10th INTERNATIONAL CONFERENCE ON OPERATIONS RESEARCH

La Habana, March 6th-9th, 2012

Organized by:

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FOREWORDS

The Organizing Committee, has the pleasure to welcome you to the 10th International Conference on Operations Research.

This edition is possible thanks to the close cooperation among research groups of Universidad de La Habana, SAMM, Université Paris I, Benemérita Universidad Autónoma de Puebla, Universidad Autónoma de Guerrero, Universidad de Las Palmas Gran Canaria and Université Paris-Dauphine. We are also grateful for the support of Agence National de la Recherche (ANR), Cubana de Aviación, Oficina del Historiador de la Ciudad, Sociedad Cubana de Matemática y Computación, Sección Investigación Operacional, Société Francaise de Statistique and Société de Mathématiques Appliquées et Industrielles.

The contributors are coming from countries of Europe, North and South America, Asia, Africa. It is an established tradition to have a set of first rated researchers as Plenary Speakers. This time, the saga goes on with the prestigious names Boris Mordukhovich, Jan Rückman, Jean N. Bacro, Anne E-Loisel, Douminique Bakry, Martin Lotz and Justo Puerto. Closed anniversaries motivate reflections and projections. We look to the past and remember the friendly support and encouragement of Professor Dr. Jurgen Guddat, the suggestions of Professor Prof. Dr. Hubertus Jongen, the kind advise of the late Prof. Dr. Luis Rodríguez-Marín.

Presently with the active leadership of Prof. Dr. Marie Cottrell, Chair of the Program Committee, the Conference is as healthy as ever and we can be optimistic about its future. This is supported by the number and the level of the contributions, as well as by the rate of participation of newcomers.

We again welcome the participants and hope that you have a pleasant time in Habana during the days ahead.

Prof. Dr. Sira Allende.
Chair of the Organizing Committee

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INVITED LECTURERS

PLENARY LECTURERS

Jean N. Bacro(France): Max-stable processes and spatial extremes.

D. Bakry(France): Diffusions and orthogonal polynomials.

A. Eyraud-Loisel(France): An overview of some financial models using BSDE and FBSDE with enlarged filtrations

M. Lotz(UK): Complexity in convex optimization and compressed sensing

B. Mordukhovich(USA): Variational analysis in Optimization and Operations Research

J. Puerto (Spain): 50 minutes on location/distribution problems and their associated fair allocation schemes.

J. Rückmann(UK): Mathematical programs with complementarity constraints: critical point theory.

MAIN LECTURERS

D. Aussel(France), B. Cornet(France), M. Cotrell(France), J. Daduna(Germany), H. Gfrerer(Austria), M.J. Negreiros(Brazil), A. Pietrus(France), J. Rynkiewicz(France), C. Tammer(Germany)

GENERAL TIME-TABLE

	Legend			
Abbrv.	Activities	Abbrv.	Activities
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ART	Algorithms and related topics	EM	Economical Models
MC	Multicriteria decision making	O	Optimization
OR	Operations Research	ORE	Operations Research Education
P	Poster	PDE	Partial differential equation
PS	Probability and statistic	SM	Stochastic Models

Tuesday 6th

09:00-10:00: Registration.
10:30-11:30: Opening Session, Aula Magna, Universidad de La Habana.
14:00-15:00: Plenary Lecture.
15:00-15:30: Tour: "Hotel Habana Riviera and its History"
15:30-17:30: PDE1.
19:30-23:00: Welcome party, Salón Internacional Hotel Habana Riviera.

Wednesday 7th

9:00-10:00: Plenary Lecture, Salón Gelabert.
10:00-10:30: Coffee Break.
10:30-12:30 Parallel Sessions

Room 1	Room 2	Room 3	Room 4
PS1	ART1	O1	PDE2

12:30-14:00: Lunch Break
14:00-15:00: Plenary Lecture, Salón Gelabert.
15:10-16:10 Parallel Sessions

Room 1	Room 2	Room 3	Room 4
PS2	ART2	OR1	PDE3

16:10-16:30: Coffee Break.
16:30-18:30 Parallel Sessions

Room 1	Room 2	Room 3	Room 4
PS3	ART3	OR2	PDE4

Thursday 8th

9:00-10:00: Plenary Lecture, Salón Gelabert.
10:00-10:30: Coffee Break,
10:30-12:30 Parallel Sessions

Room 1	Room 2	Room 3	Room 4	Hall
MC1	EM1	O2	PDE5	P1

12:30-14:00: Lunch Break
14:00-15:00: Plenary Lecture, Salón Gelabert.
15:10-16:10 Parallel Sessions

Room 1	Room 2	Room 3	Room 4	Hall
MC2	EM2	OR3	PDE6	P2

16:10-16:30: Coffee Break.
16:30-18:30 Parallel Sessions

Room 1	Room 2	Room 3	Room 4	Hall
-	EM3	OR4	PDE7	P2

Friday 9th

9:00-10:00: Plenary Lecture, Salón Gelabert.
10:00-10:30: Coffee Break.
10:30-13:30 Parallel Sessions.

Room 1	Room 2	Room 3	Room 4	Hall
SM1	ART4/ORE1	OR4	PDE7	P3

13:00-14:00: Plenary Lecture,Salón Gelabert.
14:00-...: Closing Address.

SESSIONS

Tuesday, 6th
Morning

Plenary Lecture:
14:00-15:00: B. Mordukhovich: Variational analysis in optimization and operations research, Room 4.
Introducer: S. Allende.

Partial Differential Equations 1(PDE1): 15:30-17:30, Room 4

Rodríguez, M.	Turing-Hopf patterns near the onset.
Lorz, A.	Dirac mass dynamics in parabolic equation.
Carretto, E.	An estimate of the effect of nonlinear term in the stochastic Navier-Stokes equation characterizing the "energy cascade" in a turbulent flow.
Nungesser, M.R.	Future asymptotic of homogeneous cosmological models.

Wednesday, 7th
Morning

Plenary Lecture:
9:00-10:00: J. Rückmann: Mathematical programs with complementarity constraints: critical point theory, Room 4.
Introducer: G. Bouza.

Probabilities and Statistics 1(PS1): Room 1.

Chair: P. Gaubert.

Time	Speaker	Title
10:30-11:10	Cottrell, M. Main Lecture	Professional trajectories of workers using disconnected self-organizing maps.
11:10-11:30	Hardouin, C.	Mis-parametrization subsets for a penalized least squares model selection.
11:30-11:50	Salhi, Y.	Quickest detection of changes on mortality trend.
11:50-12:10	Liu, S.	Multivariate MA(∞) processes with heavy tails and random coefficients.
12:10-12:30	Bourguin, S.	Cramer's theorem for gamma random variables.

