^2$, using Cantor's idea using only binary expansions. We also will prove that the function c is a continuous function.

3. *José M. González-Barrios M., Eduardo Gutiérrez Peña, and Raúl Rueda, "*A short note on the dependence structure of random vectors", 13 pp.

P. No. 171 . . . . . **$16.00**

Abstract

In this note we define the concept of exhaustive dependence (e.d.) for a random vector **X**. In the case where the random vector **X** is not e.d., we give an easy decomposition of **X** in e.d. subvectors which are mutually independent. We also give sufficient conditions on some of the subvectors of **X** in order for **X** to be e.d.

4. *José M. González-Barrios M., Eduardo Gutiérrez Peña, Juan D. Nieves and Raúl Rueda, "*New very simple tests of multivariate independence for copulas", 24 pp.

P. No. 170 . . . . . **$24.00**

Abstract

In this paper we propose several tests of multivariate independence for d-copulas for any $d \geq 2$. To this end, we use a novel simple characterization of independence for d-variate copulas, based on the density approximations given $C^{(m)}$ the checkerboards of order m. Then we use estimators of these checkerboard approximations proposed first in [9], and improved in [11]. These estimators, denoted by C^n_m and called sample d-copulas of order m, have very nice properties, including a Glivenko-Cantelli's theorem, proving the almost surely uniform convergence to $C^{(m)}$.

Using different metrics, such as the supremum, total variation and Hellinger distances, we propose some test statistics, which can be easily implemented to test for independence. We can even use the divergence of Kulback-Leibler to propose another test.

The main advantage of these statistics is the fact that they can be easily and quickly simulated under any alternative, even for large sample sizes in not so small dimensions. We study the performance of these tests by means of a simulation study.

5. *José M. González-Barrios and Ricardo Hoyos-Argüelles, "*Sample copula, Bernstein copula and empirical copula", 34 pp.

P. No. 169. . . . . **$38.00**

Abstract

The d-sample copula of order m, C^n_m is a d-copula based on a sample of size n, which is an estimator of $C^{(m)}$ the checkerboard approximation of order m of a d-copula C, see [7], [32] and [29]. Hence, C^n_m is a kernel density estimator of the real copula C. As we will see in

this paper, the estimator C^n_m approaches $C^{(m)}$ for every $m \geq 2$, when the sample size n increases. If m is relatively large, $C^{(m)}$ is a very good density approximation of C. Hence, C^n_m can be thought as a quasi-nonparametric method to estimate the real d-copula C, and it becomes a nonparametric estimator when we choose the order m. We will see that C^n_m, the d-sample copula of order m, is simply multilinear interpolation used in the proof of Sklar's Theorem, based on a pseudosample or modified sample. Then we will prove a Glivenko-Cantelli's Theorem for the sample d-copula C^n_m and the real d-copula C, when m increases to infinity. Using this result we give a Glivenko-Cantelli's Theorem for the total variation distance between the checkerboard approximation $C^{(m)}$ and the sample copula C^n_m for every $m \geq 2$, with some examples to check the speed of convergence. We also explore some other metrics. We will also see that we can easily simulate from the sample d-copula C^n_m, and that these simulated samples follow the same pattern of the original sample. We will also include examples with real data to study the behavior of the sample copula.

Finally, we make an extensive comparison of the supremum distance between the empirical copula C_n and the real copula C, the supremum distance between the Bernstein copula $C^d_{n,n}$, which is a polynomial approximation, and the real copula C, and the supremum distance between the real copula and the sample copula C^n_m, which is simply a kernel density estimator of C. We will see that the sample copula is a better estimator than the empirical copula, and in many instances a far better estimator than the Bernstein copula. We provide a method to estimate an adequate value of the order m of the sample copula for small sample sizes.

6. *Manuel Mendoza, Alberto Contreras and Eduardo Gutiérrez, "*Bayesian analysis for finite populations", 11 pp.

P. No. 168 . . . . . **$16.00**

Abstract

Statistical methods to procedure inferences based on samples from finite populations have been available for more than 70 years. Topics such as *Survey sampling* and *Sampling theory* have become part of the mainstream of the mainstream of the statistical methodology. A wide variety of sampling schemes as well as estimators are now part of the classical folklore. On the other hand, even though the Bayesian approach is now well established as a paradigm with implications in almost any field of the statistical arena, up to now there is no general proposal of which might be called a Bayesian survey sampling. Here, the Bayesian analysis of samples from finite populations is discussed, its relation with the idea of superpopulations is reviewed and a semiparametric approach is proposed. These ideas are assayed for some basic sampling schemes and the results are discussed.

7. *José M. González-Barrios and Ricardo Hoyos-Argüelles, "*Distributions associated to the counting techniques of the *d*-sample copula of order *m* and weak convergence of the sample process", 32 pp.

P. No. 167 . . . . . **$36.00**

Abstract

In this paper we study the distribution of the counting in the boxes generated by the uniform parition of order *m* for the sample copula under the independence assumption, and the weak convergence of the sample copula process or simply sample process.

We divide this work in two parts: in the first part, following the results given by Deheuvels in [2] for the empirical copula, we first consider a sample from the product copula. We begin with a brief description of the counting method of the number of observations in each of the boxes generated from the regular partition of order *m* in $[0, 1]^2$, and then we give the distribution, moments and correlations of counting for the two-dimensional case, we also give generalizations of these results for the *d*-dimensional case, where $d > 2$.

In the second part, we study the weak convergence of the sample process, that is, $\sqrt{n}$ $(C_{\frac{n}{m}} - C^{(m)})$, were $C^{(m)}$ is the checkerboard approximation of order *m* of the real copula *C*, see [9], when the partial derivatives of *C* are continuous, and without the independence assumption. In this way we will have, for the sample copula, a weak convergence theorem similar to that for the empirical copula. In order to apply the results of weak convergence for the empirical process, we show that the sample copula can be represented as a linear functional of the empirical copula, under this representation we have Hadamard's differentiability and then we can apply the delta method. Finally, we perform several simulations of the sample process at a given point to test the properties of the convergence to a centered Gaussian process with a given variance-covariance structure.

8. *Lizbeth Naranjo Albarrán, Federico O'Reilly Togno y Silvia Ruiz-Velasco Acosta, "*Muestras look-alike para modelos lineales generalizados y su uso en bondad de ajuste: la familia NEF-QVF*",* 27 pp.

P. No. 166. . . . . . **$28.00**

Resumen

En el análisis de modelos lineales generalizados es conveniente realizar pruebas de bondad de ajuste de los parámetros desconocidos en las que se busca obtener *p-values* en el intervalo [0, 1] para aceptar o no una hipótesis. Sin embargo, la mayoría de las estadísticas de prueba utilizadas suponen distribuciones asintóticas y por lo tanto, producen *p-values* no exactos.

El método que a continuación se presenta permite generar *p-values* exactos para las estadísticas de prueba, cuando éstas admiten una estadística suficiente minimal. El procedimiento depende de la construcción de muestras Monte Carlo, llamadas "look-alike", a partir de la distribución condicional independiente de la muestra, dada la estadística suficiente minimal. Se utilizan dos métodos para generar las muestras look-alike: la estimación de Rao-Blackwell para la función de distribución acumulativa y el muestreo de Gibbs.

Esta metodología funciona cuando los parámetros desconocidos son de localización y/o escala. Sin embargo, cuando se desconoce el parámetro de forma, éste debe estimarse de la muestra y, por tanto, la situación es diferente; las distribuciones de la estadística de prueba dependerán de los valores verdaderos del parámetro de forma.

Los modelos lineales generalizados que se estudian a continuación consideran que la componente aleatoria pertenece a la familia exponencial natural con función de varianza cuadrática y que las variables de la componente sistemática son cualitativas.

9. *José M. González-Barrios and Ricardo Hoyos-Argüelles, "*Comparison between the empirical copula and the sample copula of order *m", 31* pp.

P. No. 165 . . . . . **$32.00**

Abstract

In this paper we make an extensive comparison of the supremum distance between the empirical copula and the real copula and the supremum distance between the sample copula of order *m* and the real copula, based on different samples of size *n* of a large class of widely used families of copulas.

We simulated a large number of samples of each copula with sample sizes $n = 20$, $n = 30$ and $n = 50$, and we obtain the basic statistics of the supremum distance when we vary *m* from 2 up to *n*. We observed that always there exist values of *m* such that the supremum distance between the sample *d*-copula of order *m* and the real copula C gives better approximations than using the supremum distance between the empirical copula and the real copula.

In the last Section we provide a method to estimate the value of *m* such that C_n^m the sample *d*-copula of order *m* is a good approximation of the real copula based on the simulations.

10. *José M. González-Barrios and Trinidad González-Bonilla, "*New estimator of the correlations of multivariate normal distribution using the sample *d*-copula of order *m", 22* pp.

P. No. 164 . . . . . **$24.00**

Abstract

In this paper we propose a new estimator for the correlation of a bivariate normal distribution using the sample *d*-copula of order *m* proposed in [5]. We study the properties of this estimator and give some useful applications. The advantage of this estimator over the usual Pearson's estimator is the robustness and the simplicity of its evaluation, although it is not an unbiased estimator everywhere, it can be corrected by the first order approximation of von Mises, which makes it practically unbiased in a neighbourhood around zero. We give several examples in order to compare its behavior to the usual estimator.