Algorithms and Related Topics(ART1): Room 2.

Chair: M.L. Sandoval.

Time	Speaker	Title
10:30-11:10	Negreiros, M.J. Main lecture	Thinking in parallel: manycore technology for solving combinatorial optimization problems.
11:10-11:30	Díaz, A.	Solving the balanced academic curriculum problem using the best-worst ant system.
11:30-11:50	Pereira, A. G.C.	The non-homogeneous genetic algorithm.
11:50-12:10	Escobar, J.W.	A granular variable neighborhood tabu search metaheuristic for the capacitated-location routing problem.
12:10-12:30	de Ita, G.	Modeling work teams trough signed graphs.

Optimization 1(O1): Room 3.

Chair: C. Tammer.

Time	Speaker	Title
10:30-11:10	Aussel, D. Main Lecture	Modelization of electricity markets: from simple models to more realistic ones.
11:10-11:30	Ashtiani, A.M.	A global optimization algorithm for the nonlinear sum of ratios problem.
11:30-11:50	Bouza, G.	Generic critical points for linear equilibrium constrained problems.
11:50-12:30	Pietrus, A. Main Lecture	Non differentiable perturbed Newton's method for solving variational inclusions.

Partial Differential Equations 2(PDE2): 10:30-12:45, Room 4

González, M.M.	Classical solutions for a nonlinear Fokker-Planck equation arising in Computational Neuroscience.
D'Orsogna, M.R.	Viral entry into host cells.
Chou, T.	Reconstruction of potential energy profiles from multiple rupture time distributions.

Wednesday, 7th Afternoon

Plenary Lecture:
14:00-15:00: J.N. Bacro: Max-stable processes and spatial extremes. Room 4.
Introducer: P. Gaubert.
Probability and Statistics 2(PS2): Room 1.
Chair: C. Harduin.

Time	Speaker	Title
15:10-15:50	Rynkiewicz, J. Main Lecture	Estimating the number of regimes of non-linear autoregressive models.
15:50-16:10	Olteanu, M.	An application of regime-switching models to historical data.

Probability and Statistics 3(PS3): Room 1.
Chair: C. Harduin

16:30-16:50	Solohaja F.D.	Quantile regression to identify outliers in time series.
16:50-17:10	Oliveira, F.L.C.	Autoregressive periodic model applied to the generation of synthetic scenarios, incorporating the impact of climate phenomena through SOI index.
17:10-17:30	Baillon, J.B.	There is no variational characterization of cycles in the method of periodic projections.
17:30-17:50	Bellas, A.	Robust clustering of high-dimensional data.
17:50-18:10	Randon, J.	Urban segregation: stochastic modeling enriched by statistical physics.

Algorithms and related topics 2 (ART2): Room 3.
Chair: P. Freyre

Time	Speaker	Title
15:10-15:30	Zaboleeva, A.V.	Development of automated emotion-recognition system.
15:30-15:50	Coronado, J. R.	A computational tool for performing production and warehouse budgets in an environment with uncertainty and seasonality.
15:50-16:10	Hernández, V.	Solution of a wave propagation problem using Safem on variable resolution triangular meshes.

Algorithms and related topics 3(ART3): Room 3.

Chair: V. Hernández.

16:30-16:50	García, R.V.	Automatic selection of wavelet decomposition level to compute velocity in noisy electro-oculographic records.
16:50-17:10	Abellón, M. A.	Combining mixed (point insertion) Delaunay techniques for quality 3-dimensional mesh generation.
17:10-17:30	Estrada, J.	Cubic A-spline visualizer: a computational tool for visualization of cubic A-spline curves.
17:30-17:50	Álvarez, A.C.	Step soliton solutions of the shallow water equations.
17:50-18:10	Díaz, N.	Nuevo algoritmo para la multiplicación de matrices booleanas.
18:10-18:30	Freyre, P.	Generación aleatoria de matrices de $GL_4(GF(2^r))$ con restricciones en sus elementos.
18:30-18:50	Boushaba, M.	3-dimensional m-consecutive —k-out-of-$n : F$ system

Operations Research 1(OR1): Room 2.

Chair: A. Smirnov.

Time	Speaker	Title
15:10-15:50	Daduna, J. R. Main Lecture	Short sea shipping as the backbone for multimodal freight transport in the Caribbean area.
15:50-16:10	Sandkuhl, K.	Pattern-based knowledge architecture for information logistics.

Operations Research 2: Room 2.

Chair: J. Daduna.

16:30-16:50	Smirnov, A.	Logistics-as-a-service: ontology-based architecture and approach.
16:50-17:10	Valle, J. A.	Logistics decision support systems.
17:10-17:30	Haasis, H.D.	Sustainable dispatching of transportation services on the basis of multi-agent coordination.
17:30-17:50	Molinet, T.	New approach of the neural network for the forecasting of tourism demand in tourism destinations.
17:50-18:10	Caamal, I.	Modelos económicos, modelos estadísticos y función de producción.
18:10-18:30	Makui, A.	A new view to uncertainty in Electre III method by introducing interval numbers.

Partial Differential Equations 3(PDE3): 15:10-16:10, Room 4.

Gabriel. P.	Optimal growth for linear processes with affine control - Application to a protein amplification technique.
Reynaud-Bouret, P.	Nonparametric estimation of the division rate of a size-structured population.

Partial Differential Equations 4(PDE4): 16:30-18:00, Room 4.

Krell, N.	Statistical inference for structured populations alimented by transport-fragmentation
Marciniak, A	Spike patterns in reaction-diffusion-ODE systems

Thursday, 8th
Morning

Plenary Lecture:

9:00-10:00: A. Eyraud-Loisel(France): An overview of some financial models using BSDE and FBSDE with enlarged filtrations. Room 4.

Introducer: M. Cotrell.

Multicriteria 1(MC1): Room 1.

Chair: R. Caballero.

Time	Speaker	Title
10:30-11:10	Pérez, F. Main Lecture	Multi-objective project portfolio selection under uncertainty.
11:10-11:30	Hinojosa, M.A.	Compromise utilitarian solutions in multi-criteria optimization problems as a guide for evolutionary algorithms.
11:30-11:50	Ruiz, F.	On the determination of synthetic sustainability indicators: a reference point based approach.
11:50-12:10	Pérez, V.	Composite indicator for sustainability assessment. The case of -Cuban nature based tourism destination.
12:10-12:30	León, M. A.	A resistant index issue for individual preferences aggregation. Application in the enviromental valuation of Viñales Natural Park.

Economical Models 1(EM1): Room 2.

Chair: C. Lefèvre.