11. *Michelle Anzarut and Ramsés H. Mena*, "On a Harris process with exchangeable increments to model stochastic volatility", 30 pp.

P. No. 163 . . . . . **$36.00**

Abstract

The assumption of independent increments is a dominant characteristic within many stochastic modeling applications. However, in certain situations, empirical data suggest the existence of more complex dependence structures. Such is the case of stock return volatilities and other types of financial time-series. Here, we present a strongly-stationary Feller process with exchangeable increments. The process lies on an extension of the so-called Harris chains to continuous time. We exhibit constructions, properties, and inference methods for the process. Next, we propose a stochastic volatility model with generalized inverse Gaussian marginal distributions. We study the model performance through simulation, while illustrating its use in practice with empirical work. The model proves to be an interesting competitor to short-range stochastic volatility models; such as those based on Ornstein-Uhlenbeck-type processes.

12. *J. Iván Beltrán and Federico J. O'Reilly*, "Tests for Poisson, negative binomial and binomial distributions", 30 pp.

P. No. 162 . . . . . **$30.00**

Abstract

In this paper we propose two new test statistics, one based on the likelihood ratio for the Poisson distribution with unknown parameter. This test statistic results as good as the classical Cramer-von Mises. And the other test statistic is based on the conditional probability ratio, and its use is suggested utilizing its conditional distribution. The test is a slight variant of one based on the conditional density of the observed sample given the value of the minimal sufficient statistic. Also, the goodness of fit for binomial and negative binomial distributions is addressed, carrying out and extensive simulation study to compare the power of some recent and classical test statistics derived for these distributions.

13. *José M. González-Barrios, María M. Hernández-Cedillo and Roger B. Nelsen*, "Bounds on 2-copulas with known values on a grid and sets of parameters on grids in dimension $d \geq 2$", 30 pp.

P. No. 161 . . . . . **$32.00**

Abstract

In this paper we extend the result of finding copulas with given values in certain points to the case in which the points form an arbitrary grid on $I^2 = [0, 1]^2$, finding upper and lower bounds which are themselves copulas. We also observe that we need $2n + 1$ inequalities in the case of a square grid of size n.

We also introduce the concept of sets of parameters based on two partitions of I of size $n + 1$, this concept generalizes the ideas in [5], and in Section 3 we generalize this concept to larger dimensions, that is, $d \geq 3$.

We provide an easy definition that applies in all dimensions to construct multivariate shuffles based on a partition of I.

14. *Consuelo R. Nava, Ramsés H. Mena and Igor Prünster*, "Poisson driven stationary Markov models", 32 pp.

P. No. 160 . . . . . **$30.00**

Abstract

We propose a simple yet powerful method to construct strictly stationary Markovian models with given but arbitrary invariant distributions. The idea is based on a Poisson-type transform modulating the dependence structure in the model. An appealing feature of our approach is the possibility to control the underlying transition probabilities and therefore incorporate them within standard estimation methods. Given the resulting representation of the transition density, a Gibbs sampler algorithm based on the slice method is proposed and implemented. In the discrete case, special attention is placed to the class of generalized inverse Gaussian distributions. In the continuous case we first provide a neat treatment of the class of gamma distributions and then extend it to cover other invariant distributions. In particular, we construct diffusion models with known transition densities and invariant distributions in the generalized extreme value class. The proposed approach and estimation algorithm are illustrated with real financial datasets.

15. *Arrigo Coen and Ramsés H. Mena*, "Ruin probabilities for Bayesian exchangeable claims processes", 23 pp.

P. No. 159 . . . . . **$24.00**

Abstract

Among the driving assumptions in classical collective risk models, the independence among claims is frequently violated by real applications. Therefore, there is an evident need of models that relax such a restriction. We undertake the exchangeable claims platform and obtain some results for the infinite time ruin probability. The main result is that the ruin probability under the exchangeable claims model can be represented as the expected value of the ruin probabilities corresponding to certain independent claims cases. This allows us to extend some classical results to this dependent claims scenario. The main tool is based on the de Finetti's representation theorem for exchangeable random variables, and as a consequence a natural Bayesian modeling feature for risk processes becomes available.

16. *Ramsés H. Mena*, "On the Bayesian mixture model and identifiability", 29 pp.

P. No. 158 . . . . . **$30.00**

Abstract

This paper is concerned with Bayesian mixture models and identifiability issues. There are two sources of unidentifiability, the well-known likelihood invariance under label switching and the perhaps less well known parameter identifiability problem. When using latent allocation variables determined by the mixture model, these sources of

unidentifiability create arbitrary labeling which renders estimation of the model very difficult. We endeavor to tackle these problems by proposing a prior distribution on the allocations which provides an explicit interpretation for the labeling by removing gaps with high probability. An MCMC estimation method is proposed and supporting illustrations are presented.

17. *José M. González-Barrios and María M. Hernández-Cedillo,* "Goodness-of-fit tests for copulas using the sample *d*-copula of order *m*", 19 pp.

P. No. 157 . . . . . **$20.00**

Abstract

In this paper we introduce a new technique of goodness-of-fit tests for *d*-copulas where $d \geq 2$ stands for the dimension. The new technique uses the concept of sample *d*-copula of order m introduced in *González-Barrios, M.J. and Hernández-Cedillo, M.M.* (2013). Sample *d*-copula of order *M*. *Kybernetika*, 49, No. 5, 663-691, and the classical Theorem of Neyman-Pearson to find the best critical region of the test.

We first stard by testing two simple hypotheses including asymptotic results about the test statistic, and then we make a comparison between our powers and the results obtained in *Genest, C. et al*. (2009). Goodness-of-fit tests for copulas: A review and power study. *Insurance Mathematics and Economics*, 44, 199-213. We also include some examples in higher dimensions that prove that our test has also nice powers even for small orders of the partitions *m* and sample size *n*.

Then we propose a technique to test simple versus composite alternatives we even give a proposal for testing two composite hypotheses.

18. *Susana Gómez, Gustavo Ramos, Alejandro Mesejo, Rodolfo Camacho, Mario Vásquez and Nelson del Castillo,* "Study of the characterization of naturally fractured vuggy reservoirs, with totally penetrated wells using global optimization. Synthetic and real data", 59 pp.

P. No. 156 . . . . . **$60.00**

Abstract

The aim of this work is to study the characterization of Naturally Fractured Vuggy Reservoirs via automatic well test analysis, using a triple porosity model. The inter-porosity flow parameters and the storativity ratios, as well as the permeability ratio (parameters of the model) will be identified. Normally this problem has been solved in real time, using the Laplace transformation to solve the model, together with Stehfest method, to return to real time. However this inverse operation is ill conditioned and the resulting algorithm can be unstable and makes the process expensive in computational time.

In this work we will perform the characterization in Laplace space, using some numerical algorithms to transfer the data given in real time to Laplace space. The characterization problem in Laplace space is solved as an optimization problem using Newton type methods with a trust region to find a local minimum. However, the local

method used here called TRON, in many cases is not able to find an optimal solution with a good fit of the data.

Therefore, we will use a global optimization algorithm called the Tunneling method, to deal with the specific characteristics of the resulting optimization well test problem, and the very important fact that the triple porosity case yields multiple optimal solutions with good match to the data. Therefore, several special characteristics of this specific problem, like the fact that the parameter estimation has to be done with very high precision and the need to solve the problem computationally fast, are taken into account in the design of the algorithm.

According to the above, it is demonstrated that the algorithm developed in this study allows the user to find several optimal solutions, with good march to the data and different values of the parameters. Also, it will be shown that when predicting flow rate, all these different minima behave identically for short and long times, for both constant oil rate and constant bottom-hole pressure inner boundary conditions. This implies that any of these solutions may be used to forecast production behavior.

19. *Asael Fabián Martínez and Ramsés H. Mena*, "On a nonparametric change point detection model in Markovian regimes", 24 pp.

P. No. 155 . . . . . **$24.00**

Abstract

Change point detection models aim to determine the most probable grouping for a given sequentially observed sample. In this work, we tackle this problem using a modification of exchangeable partition probability functions. Our model is derived from a nonparametric Bayesian scheme based on Pitman's sampling formula. Emphasis will be given to the Markovian case, in particular for discretely observed Ornstein-Uhlenbeck diffusion process. Some properties of the resulting model are explained and posterior results are obtained via a novel MCMC algorithm.

20. *José María González-Barrios and María M. Hernández-Cedillo*, "Multivariate *d*-box invariant fractal copulas and the sample *d*-copula of order *m*", 28 pp.

P. No. 154 . . . . . **$28.00**

Abstract

In this paper we construct a family of *d*-copulas for any $d \geq 2$ such that it is dense in the set of all *d*-copulas. The construction is done using the ideas of Cuculescu and Theodorescu (2001), which are based in a fractal construction. The method of construction allows to give *d*-copulas with any given support, in particular we can construct singular copulas with supports of dimensions smaller than *d*.

The main section of this paper is given in section 3 where we introduce the sample *d*-copulas of order *m* where $m \geq 2$, the main idea is to use the construction given in Cuculescu and Theodorescu (2001) and its extensions given in Fredericks *et al* (2005) and in Trutschnig and Fernández-Sánchez (2012), to construct a new copula based on a sample. The greatest advantage of the sample *d*-copula is the fact that is easily obtained. We will see that these

new copulas provide a nice way to study multivariate data with an approximating copula which is much simpler than the empirical multivariate3 copula, and that the empirical is the restriction to a grid of a sample *d*-copula of order *n*. These sample *d*-copulas can be used to make statistical inference about the distribution of the data.