Time	Speaker	Title
10:30-1050	Mastinsek, M.	Time sensitivity of the option delta.
10:50-11:10	Loisel, S.	Correlations between penalty measures.
11:10-11:30	Klingelhöfer, H.E.	Environmental liability law and investments into environmental protection technologies.
11:30-11:50	Olivares, A.	A mathematical model for the export development process of firms using reliability applications.
11:50-12:10	Celebi, D.	What is the use of my tax? DEA for tax efficiency assessment.
12:10-12:30	Celebi, D.	Non-parametric assessment of socio-economic performance of countries.

Optimization 2 (02): Room 3.

Chair: J. Rückmannn.

Time	Speaker	Title
10:30-11:10	Tammer, C. Main Lecture	Stability properties of KKT points in vector optimization.
11:10-11:30	Crawford, B.	A choice function hyperheuristic for guiding enumeration in constraint programming.
11:30-11:50	Ilhuicatzi, R.	The rolling horizon procedure in the solution of an optimal replacement problem of n-machines with random horizon.
11:50-12:30	Gfrerer, H. Main Lecture	On directional (sub)regularity and optimality conditions in nonsmooth optimization.

Partial Differential Equations 5(PDE5): 10:30-12:45, Room 4.

Bergues, L.	Mathematical modeling of tumor growth in mice following low-level direct electric current
Gentile, I.	Logarithmic Sobolev inequality applied to non-linear Cauchy problems.
Mora, C.	Stochastic Schrödinger equations with unbounded coefficients.

Posters Session 1(P1): Hall, 10:30-12:30.
Topic: Probability and Statistics.
Chair: A. Fernández.

Author	Title
Romero, M. G.	User satisfaction of BUAP libraries: A multivariate analysis.
Díaz, L.	Utilización del BMA (bayesian model average) y su comparación con otros criterios de selección de modelos en un estudio sobre la presencia de preeclampsia durante el embarazo en Guerrero, México.
Alarcón M. L.	Aplicación del modelo de regresión multinomial en un estudio sobre capacidad funcional de adultos mayores de 65 años del programa pensión guerrero en México.
Tuero, A. D.	Estimation of the probability of toxicity for insufficient sample sizes using simulation techniques.
Viada, C. E.	Meta-analysis to evaluate the efficacy and safety of Nimotuzumab in patients with brain tumors.
Garc´ia, K.	Branching processes: illustration in the propagation of the Spinocerebellar ataxia type 2.
Bouza, C. N.	Ranked set sampling and variance estimation.
Díaz, M.	Linear regression mixed models in a study of immunodeficiency in pediatric patients.
Aguilera, D.	Keep-to-the-path test, a hand movement coordination test: computacional and mathematical implemented methods.
Giniebra, D.	Nonparametric estimation of covariance functions by model selection(fully data driven procedure).
Hernández, Y.	Estimation of the soil moisture by means of data assimilation techniques.
Yera, Y.	Bounds for the expected time to extinction and the probability of extinction in the Galton-Watson process.
Díaz, A.	The use of clusters in the test are you assertive?
Miranda, I.	Sistema dinámico y polinomio predictor para estimar la relación de denso-dependencia hospedante-parasitoide.

Thursday, 8th
Afternoon

Plenary Lecture:
14:00-15:00: Bakry, D.: Diffusions and orthogonal polynomials, Room 4.
Introducer: M. Rodríguez.
Multicriteria 2(MC2): Room 1.
Chair: M. A. Hinojosa.

Time	Speaker	Title
15:10-15:30	da Serra, J. F.	Evolutionary optimization to reach consistency in multicriteria decision making.
15:30-15:50	Petrovsky, A. B.	Multi-stage technique For group-sorting multi-attribute objects.
15:50-16:10	da Serra, J. F.	Multicriteria methodology to create a modern and coherent judgment model for the Schools of Samba of Rio de Janeiro's carnival.

Economical Models 2(EM2): Room 2.
Chair: M. Mastinsek.

Time	Speaker	Title
15:10-15:30	Matveenko, V.	Optimal paths in graphs, powers with an idempotent operation, and an application to analysis of agglomerations.
15:30-15:50	Lefêvre, C.	An insurance risk model with ordered claim arrivals.
15:50-16:10	Morales, M.	On general insurance risk processes: an overview and new models.

Economical Models 3(EM3): Room 2.
Chair: M. Mastinsek.

Time	Speaker	Title
16:30-17:10	Cornet, B. Main Lecture	A remark on arbitrage free prices in multi-period economy
17:10-17:30	Denoda, L.	Fuzzy regression analysis. An economical application.
17:30-17:50	Palomino, C.	Convergence of the price of double barrier options if barriers go to infinity and zero.
17:50-18:10	Ozhegov, E.M.	Recovering of the consumer multiattributive utility maximization problem with unidentified number of attributes.

Operations Research 3(OR3): Room 3.
Chair A. Ruiz.

Time	Speaker	Title
15:10-15:30	de la Cruz, J. S.	Solving stock problems using queue theory models-application on spear parts management of harvester machine in cane industries.
15:30-15:50	Soares de L., J. M.	A bioeconomic model for beef production system's analysis in Uruguay.
15:50-16:10	Racedo, J.	Modeling of transport system of a agro-industrial sector's company in the department of Magdalena.

Operations Research 4(OR4): Room 3.

Chair: A. Ruiz.

Time	Speaker	Title
16:30-16:50	Rojas, C.	Administración y control de repuestos para el mantenimiento de cosechadoras cañeras.
16:50-17:10	Chávez, J. L.	Potato demand optimization using neural networks.
17:10-17:30	Khurshid, A.	On control charts for zero truncated negative binomial distribution.

Partial Differential Equations 6(PDE6): 15:10-18:00, Room 4

Sturm, K.T.	Optimal Transport from Lebesgue to Poisson.
Fontbona, J.	A trajectorial interpretation of entropy dissipation and a non intrinsic Bakry-Emery criterion.
Cordero, D.	tba
Caputo, P.	On the relaxation to equilibrium of random surfaces.

Posters Session 2(P2): Hall, 15:10-17:30.

Topic: Optimization.

Chair: M. Negreiros

Author	Title
Fernández, A.	Penalization method applied to vehicle routing problem with simultaneous pickup and delivery using a heterogeneous fleet.
Díaz, D.	Simultaneous pick and delivery vehicle routing problem integrated to a GIS.
Calderín, J.	Tools for using GIS information on routing problems.
Palencia, G.J.	Problem solving in integer linear programs.
Miranda, R.	Sistema informático para la confección de horarios docentes.
Miranda, R.	Modelación y solución del problema de balance de carga docente para la Universidad de Cienfuegos.
Martínez, C.A,	Use of a clearing operator to encourage de development of diversity in the metaheuristic based on swarms of particles (PSO).
Camps, L.	Comparison between ACO and PSO when applied to FDI in the DC motor benchmark.
Beausoleil, R.P.	Interactive multiobjective tabu/scatter search based on reference point.
Marcial, L. R.	Bio-inspired algorithms to the image restoration problem with non convex potential function.
Rivera, M.	Comparison of algorithms for the common shortest supersequence.
Bouza G.	Critical sets in one-paramertric programs with vanishing constraints: generic case
Marrero, A.	Global optimization algorithm based on interval analysis.
Marrero, A.	Application of fuzzy logic in HIV/AIDS dynamic in Cuba.
Restrepo, M.	Simulación y sensibilidad de un modelo para epidemias de dengue.
Restrepo, M.	EPIDEMIAS SIR Y SEIR.
Pérez, I.	Quantitative model for long-term planning of services with in situ bases
Garza, R.	Quantitative techniques in the design of production lines

Friday, 9th
Morning

Plenary Lecture:
9:00-10:00: M. Lotz: Complexity in convex optimization and compressed sensing. Room 4.
Introducer: D. Aussel.

Stochastic Modeling 1(SM1): Room 1.
Chair: V. Sistachs.

Time	Speaker	Title
10:30-10:50	Pashchenko, A.F.	Implementation of consistent methods for structural identification of nonlinear systems.
10:50-11:10	Hahn, O.	Desarrollo de un sistema de agentes autónomos para estudios de modelos de combate.
11:10-11:30	Pashchenko, F.F.	Consistent method of identification of nonlinear stochastic systems.
11:30-11:50	Preston W., J.jr	Empirical tests of acceptance sampling plans.
11:50-12:10	Sánchez, J.E.	The PLS approach for systems of structural equations: a detailed presentation.

Algorithms and Related Topics (ART4): Room 2.
Chair: M.L. Baguer.

Time	Speaker	Title
10:30-10:50	Medrano, B.	Algoritmo híbrido basado en optimización por enjambre de partículas y recocido simulado para la solución de un problema de planificación de múltiples proyectos con recursos limitados.
10:50-11:10	Méndez, B. M.	Optimized keyword search in XML documents.
11:10-11:30	Molinet, J.A.	Clustering algorithms for reducing the training set in text classification.
11:30-11:50	Eremeev, A.	Methods and tools of creating the decision support systems for diagnostics of complex objects.

OR Education 1(ORE1): Room 2
Chair: S. Allende.

Time	Speaker	Title
12:00-12:20	Escobar, M. C	Teaching linear programming in social sciences.
12:20-12:40	Canen, A. G.	OR/MS education: multicultural reflections for teacher effectiveness.
12:40-13:00	Allende, S.	Postgraduate Education on OR: Towards a multidisciplinary approach to applications
13:00-13:30	Round Table	Postgraduate Education and OR

Operations Research 4: Room 3.
Chair: J. Betancourt.

Time	Speaker	Title
10:30-10:50	López, L.	Modelo de simulación con retardo para el control de la transmisión del dengue.
10:50-11:10	Arce, O.	Modelado de la vacunación univalente y bivalente del dengue con amplicación dependiente de anticuerpos ADE.
11:10-11:30	García, J. F.	Costo-efectividad de intervenciones clínicas frente al problema de muerte neonatalen Tabasco.
11:30-11:50	Betancourt, J.	Trans-disciplinary approach for the dynamic analysis of diseases spread.
11:50-12:10	Ortiz, E.	SS_vIR model with partially effective vaccination

12:30-13:30: Presentation of the book OR in Medicine and environment. Room 3.

Partial Differential Equations 7(PDE7): 10:30-13:30, Room 4

Arsénio, D.	From the Vlasov-Maxwell-Boltzmann system to incompressible viscous electro-magneto-hydrodynamics.
Fujita, H.	Mathematical modeling of the motion of atmosphere with phase transition of water.
Bisi, M.	Multi-temperature hydrodynamic equations from kinetic theory for rarefied gas mixtures.
Meunier, N.	tba

Posters Session 3(P3): Hall 10:30-12:30
Topic: Numerical Analysis
Chair: J. Lemagne.

Speaker	Title
Marín, J.	An equation to describe acoustic waves in a rotating compressible ideal fluid which have a spiral movement along the rotation axis.
Herrera, C.	Distintos métodos de almacenamiento de las matrices sparse. Aplicaciones a los sistemas lineales y no lineales.
Guerra, V.	Asymmetric bipartite cut for an image classification problem
Castellanos, L.O	A hybrid method for the solution of an inverse problem in size-structured population model
González, Y.	Non-monotone dependencies in vine estimation of distribution algorithms
Sotolongo, A.	Local linearization adaptative codes for odes
Lemagne, J.	Aplicación mediante un modelo con retardo de los mínimos cuadrados generalizados para funciones vectoriales.
Díaz, E.	Comparison of performance between the algorithms VMO, DE and ODE

Plenary Lecture:
13:30-14:30:.J. Puerto: 50 minutes on location/distribution problems and their associated fair allocation schemes.
Room 4.
Introducer: R. Caballero.

PLENARY LECTURES

MAX-STABLE PROCESSES AND SPATIAL EXTREMES

J.N. Bacro*, and C. Gaetan**
*University of Montpellier II, France.
**Universitta Ca' Foscari, Venezia, Italy.

In environmental sciences, many questions of interest bear on extreme spatial events. Max-stable processes take a prominent role in modeling the extreme spatial dependence because they appear as a natural extension of the multivariate extreme value distributions for dealing with spatial data. After a brief review on max-stable properties for one and multi-dimensional extreme values distributions, the talk will focus on spatial max-stable processes. Some classical representations (Smith, 1990; Schlather, 2002; Kabluchko et al., 2009) will be presented and inference on model parameters will be considered. Parametric inference for spatial max-stable processes is difficult since the related likelihoods are unavailable. A composite likelihood approach based on the bivariate distribution of block maxima has been recently proposed in the literature (Padoan et al., 2010). However modeling block maxima is a wasteful approach provided that other information is available. Moreover an approach based on block, typically annual, maxima is unable to take into account the fact that maxima occur or not simultaneously. To bypass such problems, two approaches for composing likelihoods based on pairs of exceedances will be presented. The first one comes from the tail approximation for bivariate distribution proposed by Ledford and Tawn (1996) when both pairs of observations exceed the fixed threshold. The second one uses the bivariate extension(Rootz**en and Tajvidi, 2006) of the generalized Pareto distribution which allows to model exceedances when at least one of the components is over the threshold. The two approaches are compared through a simulation study according to dfferent degrees of spatial dependency. Results show that the strength of the spatial dependence plays a fundamental role in determining which is the best estimating procedure.