21. *José María González-Barrios and María M. Hernández-Cedillo,* "A note on a converse results in measure theory", 42 pp.

P. No. 153 . . . . . **$40.00**

Abstract

In this paper we generalize to *n* dimensions the general frameworks for constructing new copulas by using patchwork assemblies inside a base copula. We first generalize the work of De Baets and De Meyer (2007), and then we give an alternative proof of the rectangular patchwork proposed by Durante, Saminger-Platz and Sarkoci in (2009). We also give a characterization of modular *n* dimensional functions which provide a methodology for extensions of rectangular patchwork, which includes the extension of ordinal sums to *n* dimensions. Finally, we use the gluing method of Siburg and Stoimenov (2008) to give an alternative method of patchwork construction of *n*-copulas.

22. *José María González-Barrios,* "A note on a converse results in measure theory", 8 pp.

P. No. 152 . . . . . **$10.00**

Abstract

In this paper we study a natural converse in the construction of a large family of σ-finite measure, including the Lebesgue measure, in the set of real numbers with the Borel σ algebra $B(\mathbf{IR})$. We also generalize the result for $(\mathbf{IR}^n, B(\mathbf{IR}^n))$ for $n > 1$.

23. *Arturo Erdely and José María González-Barrios,* "A nonparametric symmetry test for absolutely continuous bivariate copulas", 26 pp.

P. No. 151 . . . . . **$26.00**

Abstract

Based on the works by Klement and Mesiar (2006) and Nelsen (2007) on maximal asymmetry of copulas, we propose a simple statistic to test symmetry of a bivariate copula, given a random sample of an absolutely continuous bivariate random vector. We also make a power comparison against some other well-known nonparametric symmetry tests.

24. *Ramsés H. Mena, Matteo Ruggiero and Stephen G. Walker,* "Geometric stick–breaking processes for nonparametric inference", 11 pp.

P. No. 150 . . . . . **$14.00**

Abstract

This paper is concerned with the construction of a continuous time dependent random probability measure. The construction is based on a Bayesian nonparametric prior, that, from a statistical point of view, has proven to be quite appealing. The dependence structure is induced through a Wright-Fisher diffusion process in the weights of the corresponding species sampling representation. The proposed model inherits various appealing features from this process, resulting in a stationary, Markovian and reversible measure-value diffusion process. A simple modeling approach for random phenomena evolving in continuous time together with its corresponding estimation procedure is presented. Analysis of simulated and real data sets are also provided.

25. *Federico O'Reilly and José Mario Quintana,* "Non-parametric regression; the cone algorithm", 26 pp.

P. No. 149 . . . . . **$26.00**

Abstract

In statistical applications, quadratic programming appears often. A special kind appears in fitting non-parametric regression curves and also in using least squares subject to linear inequality constraints. Particular algorithms have been proposed for the subclass of problems where the feasible set is formed by a convex cone, namely a convex feasible region with just one vertex. In this manuscript three algorithms are compared, mentioning the similarities and differences. One, referred as the cone algorithm, which was proposed before the others is shown to have a wide advantage in terms of time required to find the solution and precision. Some examples are discussed.

26. *José Mario Quintana and Federico O'Reilly,* "Demystifying the two-envelope paradox?", 9 pp.

P. No. 148 . . . . . **$12.00**

Abstract

The Two-Envelope Paradox is a decision under uncertainty problem which is simple to state but apparently tricky to solve. It seems to lead towards incoherent behavior because acting on expectations, two players under symmetrical conditions apparently would prefer to exchange roles. After reviewing some of its abundant literature and analyzing the problem we found that its classic version seems to be just a case of a confused common intuition failing to adjust conditional probabilities according to the Bayesian recipe. Yet, some reformulations manage to exhibit, without appealing to use of improper priors, an awkwardness inherited from a more deceitful concept from a Bayesian theoretical standpoint: infinite expectations.

27. *José María González-Barrios,* "Statistical aspects of associativity for copulas", 27 pp.

P. No. 147 . . . . . **$24.00**

Abstract

In this paper it is studied in detail the associativity property of the discrete copulas. It is observed the connection between discrete copulas and the empirical copulas, and then it is proposed a statistic that indicates when a discrete copula is associative and obtain its main statistical properties under independence. It is also obtained asymptotic results of the proposed statistic. Finally, it is proposed a nonparametric test for associativity of copulas including final remarks.

28. *Miguel Carrillo and David A. Rosenblueth*, "A state-by-state method for CTL model update", 38 pp.

P. No. 146 . . . . . **$34.00**

Abstract

We develop a method for updating a Kripke structure with respect to a computation-tree logic (CTL) formula. Our method minimally modifies a Kripke structure so that the modified structure satisfies a given CTL formula at a given state. An important feature of our technique is the preservation of the truth value of a subformula. This makes it possible to find structures satisfying conjunctions by first making the leftmost conjunct hold, and then making the rest of the conjunction hold while preserving the truth value of the already–treated conjunct. In addition, we use only two basic temporal operators (**EX** an **AX**) analogous to disjunction and conjunction, respectively. This allows us to view our method as a generalization of an algorithm for computing the disjunctive normal form of a propositional formula. Just as the disjunctive normal form represents all assignments making a propositional formula true, so too our method computes a representation of all the structures satisfying the given CTL formula at the given state. The most similar structures in the sense of Zhang and Ding's ordering are explicitly generated. Unlike symbolic methods for model checking, our updater represents structures state by state.

29. *Gabriel Nuñez, Eduardo Gutiérrez and Gabriel Escarela*, "A Bayesian regression model for circular data based on the projected normal distribution", 17 pp.

P. No. 145 . . . . . **$18.00**

Abstract

Inferences based on regression models for a directional response are usually problematic. This paper presents a full Bayesian analysis of a regression model for circular data using the Projected Normal distribution. Inferences about the model are based on samples form the posterior distributions which are obtained using the Gibbs sampler after the introduction of some latent variables. The problem of missing data in the response variable is also addressed in this context as is the use of a predictive criterion for model selection.

The procedures are illustrated using two simulated data sets as well as a real data set previously analyzed in the literature.

30. *Stefano Favaro, Antonio Lijoi, Ramsés H. Mena and Igor Prünster,* "On Bayesian nonparametric inference in species sampling problems", 22 pp.

P. No. 144 . . . . . **$20.00**

Abstract

Sampling problems from populations which are made of different species arise in a variety of ecological and biological contexts. Given the information yielded by an initial sample of size *n*, most of the statistical issues to be faced are related to the concept of species richness, which can be quantified in different ways. For example, given an initial sample of size *n*, species richness might be measured by the estimated number of new species to be observed in an additional sample of size *m*. It can be alternatively evaluated in terms of the probability of discovering a new species at the probability of discovering a new species at the *(n + m +1)-th* draw, which yields the discovery rate as a function of the size of the additional sample *m*. Or it can be seen as the sample coverage achievable by means of a sample of size *n + m* which, in other words, is the proportion of distinct species detectable in a sample of size *n + m*. The need for assessing species richness naturally arises also in the analysis of genomic data, which pose additional challenge of having to deal with large value of both *n* and *m*. For instance, in the analysis of Expressed Sequence Tag (EST) data, which are generated by sequencing cDNA libraries consisting of millions of genes, prediction of the number of new gene species is required for very large sizes of the additional sample *m*.

Recently, a Bayesian nonparametric methodology has been proposed for tackling such prediction problems. This approach yields, in contrast to frequentist nonparametric procedures, reliable estimates also in cases where the size of the additional sample *m* is much larger than the size *n* of the observed sample. However, if both *n* and *m* are large, as it happens in genomic applications, the computation of the estimators may become cumbersome. In this paper we focus on the two parameter Poisson-Dirichlet model and greatly simplify the expressions of relevant estimators in species sampling problems so that they can be easily evaluated for any sizes of *n* and *m*. Moreover, in order to associate a measure of uncertainty to the estimates, we study the asymptotic behaviour of the number of new species conditionally on the observed sample: such an asymptotic result, which is also of independent interest, allows to derive asymptotic highest posterior density intervals for the estimates of interest. In order to sample form the limiting random variable, we develop a suitable simulation scheme. Finally, we illustrate the implementation of the proposed methodology by the analysis of 5 genomic datasets.

31. *Eduardo Gutiérrez, Raúl Rueda and Alberto Contreras,* "Parametric objective Bayes procedures from a nonparametric perspective", 21 pp.

P. No. 143 . . . . . **$20.00**

Abstract

In a recent paper, Gutiérrez-Peña and Walker (2005) view traditional parametric procedures as statistical decision problems where the uncertainty on the unknown model generating the observations is modeled nonparametrically.

Here we explore the use of this approach to construct parametric objective Bayes procedures for such problems as model averaging, model selection, and estimation. We discuss model selection in some detail and compare three methods through a simple but illustrative example.

32. *Dante Campos, Alberto Contreras, Carlos Martínez and Federico O'Reilly*, "Inferences for mixtures of distributions for centrally censored data with partial identification", 30 pp.

P. No. 142 . . . . . **$27.00**

Abstract

In this paper, several methods to make inferences about the parameters of a finite mixture of distributions in the context of partially identifiable centrally censored data are revised. These methods are an adaptation of the work in Contreras-Cristán *et al.* (2003), in the case of right censoring, one of which is related to a recently proposed Bayesian method in Baker *et al*. (2005). The first method focuses on an asymptotic approximation to a suitably simplified likelihood using some latent quantities; the second method is based on the EM algorithm. Both methods make explicit use of latent variables and provide computationally efficient procedures compared to non Bayesian methods which deal directly with the full likelihood of the mixture appealing to its asymptotic approximation. The third method, from a Bayesian perspective, uses data augmentation to work with an uncensored sample. Our proposal of the three adapted methods is shown to provide similar inferential answers, thus offering alternative analyses.

33. *José M. González-Barrios, Federico O'Reilly and Raúl Rueda*, "Need for goodness-of-fit tables?", 26 pp.

P. No. 141 . . . . . **$25.00**

Abstract

This manuscript is intended to revise two extreme approaches in time to composite goodness-of-fit problems. The first approach with several known results, was intended to reduce a composite problem into a simple one, namely one where the test of fit was of a completely specified distribution. The second and more recent approach, is based on computer intensive methods to evaluate *in situ* the *p*-value as accurately as possible without any need of tables. It comprises the use of parametric bootstrap and special simulation to compute conditional *p*-values. Quite remarkably, a result published 45 years ago by J. Durbin, applicable to the first type of efforts, is up to date if asked to be applied, in a computer intensive procedure.

34. *Federico O'Reilly and Raúl Rueda*, "Inference for the truncated exponential distribution", 7 pp.

P. No. 140 . . . . . **$8.00**

Abstract

Lindqvist and Taraldsen (2005) introduced an interesting parametric family of distributions in the unit interval. In this note, inference procedures are given, both from the classical and the Bayesian view point. It is shown numerically through various examples that the posterior distribution for the parameter and the induced fiducial distribution are almost equivalent. The parametric family under study is a regular member of the Natural Exponential Family (NEF) and so use of this fact permits induction of a unique fiducial in terms of the minimal sufficient statistic.

35. *Arturo Erdely and José M. González-Barrios*, "Distributional properties of the diagonal of the empirical copula and a nonparametric test for independence for the archimedean family", 24 pp.

P. No. 139 . . . . . **$20.00**

Abstract

The problem of determining whether two random variables are independent or not has been widely studied in the statistical literature, and in many cases independence tests have been proposed. The development of the theory of copulas has had a great impact in the study of dependence, especially in the case of continuous random variables.

In this paper we study the problem of independence of two continuous random variables using the fact that there exists a unique copula that characterizes independence, and that this copula is of the Archimedean type. Sungur and Yang (1996) have already shown that in the case of Archimedean bivariate copulas the diagonal section contains all the information about the copula. In the case of two random variables, this reduces the dimension of the estimation of the copula from two to one. We analyze some properties of the empirical diagonal and its use for a nonparametric independence test for two continuous random variables, under the assumption that the underlying copula is of the Archimedean type. We compare our proposal to some well-known independence tests to check the power. The ideas proposed in this paper can be carried out easily to higher dimensions.

36. *Alberto Contreras and José M. González-Barrios*, "Model selection using conditional densities", 18 pp.

P. No. 138 . . . . . **$18.00**

Abstract

In this paper, we propose a new method to select a discrete model $f(x;\theta)$, based on the conditional density of a sample given the value of a sufficient statistic for θ. The main idea is to work with a broad family of discrete distributions, called the family of power series

distributions, for which there is a common sufficient statistic for the parameter of interest. The proposed method is to maximize conditional density in order to select the best model.

We compare our proposal with the usual methodology based on Bayes factors. We provide several examples that show that our proposal work fine in most instances. Bayes factors are strongly dependent on the prior information about the parameters. Since our method does not require the specification of a prior distribution, it provides a useful alternative to Bayes factors.

37. *Alberto Contreras, José M. González-Barrios and Federico O'Reilly*, "A nonparametric two–sample test for equal distributions for categorical data", 18 pp.

P. No. 137 . . . . . **$18.00**

Abstract

In this paper, we analise a proposal for testing equal distributions of two populations of discrete observations, categorical or ordinal, based on an extension of Fisher's exact treatment of 2 x 2 contingency tables, given by Freeman and Halton in 1951. The idea is to condition on the observed values of sufficient statistics for the marginal probabilities. We present several simulations, as well as a real data example in order to illustrate the power of this methodology. We also list the main properties of other methods, which are used in practice for discrete or categorical observations, and we make comparisons against some of them. We also observe by means of examples some limitations of the different methodologies for the case of discrete observations.

38. *Arturo Erdely and José M. González-Barrios*, "On the construction of families of absolutely continuous copulas with given restrictions", 12 pp.

P. No. 136 . . . . . **$14.00**

Abstract

The problem of constructing copulas with a given diagonal section has been studied by Fredricks and Nelsen in several articles (1997, Diagonal copulas. In Beneš, V. and Štěpán, J. eds., *Distributions with given marginals and moment problems*. Dordrecht: Kluwer Academic Publishers, 121-128; 1997a, Copulas constructed from diagonal sections. In Beneš, V. and Štěpán, J. eds., *Distributions with given marginals and moment problems*. Dordrecht: Kluwer Academic Publishers, 129-136; 2002, The Bertino family of copulas. In Cuadras, C.M., Fortina, J. and Rodríguez-Lallena, J.A. eds. *Distributions with given marginals and statistical modelling*. Dordrecht: Kluwer Academic Publishers, 81-91). In all cases, the resulting copulas are singular type. In this paper we provide a broad family of absolutely continuous copulas with a fixed diagonal, wich can differ from another absolutely continuous copula almost everywhere with respect to Lebesgue measure. It is important to mention that the asymmetry in the proposed methodology is not an issue, since the construction itself allows to find copulas with desired degree of asymmetry.

39. *L.M. Grossman and Jean-Pierre Hennart,* "Nodal approximations in space-time neutron kinetics", 68 pp.

P. No. 134 . . . . . **$58.00**

Abstract

Approximation methods for the solution of the space-energy-dependent neutron kinetics equations have been of interest in reactor physics and reactor design since the early sixties, when the numerical experiments of Yasinsky and Henry (1965), and others demonstrated the inadequacy of the "point reactor" model for the analysis of the large thermal Light Water Reactors (LWR's) being designed at the time.

The importance of the spatial variations of neutron flux in the safety analysis of nuclear reactors depends on the fact that the "point-reactor" power predictions are not only inaccurate in many cases, but also underestimate the reactivity insertion, and hence are non-conservative in a safety sense. While the effect of spatial variations in dynamic reactor analysis is less pronounced in fast, as compared with thermal reactors, (because the former are less tightly coupled due to a larger neutron mean-free-path) even in the Liquid Metal Fast Breeder Reactor (LMFBR), space-energy dependence is significant in accident analysis.

40. *Javier F. Rosenblueth,* "Convex cones and conjugacy for inequality control constraints", 30 pp.

P. No. 133 . . . . . **$28.00**

Abstract

Three approaches to conjugacy available in the literature, applicable to optimal control problems with inequality and equality constraints in the control, are studied. A clear and unified review of the second order conditions obtained in each case is given, and the three definitions of "generalized conjugate points" are improved in the sense that, either the range of applicability is enlarged, or the conditions defining membership of the different sets of points are simplified.

41. *Federico O'Reilly and Leticia Gracia-Medrano,* "On the conditional distribution of goodness-of-fit tests", 12 pp.

P. No. 132 . . . . . **$14.00**

Abstract

The idea of the present manuscript is to advocate the use of the conditional distribution of the goodness-of-fit test statistic given the value of a minimal sufficient statistic for the parameters. This, in the problem of testing fit of a distribution known only in its form but in presence of unknown parameters. In such a setting, since the parameters themselves are not of interest, they are considered nuisance and so conditioning seems to be appropriate. Some comments are made regarding this procedure in testing fit, and emphasis is placed on the

fact that with this approach there is no need for sets of tables but rather for just a simple algorithm based on simulation which produces the "exact" conditional *p-value*. So it may be claimed to have an exact level a, finite-*n* procedure, at least in the continuous case. As an example, the inverse Gaussian in discussed, comparing the results of the advocated procedure with recent work which include some simulations, and showing that for the alternatives used, there is an increase of power due to conditioning.

42. *Raúl Rueda*, "Simulación estocástica", 119 pp.

P. No. 131. . . . . . **$100.00**

Resumen

Una actividad común de la humanidad ha sido la de intentar explicarse el mundo que la rodea. La observación de algunos fenómenos le permitía entenderlos mejor y utilizar ese conocimiento para sus actividades principales. Así nació la agricultura. El entendimiento de las leyes de la naturaleza es un proceso lento. Posiblemente, uno de los mejores ejemplos sea la descripción del movimiento de los planetas.