Keywords: Max-stable processes, Composite likelihood, Extremal dependence, Generalized Pareto distribution, Spatial statistics.

DIFFUSIONS AND ORTHOGONAL PLYNOMIALS

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Diffusion semigroups are described through their generators, which are in general in $\mathbb{R}^n$ or an open set in it second order differential operators of the form

$$L(f)(x) = \sum_{ij} a^{ij}(x) \frac{\partial^2 f}{\partial x_i \partial x_j} + \sum_i b^i(x) \frac{\partial f}{\partial x_i}$$

The easiest cases are when one is able to diagonalize this operator in an basis of orthogonal polynomials, since then one is able to have a quite explicit description of the associated law of the underlying process. In dimension 1, there are not many examples of such a situation. It reduces to the family of Jacobi, Laguerre and Hermite polynomials. In higher dimension, many examples come from Lie group actions of homogeneous spaces, or generalizations of them, through root systems or other algebraic constructions. We shall give a complete characterization of the problem : on which open sets in Rn one may expect to find a probability measure for which the associated orthogonal polynomials are eigenvectors of diffusion operators.

We shall give a complete description of all the models in dimension 2, where we are able to completely solve this problem. There are exactly 11 compact sets (up to affine transformations), and 7 non compact ones, on which there exist such a measure. We shall also describe all the associated measures and operators.

AN OVERVIEW OF SOME FINANCIAL MODELS USING BSDE AND FBSDE WITH ENLARGED FILTRATIONS

Anne Eyraud-Loisel

Université Lyon 1, France.

The general aim of the talk is to present general financial hedging problems in an asymmetrical information framework. A first model will use Backward Stochastic Differential Equations to model it, and an extension model will appear when considering an influential and informed investor. A financial agent is supposed to possess an additional information, and is also supposed to influence the market prices. The problem is then modeled by a forward-backward stochastic differential equation (FBSDE), to be solved under an initial enlargement of the Brownian filtration. An existence and uniqueness Theorem is proved under standard assumptions. The financial interpretation is derived, together with an example of such influenced informed model. The problem is then studied from the point of view of a non informed agent hedging an option in this influenced and informed market. Her lack of information makes the market incomplete to the non informed agent. The obtained results are the expressions and a comparison between the strategy of the non informed trader, and the strategy of the informed agent. An expression of the residual risk a non informed trader keeps by detaining an option in this influenced and informed market is derived using a quadratic approach of hedging in incomplete market. Finally, the analysis leads to a measure of the lack of information that makes the incompleteness of the market. We also give an example of such influenced informed model.

COMPLEXITY IN CONVEX OPTIMIZATION AND COMPRESSED SENSING

Martin Lotz

University of Edinburgh, UK.

The performance of algorithms in convex optimization often depends on measures of condition that rely both on the representation and the geometry of the problem. Recently, these condition measures have found applications in the new field of compressed sensing. Compressed sensing is concerned with efficient non-adaptive recovery of sparse signals from relatively few linear measurements. This talk will give an overview of the foundations of compressed sensing and describe methods from the probabilistic analysis of condition numbers as they are applied to this field.

VARIATIONAL ANALYSIS IN OPTIMIZATION AND OPERATIONS RESEARCH

Boris Mordukhovich

Wayne State University, USA.

Variational analysis has been recognized as an active and rapidly growing area of applied mathematics and operations research motivated mainly by the study of constrained optimization and equilibrium problems, while also applying perturbation ideas and variational principles to a broad class of problems and situations that may be not of a variational nature. One of the most characteristic features of modern variational analysis is the intrinsic presence of nonsmoothness, which naturally enters not only through the initial data of the problems under consideration but largely via variational principles and perturbation techniques applied to a variety of problems with even smooth data. Nonlinear dynamics and variational systems in applied sciences also give rise to nonsmooth structures and motivate the development of new forms of analysis that rely on generalized differentiation.

This talk is mainly devoted to some recent achievements in variational analysis and its applications to problems of constrained optimization as well other areas of operations research. We will a particular attention to new results on conditioning in optimization and game theory, Newton-type methods to solve nonsmooth equations, and robust stability for favorable classes of optimization problems.

50 MINUTES ON LOCATION/DISTRIBUTION PROBLEMS AND THEIR ASSOCIATED FAIR ALLOCATION SCHEMES

Justo Puerto

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In this talk we analyze some facility location/distribution models, their resolution problems and some allocation processes that appear to enforce cooperation among their users. These optimization problems are endowed with natural cooperative games where players are the customers (demand points) in the location/distribution problem and the characteristic value of a coalition (subgroup of customers) is the cost of optimally serving its members. Specifically, we shall address general continuous single facility location problems, network design problems and some classes of logistics problems that can be solved using new techniques borrowed from the theory of semidefinite programming. In particular, we shall address the cases of total set up cost plus transportation cost and different types of coverage costs (radius and diameter).

We study the existence and computation of optimal solutions and the existence of stable and fair allocations for these situations, focusing on different framework spaces as finite dimension normed spaces and network spaces, i.e. finite metric spaces induced by undirected graphs and positive edge lengths.

MATHEMATICAL PROGRAMS WITH COMPLEMENTARITY CONSTRAINTS: CRITICAL POINT THEORY

Jan Rückmann

University of Birmingham, UK.

We study mathematical programs with complementarity constraints from a topological point of view. We derive a Morse Lemma at nondegenerate C-stationary points and prove two basic theorems from Morse theory (deformation theorem and cell-attachment theorem). Outside the C-stationary point set, continuous deformation of lower level sets can be performed and, as a consequence, the topological data (such as the number of connected components) remain invariant. However, when passing a level containing a C-stationary point, the topology of

the lower level set changes via the attachment of a q-dimensional cell where its dimension equals the stationary C-index of the corresponding C-stationary point. The stationary C-index depends on both the restricted Hessian of the Lagrangian and the Lagrange multipliers related to bi-active complementarity constraints. Finally, some relations with other stationarity concepts are discussed.

ABSTRACTS

COMBINING MIXED (POINT INSERTION) DELAUNAY TECHNIQUES FOR QUALITY 3-DIMENSIONAL MESH GENERATION

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In this paper we discuss, study and compare several mixed point insertions strategies that combines improvement and Delaunay refinement techniques. Our algorithms achieve quality by inserting Steiner points into the mesh and using the Delaunay algorithm for the automatic refinement. Numerical evidence is provided about the quality of the tetrahedra constructed.

Keywords: Delaunay Triangulation; mesh refinement; triangulation refinement.