Imaginemos a los primeros seres humanos viendo hacia el firmamento: ¿qué veían? Que el sol aparecía en el horizonte y que al final del día desaparecía y aparecía la luna. Lo mismo ocurría con los otros planetas y las estrellas: se movían alrededor de la Tierra. ¿Cuál es la conclusión obvia? La Tierra es el centro del universo y el sol, la luna, los planetas y las estrellas se mueven alrededor de ella. Esta teoría, llamada egocéntrica fue defendida por el filósofo griego Platón (428-348 a.c.) quien aseguraba, además, que la Tierra era redonda, a diferencia de lo que se decía en esa época Anaximandro (610-546 a.c.) argumentaba que era plana y estática, pues "no hay ninguna razón por la que deba moverse"). La idea básica era que la Tierra era el centro del universo y todo lo demás giraba en torno de ella en unas esferas huecas. Para explicar los movimientos aparentes de los planetas, llegaron a construir modelos hasta con 56 esferas como en el modelo de Aristóteles (384-322 a.c.). El modelo egocéntrico más exitoso fue el de Ptolomeo (160-100 a.c.). Su idea se basó en ir ajustando los movimientos de los planetas en órbitas circulares y dentro de cada una, usando epiciclos, esto es, movimientos circulares alrededor del eje orbital. Las observaciones que se tenían en esa época se ajustaron tan bien a este modelo, que tuvo una vigencia de ¡1400 años!

Nicolás Copérnico (1473-1543) en 1514, descubrió que un modelo más sencillo que explicaba las observaciones disponibles, se lograba colocando el sol en el centro (¡no del universo!) y haciendo que la Tierra y los demás planetas girarán alrededor de él en órbitas circulares. El primer indicio de la teoría heliocéntrica fue propuesto por Aristarco aproximadamente en el año 281 a.c. ¡Tuvieron que pasar 1754 años para que fuera retomada! La publicación de la teoría de Copérnico ocurrió después de su muerte, pues la iglesia no estaba de acuerdo con estas ideas y acusaba de hereje a todo aquel que estuviera en contra de las Sagradas Escrituras. El modelo de Copérnico no fue tomado en serio sino hasta un siglo después, con los trabajos de Galileo Galilei (1564-1642) y de Johannes Kepler (1571-1630). Los dos apoyaban, públicamente, la teoría de Copérnico aunque coincidían en que las órbitas circulares no se ajustaban bien a las observaciones que ellos tenían. El descubrimiento de los satélites de Júpiter y el gran cúmulo de información que el astrónomo aficionado Tycho Brahe (1546-1601) había acumulado por largo tiempo,

definieron finalmente que los planetas giraban alrededor del sol, describiendo elipses. Esto lo descubrió Johannes Kepler en 1609. Sin embargo, Isaac Newton (1642-1727) fue quien describió matemáticamente las leyes que rigen los movimientos de los cuerpos en el espacio, además de la famosa ley de gravitación universal en 1687. Todos sabemos que esta historia no terminó aquí. Albert Eistein (1879-1955) con sus teorías especial y general de la relatividad, publicadas en 1905 y 1919, respectivamente, explicó algunas imprecisiones en el movimiento del planeta Mercurio, que la teoría de Newton no explicaba. Y la historia... continúa.

¿Cuál es la moraleja? De hecho son varias, pero hay dos que debemos de resaltar. Primero, dado un modelo que describe un fenómeno cualquiera no puede demostrarse su veracidad. Lo único que puede irse verificando es si lo que vamos observando está de acuerdo con el modelo, o dicho de otra forma, las predicciones que se hacen con el modelo, concuerdan con la realidad. Así es como avanza la ciencia. Puede demostrarse que es falso cuando las observaciones no coinciden con lo que el modelo predice y será útil mientras esto no ocurra. Y esta es la segunda moraleja: la confrontación del mundo real con el modelo propuesto. Un modelo deber ser útil, ya sea para describir una serie de fenómenos o bien, para hacer predicciones con base en un conjunto de observaciones. Si estas predicciones o descripciones son consistentes, el modelo no es malo, pero si no es así, deberá corregirse, ya sea transformándolo, ampliándolo o en el peor de los casos, tirándolo. Eso hizo Kepler: desechó muchas posibles descripciones del movimiento de los planetas pues no coincidían con todas las observaciones con las que contaba, antes de lograr postular sus tres célebres leyes.

Se preguntarán, ¿y esto qué tiene que ver con lo que se verá en estas notas? ¡Mucho! En diferentes áreas del conocimiento humano se utilizan modelos matemáticos para explicar los comportamientos de los fenómenos bajo estudio. ¿Por qué utilizar las matemáticas? Por la generalidad de sus resultados y su, aparente, ausencia de contradicciones (recordemos el teorema de Gödel). Por lo mismo, son la base teórica de la estadística y de la probabilidad, disciplinas que nos permiten estudiar fenómenos en ambientes de incertidumbre.

La construcción de modelos generales que describan situaciones en ambiente de incertidumbre ha sido relevante en el desarrollo de la economía, la física, la ingeniería y otras áreas del conocimiento. Hace algunos años, el investigador se enfrenta al dilema de proponer un modelo muy detallado del fenómeno cuyo análisis matemático era prácticamente imposible o bien, proponer uno que fuera tratable matemáticamente, pero que omitiese aspectos relevantes del problema. Con la llegada de las computadoras, sobre todo en los últimos años, el uso de modelos cada vez más complicados ha sido posible. Problemas que era impensable plantear, ahora pueden resolverse. Específicamente en estadística, analizar observaciones multidimensionales, digamos de 10 dimensiones, era una tarea dura. Los métodos y algoritmos que veremos en este curso nos permitirán hacer esto sin esfuerzo.

43. *Blanca E. Flores, Jean-Pierre Hennart and Edmundo del Valle,* "Mesh-centered finite differences from unconventional mixed-hybrid nodal finite elements", 14 pp.

P. No. 130 . . . . . **$16.00**

Abstract

This formulation and the classical Raviart-Thomas mixed finite elements will be briefly recalled in Section 2. In Section 3, the main ideas behind the special quadrature rules used here will be outlined. Applications to the URT1 scheme (unconventional Riviart-Tomas of index 1) will then be given in the next section. We shall limit ourselves to show that the schemes obtained are, after a trivial transformation from point values to cell an edge values, strictly equivalent to the schemes derived in Hennart and Del Valle (1998) and we shall refer to that first paper for numerical results.

44. *Jean-Pierre Hennart and Edmundo del Valle*, "Nodal methods in numerical reactor calculations", 8 pp.

P. No. 129 . . . . . **$10.00**

Abstract

The present work describes the antecedents, developments and applications started in 1972 with Prof. Hennart who was invited to be part of the staff of the Nuclear Engineering Department at the School of Physics and Mathematics of the National Polytechnic Institute. Since that time and up to 1981, several master theses based on classical finite element methods were developed with applications in point kinetics and in the steady state as well as the time-dependent multigroup diffusion equations. After this period the emphasis moved to nodal finite elements in 1, 2 and 3D Cartesian geometries. All the thesis were devoted to the numerical solution of the neutron multigroup diffusion and transport equations, few of them including the time dependence, most of them related with steady state diffusion equations. The main contributions were as follows: high order nodal schemes for the primal and mixed forms of the diffusion equations, block-centered finite-differences methods, post-processing, composite nodal finite elements for hexagons, and weakly and strongly discontinuous schemes for the transport equations. Some of these are now being used by several researchers involved in nuclear fuel management.

45. *Javier F. Rosenblueth*, "Conjugacy for normal or abnormal linear Bolza problems", 13 pp.

P. No. 128 . . . . . **$14.00**

Abstract

For certain Bolza problems with linear dynamics, two sets extending the notion of conjugate points in the calculus of variations are introduced. Independently or nonsingularity assumptions, their emptiness, in one case without normality assumptions, is shown to be equivalent to a second order necessary condition. A comparison with other notions available in the literature is given.

46. *Javier F. Rosenblueth*, "Three improved notions of conjugate points in optimal control", 26 pp.

P. No. 127 . . . . . **$24.00**

Abstract

Three widely quoted approaches to conjugacy in optimal control, due to Zeidan & Zezza, Loewen & Zheng, and Zeidan, are studied. The three definitions of "generalized conjugate points" are improved in the sense that, either the range of applicability is enlarged, or the conditions defining membership of the different sets of points are simplified. No strong normality or nonsingularity assumptions are imposed. Moreover, the new sets introduced characterize completely a second order condition, a property which has remained uncertain for the previous sets.

47. *Eduardo Gutiérrez and Stephen Walker*, "Statistical decision problems and bayesian nonparametric methods", 36 pp.

P. No. 126 . . . . . **$32.00**

Abstract

This paper considers statistical decision problems conducted within a Bayesian nonparametric context. Our work was motivated by the realisation that typical parametric model selection procedures are essentially incoherent. We argue that one solution to this problem is to use a flexible enough model in the first place, a model that will not be checked no matter what data arrive. Ideally, one would use a nonparametric model to describe all the uncertainty about the density function generating the data, but in some situations a semiparametric model is all one can realistically hope for and we allow for this case too. However, parametric models are the preferred choice for many statisticians, despite the incoherence involved in model checking, incoherence that is quite often ignored for pragmatic reasons. In this paper we show how coherent parametric inference can be carried out via decision theory and Bayesian nonparametrics. None of the ingredients discussed here are new, but our main point only becomes evident when one sees all priors - even parametrics ones- as measures on sets of densities as opposed to measures on finite-dimensional parameter spaces.

48. *José M. González-Barrios, Federico O'Reilly and Raúl Rueda*, "Goodness of fit for discrete random variables using the Rao–Blackwell Density", 20 pp.