AN APPLICATION OF REGIME-SWITCHING MODELS TO HISTORICAL DATA

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Hidden Markov models have been used already in segmenting time series in fields such as economics, finance or biology. This paper is devoted to an application to historical data. The time series we investigate contains the production of normative texts regarding military logistics, issued by the Duke of Savoy between 1559 and 1660. Empirical observa- tions showed that periods of conict are characterized by an important increase of the norm. Furthermore, it is during the studied period that the State increased and reinforced its grip on the whole society. But at what rhythm and which were the different steps of this action ? A segmentation of the data should bring some elements of answer: are there synchronous periods when comparing the normative production with the situations of war ? Or are there discordances between the two that can inform us on the State politics ? From the statisticians point of view, the data we had to deal with was very specific: an integer-valued time series with excess zeros. Moreover, according to the expert, a dependence up to the sixth lag of time was to be considered. Therefore, we propose two new models to analyze the data. In the first one, we introduce a zero-inated Poisson distribution in the context of hidden Markov models. The second model generalizes integer-valued autoregressive processes by adding a hidden Markov chain. Both models are estimated using the EM algorithm and are trained on the data set. The results are then commented and compared with other classical models.

Keywords: Regime-switching models, integer-valued time series, zero-inated distributions

POSTGRADUATE EDUCATION ON OR: TOWARDS A MULTIDISCIPLINARY APPROACH TO APPLICATIONS

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University careers such as Mathematics, Economy and Engineering, provide ORs knowledge organized in different courses. However the relations between different disciplines are poorly discussed. Postgraduate education should provides interdisciplinary knowledge and in this way, researchers able of facing real problems. In this contribution, we present a postgraduate program which attempt to satisfy such conditions. The program has been conceived for mathematicians; informatics and other professionals interested for applications of OR research models in practical problems. Goal of the workshop is to open a discussion about teaching strategies for postgraduate education, curricular design, courses organization and evaluation, roll of working groups, use of information and communication technologies, learning strategy, international collaboration.

TOOLS FOR USING GIS INFORMATION ON ROUTING PROBLEMS

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Many algorithms have been developed for solving Vehicle Routing Problems, aimed for the wide application of these models on real life. To minimize the routed distances is the goal by planning travels schedule and products distribution on traffic urban network; these problems can be modeled as vehicle routing problems. To calculate the distances between each pair of points on the network it is necessary to process geographical information of the interesting region. In this paper we present a tool that allows to represent a region on a mixed graph (vial graph) using a Geographical Information System (GIS). Vial information is taken account. Address could be linked to graph vertexes. Given any two points of the region, the shortest path between them is calculated with error less than 70m and showed on the map. That information is available for other routing algorithms.
Keywords: GIS,Collaborative Knowledge Creation, Software Tool.

SIMULTANEOUS PICK AND DELIVERY VEHICLE ROUTING PROBLEM INTEGRATED TO A GIS

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The Vehicle Routing Problem with Simultaneous Pickup and Delivery (VRPSPD) consist to find the optimum route set that allows the demand satisfaction of a set of clients, assuring on each point of the tour the fulfillment of the fleets capacity associated restriction. An instance of the problem is described by the following data: a depot of vehicles fleet and merchandise to be delivered, a set of clients with known demands of merchandise pickup and delivery and the travel costs between each clients pair and between each client and the central depot; and a heterogeneous fleet regarding capacity and fixed cost associated to each vehicle.

On real life data about depot and clients location, so as travel costs between each pair of clients are obtained processing stored information from a GIS. In this paper we present a tool developed to ease the interaction between a GIS and the solution of VRPSPD. The tool allows the caption of the data from a GIS and to show the results on the map. An heuristic algorithm for solving VRPSPD is implemented in the solver of the tool.
Keywords: GIS, Vehicle Routing, Software Tool

STEP SOLITON SOLUTIONS OF THE SHALLOW WATER EQUATIONS

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In this paper generalized solutions of the shallow water equation are obtained. One studies the particular case of a generalized soliton function passing by a variable bottom. We consider a case of discontinuity in bottom depth. We assume that the surface elevation is given by a step soliton which is defined using generalized solutions [J. F. Colombeau. Multiplication of distributions, Lectures Notes in Math. no.1532, Springer Verlag, 1993]. Finally a system of functional equations is obtained where the amplitudes and celerity of wave are the unknowns parameters. Numerical results are presented showing that the generalized solution produces good results having physical sense.
Keywords: generalized function, shallow water equation, step soliton.

MODELADO DE LA VACUNACIÓN UNIVALENTE Y BIVALENTE DEL DENGUE CON APLICACIÓN DEPENDIENTE DE ANTICUERPOS ADE

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Universidad Médica de Camagüey-Cuba,

Se presenta el modelado matemático de la dinámica de transmisión y control por vacunación contra el dengue, en una población endémica de virus, mediante un sistema de ecuaciones diferenciales ordinarias no lineales, se incluye en este modelo el fenómeno inmunológico ADE: Aplicación dependiente de anticuerpos y se pretende por tal mostrar la necesidad de una vacuna tetravalente para prevenir los casos graves de FHD y evitar el incremento de casos fatales por reinfección de la enfermedad.
Palabras clave: Dengue, Vacunación, Vacuna univalente, Modelado, ADE, Serotipos.

FROM THE VLASOV-MAXWELL-BOLTZMANN SYSTEM TO INCOMPRESSIBLE VISCOUS ELECTRO-MAGNETO-HYDRODYNAMICS

D Arsénio and L. Saint-Raymond

Under suitable hydrodynamic regimes, the Vlasov-Maxwell-Boltzmann system converges, at least formally, towards an incompressible Navier-Stokes-Fourier system coupled with self-induced electromagnetic forces. In this talk, we discuss the rigorous justification of this asymptotic regime in the framework of renormalized solutions, both with and without cutoff assumptions. We will put special emphasis on the new mathematical dificulties specific to the Vlasov-Maxwell-Boltzmann system. In particular, we will discuss the persistence of acoustic and electromagnetic waves, the hypoellipticity in kinetic transport equations, and the existence of measure-valued renormalized solutions and of renormalized solutions with a defect measure.

A GLOBAL OPTIMIZATION ALGORITHM FOR THE NONLINEAR SUM OF RATIOS PROBLEM

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This paper addresses the problem of maximizing a sum of fractional functions over a convex set, where each fractional function is described by the ratio between a concave and a convex function. Linear-fractional pro-

gramming problems fall into this category as important special cases. A global optimization algorithm based on a suitable reformulation of the problem in the outcome space is proposed. Global maximizers are obtained as the limit of the optimal solutions of a sequence of special linear-fractional programs, solved by using a rectangular branch and bound procedure. The results of a com- putational experience are reported. Experimental results have attested the robustness, the viability and the efficiency of the proposed branch and bound algorithm, which in addition is, applicable on a wide range of problems, beside being easily programmed through standard optimization packages.