P. No. 125 . . . . . **$20.00**

Abstract

In this paper we find a new test of goodness of fit in the case of discrete random variables. The main advantage of the methodology proposed in this paper relies on the fact that given

the sample, we can control the probability of error type I, that is a, and then find the exact value of the probability of error type II, b, associated. Therefore the results are not asymptotic, but exact. We also include some simulations in order to check the power of the new test.

49. *Javier F. Rosenblueth*, "A conjugate journey in optimal control", 31 pp.

P. No. 124 . . . . . **$28.00**

Abstract

This paper seeks to unify, and improve, different approaches to conjugacy applicable to certain classes of optimal control problems. This covers the classical notion of conjugate points in the calculus of variations, various extensions of this concept to optimal control, and the recently developed theory of conjugate intervals.

50. *Javier F. Rosenblueth and Gerardo Sánchez Licea*, "Relaxing Weierstrass' strengthened condition", 7 pp.

P. No. 123 . . . . . **$10.00**

Abstract

Sufficiency for strong local optimality in the calculus of variations involves, in the classical theory, Weierstrass' strengthened condition. A proof of sufficiency for strong minima, relaxing this condition under certain uniform continuity assumptions on the functions delimiting the problem, is presented. The proof is direct in nature as it makes no use of fields, Hamilton-Jacobi theory, Riccati equations or conjugate points. Some examples illustrate clear advantages of the new sufficient condition over the classical one.

51. *Javier F. Rosenblueth and Gerardo Sánchez Licea*, "Strengthening Weierstrass' condition", 17 pp.

P. No. 122 . . . . . **$18.00**

Abstract

Sufficiency for strong local optimality in the calculus of variations involves, in the classical theory, the strengthened conditions of Legendre and Weierstrass. In particular, the former implies nonsingularity of the arc under consideration, an assumption which has been fundamental in any of the classical sufficiency theorems. Both conditions are removed and two sufficiency theorems, obtained by strengthening the classical necessary condition of Weierstrass in ways different than the usual one, are presented.

52. *Stephen Walker and Eduardo Gutiérrez.* "Bayesian parametric inference in a nonparametric framekork", 10 pp.

P. No. 121 . . . . . **$12.00**

Abstract

This paper considers the problem of reporting a "posterior distribution" using a parametric family of distributions while working in a nonparametric framework. This "posterior" is obtained as the solution to a decision problem and can be found via a well-known optimization algorithm.

53. *Jaime Jiménez, Carlos Rodríguez, Juan C. Escalante y José Aguirre,* "El futuro de la Facultad de Estadística e Informática, Universidad Veracruzana. Hacia la formulación de un plan de desarrollo", 67 pp.

P. No. 120 . . . . . **$60.00**

Resumen

El presente trabajo recoge los frutos de lo que constituyó un ejercicio de reflexión y planeación efectuado por la mayoría de los miembros del personal académico, coordinadores, administrativos, autoridades y alumnos de la Facultad de Estadística e Informática (FEI) de la Universidad Veracruzana. El ejercicio se llevó a cabo del 6 al 8 de febrero de 2003, empleando el método de planeación participativa denominado Reunión de Reflexión y Diseño (RRD), que es una adaptación a la cultura organizacional mexicana de la Conferencia de Búsqueda (CB).

54. *Federico O'Reilly,* "Two-envelope paradox", 7 pp.

P. No. 119 . . . . . **$10.00**

Abstract

The notes address a paradox which has been studied and analyzed over a number of years. From the statement known to the author, this problem evokes past efforts to produce a unique way to act, which perhaps is not achievable, since it involves individual perceptions and the utility of money. Nevertheless a "classical" analysis is provided as well as an analysis using the Bayesian point of view. The first analysis shows that there appears to be no paradox and the second one makes explicit use of the concept of data translated likelihood to elicit a non-informative prior. This leads to a Bayesian explanation that implies a logarithmic utility function which also avoids the paradox.

55. *Guillermina Eslava, Ignacio Méndez and José Luis Castrejón*, "The 2000 Mexican Presidential Election: sampling designs evaluation", 22 pp.

P. No. 118 . . . . . **$22.00**

Abstract

Based on the official results of the 2000 presidential elections, for each voting station, an evaluation of various sampling designs and different sampling sizes useful for quick counts is reported. A description of the sampling design and result of the quick count used by the Federal Electoral Institute on election night is also given. A discussion on some aspects of design and sampling sizes offers a guide for future sampling designs of quick counts for presidential elections. Complementary a graphical representation of the election data results is presented.

56. *Federico O'Reilly,* "Significance distributions", 14 pp.

P. No. 117 . . . . . **$16.00**

Abstract

The purpose of this work is to stress the very important role of significance tests in the construction of fiducial inferences. In literature, a great deal of manuscripts have criticized fiducial inference because, among other properties, the densities obtained may have defective mass (i.e. they do not integrate up to unity). It is shown here, that there is no lack of mass but rather that in the extremes of the parametric interval, fiducial masses may exist, a property inherited from the parametric family of distributions under study. Several well known examples are discussed and it is shown that in the Natural Exponential Family, a fiducial distribution may be obtained always and will be absolutely continuous if the family is regular. A brief mention is made to the case where the statistic is discrete and contrary to what is accepted, it is shown that in the binomial and negative binomial cases, likelihood equivalent results lead to identical inferences if for the binomial and negative binomial., the fiducial is asked to be invariant with respect to naming failure and success differently, thus obeying the Strong Likelihood Principle. Other examples, both discrete and continuous are discussed.

57. *Juan González,* "An example of an averaged Markov decision process without stable policies", 3 pp.

P. No. 116 . . . . . **$16.00**

Abstract

We give an example of a Markov decision processes with expected average cost where the optimum value is no reach by a stable policy and a variation of this where there are not stables policies.

58. *Jean–Pierre Hennart, E.H. Mund and Edmundo del Valle*, "Third order nodal finite element methods with transverse and reduced integration for elliptic problems", 32 pp.

P. No. 115 . . . . . **$28.00**

Abstract

This paper describes an efficient solution technique for multidimensional elliptic problems based on the use of some third order nodal finite elements and on a reduction of the basic (multidimensional) problem to a set of coupled one-dimensional problems. This solution technique, developed rather heuristically in the framework of nuclear reactor computations in conjunction with early nodal methods, gets on a much firmer ground when applied with nodal finite elements. The first part of the paper deals with the general context of variational nodal finite element methods. The so-called "Transverse and Reduced Integration Method" is then described in the second part of the paper. Its numerical properties are illustrated by some examples.

59. *Jean-Pierre Hennart y Edmundo del Valle,* "Cuadraturas numéricas para esquemas nodales en transporte unidimensional de neutrones", 15 pp.

P. No. 114 . . . . . **$14.00**

Resumen

En trabajos recientes se presentó un formalismo generalizado de *elementos finitos nodales* para virtualmente *todas* las aproximaciones conocidas de diferencias finitas lineales a las ecuaciones de ordenadas discretas en geometría plana. Para una dirección particular μ, el flujo de neutrones Ψ se aproxima usualmente por una función Ψ_h que sobre cada intervalo espacial puede ser polinomial o casi polinomial. En este trabajo sólo se tratará el caso polinomial. Sobre cada intervalo espacial Ψ_h es un polinomio de grado k, que interpola los parámetros dados por $\{\Psi_\ell, \Psi_r, \Psi_c^0, ..., \Psi_c^{k-2}\}$, k = 1, 2, ... y $\{\Psi_r, \Psi_c^0, ..., \Psi_c^{k-1}\}$, k = 0, 1, ..., en los casos continuos y discontinuos, respectivamente. Ψ_ℓ Ψ_r, y Ψ_c^k, son el flujo angular en los extremos izquierdo y derecho y el k–ésimo momento de Legendre de Ψ sobre la celda considerada. En dichos trabajos se describen con todo detalle los esquemas CMPk de índice k (de sus siglas en inglés *Continuous Moment Polynomial*) y los DMPk de índice k (de sus siglas en inglés *Discontinuous Moment Polynomial*) para los cuales se toman k (resp. k + 1) momentos de Legendre del residuo de la ecuación de transporte para obtener un conjunto de k (resp. k + 1) ecuaciones. Las incógnitas son obtenidas celda por celda de izquierda a derecha cuando $\mu > 0$. Estos esquemas conducen a aproximaciones racionales de Padé (k, k) (resp. Padé (k, k + 1)) de exp(-ε) ($\varepsilon = \sum h / \mu$, donde h es el tamaño de la malla) y a órdenes de convergencia discretos y continuos $O(h^{2k})$ y $O(h^{k+1})$ (resp. $O(h^{2k+1})$ y $O(h^{k+1})$). Ciertamente fueron los métodos continuos los que por primera vez se emplearon para resolver la ecuación de transporte. Sin embargo, bajo situaciones muy especiales, la solución aproximada llegaba a presentar fuertes oscilaciones (como en el caso del método Diferencia Diamante y otros de características similares, pero de mayor precisión). Por esta razón se empezaron a emplear métodos discontinuos, cuya aplicación conducía a una solución aproximada en la que las oscilaciones se atenuaban fuertemente o que en algunos casos desaparecían totalmente. En este trabajo se describe cómo aplicar cuadraturas numéricas a los esquemas antes mencionados con el propósito de obtener nuevos esquemas nodales con buenas propiedades de estabilidad numérica y precisión,

además de extender su aplicación al caso donde las secciones eficaces no son constantes por pedazos. Se ofrecen resultados numéricos para un par de problemas modelo, uno con $\sum$ constante y el otro con $\sum$ variable. Los resultados confirman los órdenes de convergencia discretos y continuos sugeridos por la aproximación espacial del flujo angular.