Keywords: Fractional Programming, Branch and Bound Algorithm, Global Optimization.

MODELIZATION OF ELECTRICITY MARKETS: FROM SIMPLE MODELS TO MORE REALISTIC ONES

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**Czech Academy of Sciences, Czech Republic.

After the deregulation of the electricity markets in Europe different models have been proposed to handle the day-ahead market. Our aim in this talk is to present the evolution in the complexity of the models in order to take into account real word constraints. Qualitative properties of the proposed models will be presented.

THERE IS NO VARIATIONAL CHARACTERIZATION OF CYCLES IN THE METHOD OF PERIODIC PROJECTIONS

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The method of periodic projections consists in iterating projections onto m closed convex subsets of a Hilbert space according to a periodic sweeping strategy. In the presence of m_3 sets, a long-standing question going back to the 1960s is whether the limit cycles obtained by such a process can be characterized as the minimizers of a certain functional. In this paper we answer this question in the negative. Projection algorithms that minimize smooth convex functions over a product of convex sets are also discussed.

Keywords: alternating projections, best approximation, limit cycle, Von Neumann Algorithm

QUANTITATIVE MODEL FOR LONG-TERM PLANNING OF SERVICES WITH IN SITU BASES

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The main business of a services company requires interaction with the customer to create value. Some companies provide services with in situ bases, where production and consumption take place in the customer's environment, involving a greater number of resources, which can be grouped into three categories: physical (technologies, equipment, facilities), human (knowledge, experience, skills) and organizational (systems for planning, execution and control). The resources must be combined to achieve a sustained competitive advantage. Therefore, the efficient planning of physical resources, through the skills created by companies, should allow them satisfy the growing needs of its customers. Consequently, the lack of consistent methods for planning, involves considerable problems when empiricism fails to accomplish all the constraints to consider. In this way, the objective is to

develop a quantitative model that allows obtaining long-term plan of services. The research was divided into two stages: (1) determine the number of customers to attend in each planning unit, based on customer types, time and frequency of service, and (2) determine which customers address in each unit planning, using the distance between the starting ?and end- point and customers, and each other. Among the techniques used are: weighted sum, regression, linear programming and a heuristic search technique designed to select customers for the units planning. Finally, the model provides the annual plan, balancing the load in time and grouping customers by proximity.

Keywords: Long-term planning, services, in situ, linear programming; heuristic.

INTERACTIVE MULTIOBJECTIVE TABU/SCATTER SEARCH BASED ON REFERENCE POINT

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This paper presents multiobjective tabu/scatter search architecture with preference information based on reference points for problems of continuous nature. Features of this new version are: its interactive behavior, its deterministic approximation to Pareto-optimality solutions near the reference point, and the possibility to change progressively the reference point to explore different preference regions. The approach does not impose any restrictions with respect to the location of the reference points in the objective space. On 2-objective to 10-objective optimization test problems the modified approach shows its efficacy and efficiency to find an adequate non-dominated set of solutions in the preferred region.

ROBUST CLUSTERING OF HIGH-DIMENSIONAL DATA

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We address the problem of robust clustering of high - dimensional data, which is recurrent in real-world applications. Existing robust clustering methods are unfortunately sensitive in high dimension, while existing ap- proaches for high-dimensional data are in general not robust. We propose a hybrid iterative EM-based algorithm that combines an efficient high- dimensional clustering algorithm and the trimming technique. We test our algorithm on synthetic data and show its efficiency for high-dimensional noisy datasets.

Keywords: model-based clustering; robust clustering; trimming approach; high-dimensional data.

TRANSDISCIPLINAR APPROACH FOR THE DYNAMIC ANALYSIS OF DISEASES SPREAD

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The present article is aimed to people who work as health care providers and that are not familiarized with the use of the applied mathematics; the long term intention of the author is propitiating the integration of teams with working transdisciplinar style. A brief introduction to the topic and elements of the Theory of Epidemics is carried out. The future education and training of this group of health care providers must be based on simulations that improve decision making, allowing them to design sustainable strategies of sanitary control and to estimate early the parameters of epidemics from data.

Keywords: Transdiscipline; mathematical epidemiology, diseases spread

MULTI-TEMPERATURE HYDRODYNAMIC EQUATIONS FROM KINETIC THEORY FOR RAREFIED GAS MIXTURES

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Starting from the Boltzmann kinetic equations for a mixture of gas molecules, we show that the asymptotic limit assuming mechanical encounters between particles of the same species dominant (fast processes) with respect to all other (mechanical or chemical) interactions, leads to multi-temperature and multi-velocity hydrodynamic equations. Preliminary results have been obtained for a mixture of four gases with only translational degrees of freedom, subject also to a bimolecular and reversible chemical reaction. More desirable is the generalization of this procedure to a mixture of gas molecules whose internal structure is described by a discrete set of internal energy levels. Even in this case the Euler equations for densities, velocities and temperatures of each component are derived. Balance equations retain collision terms, contributed by the slow processes, which have to be closed, in the zero order Chapman-Enskog expansion, by the fast collision equilibrium. Analytical expressions for such contributions may be achieved in special situations, like Maxwell collision model, or hard-sphere interactions and only one energy level per species.

CRAMER'S THEOREM FOR GAMMA RANDOM VARIABLES

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We address the problem of knowing if whether or not the random variables X and Y each follow a Gamma law, given a random variable $Z = X + Y$ with Gamma law such that X and Y are independent. This is related to Crammer's theorem which states this result in the Gaussian distribution case. Using some characterization results on the Gamma distribution obtained by Nourdin and Peccati, we were able to prove that this property is true in the Gamma context for random variables living in a Wiener chaos of fixed order. We also give asymptotic variants of our results.
Keywords: Crammer's theorem, Gamma distribution, multiple stochastic integrals, limit theorems, Malliavin calculus.

3-DIMENCSIONAL m-CONSECUTIVE k-OUT-OF-n : F SYSTEM

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A 3-dimensional m-consecutive k-out-of-n : F system consists of n^3 components disposed on a cubic grid of size n, it fails if and only if all the components of at least m nonoverlapping cube of size k, $(1 < k < n)$ fail $(m \times k^3$ components). When $m = 1$, we obtain an ordinary 3-dimensional con- secutive k-out-of-n : F system. In this paper, we propose, in the independent and not necessarily identical case, a lower bound which has the advantage of being calculated directly from the reliability of a one dimensional consecutive- k-out-of-n : F system. To do this, we derive an intermediate system which behaves like a one dimensional m-consecutive k-out-of-n and is less reliable than the initial 3-dimensional m-consecutive k-out-of-n : F system, hence its suitability as the lower bound. Our approach converts a three-dimensional system into a one dimensional system directly.