60. *Ricardo Berlanga and Javier F. Rosenblueth*, "A new approach to conjugacy", 14 pp.

P. No. 113 . . . . . **$14.00**

Abstract

This paper concerns a characterization of second−order optimality conditions for the fixed-endpoint problem in the calculus of variations. The key new concept is a set $S(x)$ with the property that $S(x) \neq 0$, if and only if the second variation with respect to x, independently of nonsingularity assumptions, is nonnegative along admissible variations. We show that, for this set of points, it may be much easier (and never more difficult) to prove its nonemptiness than directly finding variations that make the second variation negative. Earlier Loewen and Zheng, and Zeidan, introduced related sets $C_1(x)$ and $C_2(x)$, applicable to certain optimal control problems, whose nonemptiness has been established merely as a sufficient condition for the existence of negative second variations. These sets, when reduced to the problem we are considering, are related according to $C_1(x) \subset C_2(x) \subset S(x)$. Contrary to the behaviour of $S(x)$, verifying membership of $C_1(x)$ or $C_2(x)$ may be more difficult than verifying directly if the second−order condition holds. We provide several examples for which it is straightforward to prove that $S(x) \neq 0$, but determining the sets $C_1(x)$ or $C_2(x)$ may be very difficult or perhaps even a hopeless task.

61. *Ricardo Berlanga and Javier F. Rosenblueth*, "A Sturm−Liouville approach applicable to different notions of conjugacy", 6 pp.

P. No. 112 . . . . . **$8.00**

Abstract

In recent papers, Loewen and Zheng, and Zeidan, introduced sets of "generalized conjugate points", say $C_1(x)$ and $C_2(x)$, applicable to certain optimal control problems. These sets present two undesirable features. First of all, their nonemptiness has been established merely as a sufficient condition for the existence of negative second variations. Second, one can easily find examples for which, to solve the question of nonemptiness of these sets, may be much more difficult than directly finding variations that make the second variation negative. For the fixed−endpoint problem in the calculus of variations, both difficulties are solved by means of a third set $S(x)$ which we recently introduced. In this setting, it is a simple fact to show that $C_1(x) \subset C_2(x) \subset S(x)$. However, it is not know if the three sets coincide, and a comparison between them may be extremely cumbersome. In fact, there are examples for which it is straightforward to prove that $S(x) \neq 0$, but determining the sets $C_1(x)$ or $C_2(x)$ may be a very difficult or perhaps even a hopeless task. In this paper we make use of the Sturm−Liouville theory to show that, in the one−dimensional case, and under certain assumptions on the functions delimiting the problem, the three sets coincide.

62. *Mikhail, Kudryavtsev*, "The direct and inverse problem of spectral analysis for finite–difference operators of forth order", 14 pp.

P. No. 111 . . . . . **$10.00**

Abstract

It is known that tree-diagonal matrices (the Jacobi matrices) are closely connected with the theory of orthogonal polynomials on the real line. In this work we are going to consider the five–diagonal symmetric matrices, which resemble a lot the three-diagonal matrices. There are two reasons for which the study of the five-diagonal matrices is important. First, the describe the oscillation of a mechanical system of masses, each of which is elastically connected with two neighbors on each side. Second, the fine–diagonal matrices are discrete analogs of the selfadjoint operators of the forth order. So, the study of inverse problems for five-diagonal matrices can help to solve the corresponding problems for the differential operators of the forth order. In the same way, the case of the Jacobi matrices provided ideas to solve the inverse spectral problems for the salfadjoint operators of the second order (the Sturm-Liouville operators). Therefore, this work indirectly concerns the possible extension of the Schrödinger operators to the operators of the forth order.

63. *Eduardo Gutiérrez and Pietro Muliere*, "Conjugate priors for exponential families: an information theoretical justification", 15 pp.

P. No. 110 . . . . . **$18.00**

Abstract

It is well known that Jeffreys' prior is asymptotically least favorable under the entropy risk, i.e., it asymptotically maximizes the mutual information between the sample and the parameter. In this paper we show that, on the other hand, the prior that minimizes (subject to certain constraints) the mutual information between the sample and the parameter is natural conjugate when the model belongs to a natural exponential family. Thus, conjugate priors can be regarded as maximally informative in the sense that they minimize the weight of the observations on inferences about the parameter; in other words, the expected relative entropy between prior and posterior is minimized when conjugate priors are used.

64. *José M. González-Barrios y Silvia Ruiz-Velasco*, "Componentes principales y medidas de dependencia", 26 pp.

P. No. 109 . . . . . **$22.00**

Resumen

En este trabajo se estudian las relaciones existentes entre el análisis de componentes principales y una estadística de dependencia multivariada. Se demuestra, con ejemplos y datos reales, que la información que provee componentes principales, es equiparable a la obtenida mediante la estadística de dependencia δ. Aun más, se ve que cuando el análisis de componentes principales falla, debido a una relación no lineal entre las variables, la

estadística δ sigue dando resultados confiables. Finalmente se dan algunas indicaciones de cómo utilizar la estadística d para reducción de dimensionalidad.

65. *Javier F. Rosenblueth,* "Necessity and sufficiency for isoperimetric problems", 17 pp.

P. No. 108 . . . . . **$18.00**

Abstract

Little attention has been paid to the proof, indirect in nature, given several years ago by Hestenes to establish a sufficiency theorem for the isoperimetric problem of Bolza in the calculus of variations. The usefulness of this proof is evident since it can be easily extended to other variational problems where Jacobi's theory and the notion conjugate points, or Mayer fields together with the use of an invariant integral, may fail to exist. The purpose of this paper is to give a detailed explanation of this proof. Some of the conditions implying the main result are now weakened, and several steps in the original proof which are omitted or simply sketched are now expanded in full detail. We hope that this approach will provide a clearer way of dealing with this indirect method for sufficiency.

66. *Javier F. Rosenblueth,* "A new notion of conjugacy for isoperimetric problems", 17 pp.

P. No. 107 . . . . . **$18.00**

Abstract

For problems in the calculus of variations with isoperimetric constraints, we provide in this paper a set of points whose emptiness, independently of nonsingularity assumptions, is equivalent to the nonnegativity of the second variation along admissible variations. The main objective of introducing a characterization of this condition should be, of course, to obtain a simpler way of verifying it. There are two other sets of points, introduced by Loewen and Zheng (1994) and Zeidan (1996), for which this necessary condition implies their emptiness. However, we show that verifying membership of these sets may be more difficult than verifying directly if that condition holds. Contrary to this behaviour, we prove that the desired objective of characterizing that condition is achieved by means of the set introduced in this paper.

67. *Javier F. Rosenblueth* "Conjugate intervals for the linear fixed endpoint control problem", 19 pp.

P. No. 106 . . . . . **$20.00**

Abstract

In this paper we introduce, for the linear fixed endpoint control problem, a set *R(x, u)* whose emptiness is a necessary condition for optimality, *independently of normality or nonsingularity assumptions*. When reduced to the fixed endpoint problem in the calculus of

variations this set contains, for nonsingular trajectories, that of conjugate points in the underlying open time interval, so that this new condition is an extension of that of Jacobi (both for more general problems as well as for singular extremals). For certain classes of optimal control problems involving equality and inequality constraints in the control, Loewen and Zheng (1994) and Zeidan (1996) defined two other sets whose emptiness, assuming normality of the extremal under consideration, is also necessary for optimality. When reduced to the problem considered in this paper, $R(x, u)$ turns out to be more general in the sense that, if any of them is nonempty, so is $R(x, u)$, but one can easily find examples for which one deduces the nonoptimality of (x, u) by proving that $R(x, u) \neq \emptyset$, while the theory developed for those two sets fails to detect it.

68. *Javier F. Rosenblueth* "Conjugate intervals for singular trajectories in the calculus of variations", 16 pp.

P. No. 105 . . . . . **$16.00**

Abstract

There is a wide range of problems in the calculus of variations for which Jacobi's necessary condition (*the are no conjugate points in* (t_0, t_1)*, the interior of the underlying time interval*) cannot be applied because this condition depends upon the hypothesis that the trajectory under consideration is *nonsingular*. For singular trajectories, three sets of "extended conjugate points", defined by Loewen and Zheng $C_1(x)$, Zeidan $C_2(x)$, and Berlanga and Rosenblueth $R(x)$, have been recently introduced in the literature. They share several features in common. In particular, it has been shown that independently of the nonsingularity of the trajectory, a necessary condition for optimality is the nonexistence of such points in (t_0, t_1). This is, in a way, a generalization of Jacobi's condition for singular extremals. However, we show in this paper that the above condition continues being necessary if we include the endpoint t_1 (contrary to Jacobi's condition which holds only in the open interval). Also, we show that each of these sets is an interval in $(t_0, t_1]$ (contrary to the classical set of conjugate points which consists always of isolated points). The are, on the other hand, important differences between them. First of all, while the nonnegativity of the second variation along admissible variations simplies emptiness of any of these sets, the converse of this statement has been proved only for the set $R(x)$. Also, we establish in this paper the relations $C_1(x) \subset C_2(x) \subset R(x)$ for all points in the half-open interval $(t_0, t_1]$. Apart from this, we illustrate the fact that it may be much easier (and never more difficult) to verify nonemptiness of $R(x)$ than that of $C_1(x)$ or $C_2(x)$. In particular, for two of the examples provided in this paper, one can easily show that $R(x) \neq \emptyset$ (thus showing that the trajectory under consideration is not a solution of the problem) while it is not even clear if $C_1(x)$ or $C_2(x)$ are empty or not.

69. *Alberto Contreras and José M. González-Barrios*, "A statistical method for the determination of the appropriate order in a general class of time series models", 11 pp.

P. No. 104 . . . . . **$14.00**

Abstract

We propose a method to determine the order q of a model in a general class of time series models. For the subset of linear moving average models (MA(q)), our method is compared with that of the sample autocorrelations. Since the sample autocorrelation is meant to detect a linear structure of dependence between random variables, it turns out to be more suitable for the linear case. However, our method presents a competitive option in that case, and for nonlinear models (NLM(q)) it is shown to work better. The main advantages of our approach are that is does not make assumptions on the existence of moments and on the distribution of the noise involved in the moving average models.

70. *José M. Bernardo and Raúl Rueda,* "An objective bayesian approach to multivariate precise hypothesis testing", 14 pp.

P. No. 103 . . . . . **$12.00**

Abstract

For any probability model $M \equiv \{p(z \mid \theta,\omega),\ \theta\ O\ B,\ \omega\ O\ I\}$ assumed to describe the probabilistic behaviour of data $z\ O\ Z$, it is argued that testing whether or not the available data are compatible with a precise hypothesis $H_0 \equiv \{\theta = \theta_0\}$ is best considered as a decision problem concerning the use of the probability model $M_0 \equiv \{p(z \mid \theta_0\ ,\omega),\omega\ O\ I\}$, where the loss function measures the amount of information which could be lost if the simplified model M_0 were used as a proxy for the assumed model *M*. The expected loss with respect to the appropriate reference posterior distribution provides an attractive test statistic, the Bayesian reference statistic $b_0(z)$, which is invariant under reparametrization. The reference statistic $b_0(z)$ is measured in units of information, and its calibration (for any sample size and dimensionality) does not depend on its sampling distribution. The corresponding Bayes rule, the Bayesian reference criterion (BRC), indicates that H_0 should only be rejected if the posterior expected loss of information from using the simplified model M_0 is too large. The BRC criterion provides a general objective Bayesian solution to precise hypothesis testing which does not assume a probability mass concentrated on M_0 and, hence, it is inmmune to Lindley's paradox. The theory is illustrated within the context of multivariate normal data, and is shown to avoid Rao's paradox on the inconsistency between univariate and multivariate precise testing.

71. *José M. González-Barrios and Raúl Rueda,* "How to identify the dimension of a euclidean distance matrix", 6 pp.

P. No. 102 . . . . . **$10.00**

Abstract

Given *D* and Euclidean distance matrix between *m* points where the dimension *n* of the points is unknown, we present an algorithm to detect the right dimension. Using this algorithm it is always possible to find coordinates of the *m* points such that their distance

matrix is exactly D. The only restriction that we impose to find the exact dimension is that $m \geq n + 2$.

72. *Begoña Fernández y José M. González-Barrios*, "Multidimensional dependency measures", 33 pp.

P. No. 101 . . . . . **$16.00**

Abstract

The problem of dependency between two random variables has been studied thoroughly in the literature. Many dependency measures have been proposed according to concepts such as concordance, quadrant dependency, etc. More recently the development of the Theory of Copulas has had a great impact in the study of dependency of random variables especially in the case of continuous random variables. In the case of the multivariate setting the study of the strong mixing conditions has lead to interesting results that extend some results like the Central Limit Theorem to the case of dependent random variables.

In this paper we study the behavior of a multidimensional extension of two well known dependency measures, finding their basic properties as well as several examples. The main difference between these measures and other previously proposed is that these ones are based on the definition of independence among n random elements or variables, therefore they provide a nice form to measure dependency.

We also provide a sample version of one of these measures and find some interesting properties. Finally, based on this sample version we proposed a test of independence of multivariate observations.

73. *Alberto Contreras, Federico O'Reilly and Eduardo Gutiérrez,* "Statistical inference for mixtures of distributions for censored data with partial identification", 30 pp.

P. No. 100 . . . . . **$28.00**

Abstract

In the context of partial identifiable data, two methods are proposed to make inferences about the parameters in a mixture of distributions. We describe the use of latent variables both in the frequentist and in the Bayesian approaches to this problem. For the case of k = 2 populations, our proposal is illustrated on a classical example on failure times for communication devices first studied by Mendenhall and Hader (1958).

74. *Javier F. Rosenblueth,* "Jacobi's condition for singular extremals: an extended notion of conjugate points", 6 pp.

P. No. 99 . . . . . **$10.00**

Abstract

For the simple fixed endpoint problem in the calculus of variations, Jacobi's condition ("there are no conjugate points in the interior of the underlying time interval") is necessary for optimality if the trajectory under consideration is nonsingular. In this paper we extend the notion of conjugate point so that the above condition (in terms of this new notion) is necessary also for singular extremals. This is echieved by showing that, without any additional assumption on the trajectory, the nonnegativity of the second variation on the space of admissible variations is equivalent to the nonexistences of these "extended conjugate points".

75. *David R.S. Talbot*, "Bounds for the effective properties of nonlinear composites", 28 pp.

P. No. 98 . . . . . **$28.00**

Abstract

These notes are designed to provide a brief introduction to some of the ideas that have been used to obtain bounds on the effective properties of nonlinear composite materials. The main technique employed is the generalisation to nonlinear problems of the Hashin-Shtrikman variational principles. The methodology uses a comparison material and allows the construction of bounds for the overall energy of any composite whose material behaviour is characterised by a convex potential function. The development here is in the context of nonlinear electrostatics although the algebraic structure applies equally well to nonlinear conductivity and nonlinear creep, for example.

76. *Valery M. Levin,* "The self-consistent methods in mechanics of composite materials", 90 pp.

P. No. 97 . . . . . **$78.00**

Abstract

Composite materials are finding an increasing role in modern technology. This expalins the interest on the investigation of a variety of macroscopic (or overall) mechanical and other properties of such materials and their response to external actions. Among the many kinds of composite materials, there is an important class, so-called particulate composites, that consist of a homogeneous matrix and embedded inclusions of another materials. The main difficulties in the prediction of the overall properties of such materials lies in the necessity of taking into account the interaction of many randomly positioned inclusions. There is a group of methods in theoretical physics, named the self-consistent methods that allow the solution of this problem approximately. The aim of this lecture course is to describe some of these methods in detail and to present the main results that can be obtained with the help of them in the prediction of the overall elastic (static and dynamic) as well as coupled electroelastic (piezoelectric) properties of matrix composite materials.

77. *David Romero, Carlos Barrón and Susana Gómez,* "The optimal geometry of Lennard-Jones clusters: 148-309", 13 pp.

P. No. 96 . . . . . **$14.00**

Abstract

This paper deals with the global optimization problem of determining the n-atom cluster configuration that yields the minimum Lennard-Jones potential energy. To approach this problem we propose a genetic algorithm combined with a stochastic search procedure on icosahedral lattices. Although the potentials obtained with our method for n = 148,..., 309, are in fact only upper bounds for the global minima, we believe that most of these upper bounds are tight. We provide a geometrical description of the optimal configurations found, whose structures are either icosahedral or Marks decahedral in character. Also, we were able to discover a novel morphology -called FD here- for Lennard-Jones atomic cluster.

78. *Jean-Pierre Hennart, E.H. Mund and Edmundo del Valle,* "High order nodal finite element methods for elliptic problems", 45 pp.

P. No. 95 . . . . . **$40.00**

Abstract

This paper introduces a set of primal polynomial nodal finite elements of second and third order in L^2 norm. Their parameters and basis functions are given explicitly. The nodal finite elements are applied to the approximation of general multidimensional elliptic problems. We then concentrate on a simplified version bases on transverse and numerical integration whereby one-dimensional problems are solved sequentially. Since the third order schemes (RT1, BDM1, BDFM1) are the most important ones in practice, we focus the analysis on these schemes. Special attention is paid to the BDM1 scheme of order two in mixed formulation that may be raised to the third order in the present context, and to the evaluation of the flux $\mathbf{v} = - p\nabla u$, especially for those schemes like RTk and BDFM1 where flux conservation between cells is ensure. The various possibilities are explored and tested on three benchmark problems.

79. *A. Ballesteros, S.M. Chumakov and A.N. Leznov,* "Representation of the quantum algebra SUq(2) in the basis with diagonal "Jx" generator", 10 pp.

P. No. 94 . . . . . **$10.00**

Abstract

Generators of the quantum $Su_q(2)$ algebra are obtained in the explicit form in the basis where the operator exp J_z J_x exp J_z is diagonal. It is shown that the solution of this problem is related to the representation theory of the two−dimensional algebra [s, r] = than t (s^2 – r^2 + 1). The relevance of such basis to some problems of quantum optics is discussed.