RANKED SET SAMPLING and VARIANCE ESTIMATION

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This paper is devoted to the analysis of the estimation of the mean of a sensitive variable. The use of a randomized response (rr) procedure gives confidence to the interviewed that his privacy is protected. We consider that a simple random sampling with replacement design is used for selecting a sample. The behavior of the rr procedure, when ranked set sampling is the design used, is developed under three different ranking criteria. The usual gain in accuracy associated with the use of ranked set sampling is exhibited only by one of the designs. The behavior of the models is illustrated using data provided by a study of samples randomly neerated.

Keywords: Order statistics, expected model variance, unbiasedness

CRITICAL SETS IN ONE-PARAMETRIC MATHEMATICAL PROGRAMS WITH VANISHING CONSTRAINTS: GENERIC CASE

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One-parametric mathematical programs with vanishing constraints(MPVC) are considered

$$\min f(x,t) \text{ s.t. } h_i(x) \geq 0,\ h_i(x)g_i(x) \leq 0,\ i = 1,\ldots,l$$

Due to its disjunctive structure, linear independence constraints qualification is never satisfied. So, this concept has been adapted for this kind of problem, leading to the so called MPVC-LICQ. Under this assumption, necessary and sufficient optimality conditions have been obtained. In this work, the local structure of the set of critical points is analyzed if MPVC-LICQ holds. 4 clases of critical points are defined and we prove that for almost every quadratic perturbation of the objective function if MPVC-LICQ hold at a critical points then it belongs to one of these classes.

Keywords: parametric program with vanishing constraints, critical point, MPVC-LICQ, genericity analysis.

GENERIC CRITICAL POINTS FOR LINEAR EQUILIBRIUM CONSTRAINED PROBLEMS

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Equilibrium constrained models appear in practical applications such as the computation of Nash equilibrium points. However, these models are complicated problems because for checking if a point is feasible, we need to solve an equilibrium problem. Let us consider the linear case, *i.e.* all involved functions and the equilibrium condition are linear. So, we can identify each problem as an element of R^K, for a certain K, given by the vectors and constants defining the problem. In this work, we will characterize, for almost every $Q \in R^K$, the solutions of the problem corresponding to Q.

Keywords: equilibrium constrains, generalized critical points, genericity, parametric optimization

MODELADO MATEMÁTICO PARA EL CRECIMIENTO DE TUMORES TRATADOS CON ELECTROTERAPIA

L. Buergues

La electroterapia en el cáncer viene cobrando auge en el tratamiento de tumores; sin embargo, no está implementada en la Oncologia clínica, a pesar de sus prometedores en humanos, porque la misma no se ha estandarizado ni se conoce el mecanismo de acción. La no estandarización se explica en parte porque no se conoce la dosis óptima por tipo de tumor y los modelos existentes no explican las diferentes respuestas de los tumores después de aplicada la terapia, como progresión de la enfermedad, enfermedad estable, respuesta parcial y remisión completa. El objetivo de la presentación es la modicación de la ecuación de Gompertz para describir dichas respuestas. Un nuevo tipo de respuesta fue revelada, la respuesta parcial estacionaria. Se concluye que la ecuación de Gompertz modificada es factible para describir las cinéticas de crecimiento de los tumores no perturbados y perturbados con corriente eléctrica directa.

MODELOS ECONÓMICOS, MODELOS ESTADÍSTICOS Y FUNCIÓN DE PRODUCCIÓN

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La economía, de acuerdo con la escuela neoclsica, se preocupa por tratar los medios por los cuales la escasez de recursos se utiliza para satisfacer fines competitivos. Para conocer el uso eficiente de los recursos escasos la teoría económica plantea que las teorías, las categorías y las definiciones económicas se deben transformar o simplificar en modelos económicos y los modelos económicos deben concretarse en modelos matemáticos y estadísticos, para la cuantificación de las principales variables económicas. Los modelos econóicos se pueden identificar con las funciones económicas, algunas de las cuales son las funciones de importación y exportación; las funciones de demanda y oferta agregadas; las funciones de ahorro e inversión; las funciones de demanda y oferta sectoriales; las funciones de oferta y demanda por producto; las funciones de precios; y las funciones de producción, entre otras. La función de producción relaciona el nivel de producción (variable dependiente) y el conjunto de factores de la producción (variables independientes) que participan en la generación de un producto determinado. En este trabajo se presentan los niveles de producción obtenidos de los productos agrícolas (maíz y limón persa), utilizando un modelo de regresión lineal múltiple y un modelo de regresión exponencial (Cobb-Douglas). Los modelos estadísticos utilizados permitieron conocer los niveles de producción del maíz y del limón persa, los cuales se encuentran en las etapas eficientes de la producción, segunda etapa de la producción. Los resultados reflejan que el uso de los modelos económicos y estadísticos son muy útiles para la cuantificación de la economía agrícola, especialmente de la producción agrícola, y se recomienda la aplicación de estos instrumentos en los estudios económicos.

Palabras clave: Regresión, estimadores, elasticidades.

OR/MS EDUCATION: MULTICULTURAL REFLECTIONS FOR TEACHER EFFECTIVENESS

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Higher education institutions and other non-academic organisations, which constitute the destiny of OR/MS workforce are multicultural both in terms of the culturally diverse actors that take part in them, and their institutional and organisational identity, as constructed in their mission and philosophy. In a multicultural perspective, the present paper presents the results of two studies: in the first one, a research about knowledge construction in relation to multiculturalism and OR/MS education has been undertaken, and a framework for

a multicultural OR/MS education has been proposed, so as to contribute to multicultural thinking in the area; in the second one, a case study has been developed that analysed the extent to which multicultural sensitivities have had any impact in the course contents of OR/MS education in two main Higher Education Institution (HEI) in Rio de Janeiro, Brazil, taken as a case studies, as gleaned from documentary analysis and interviews with OR/MS academic staff. The main argument is that embedding OR/MS Education in a multicultural perspective should likely help teacher effectiveness not only in dealing with students cultural diversity but also in taking into account cultural variables that interfere with the modeling and the implementation of OR/MS models in real life organizations. It analyses the challenges and the potentials involved in that proposal, so as to contribute to the debates in the area.

Keywords: OR/MS education; multiculturalism; Higher Education; teacher effectiveness.

ON THE RELAXATION TO EQUILIBRIUM OF RANDOM SURFACES

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We consider the stochastic evolution of a class of random surfaces naturally arising in combinatorial structures - dimer coverings of the honeycomb lattice - and in statistical mechanics - Ising interfaces and the Solid-On-Solid model. Under the assumption of planar boundary conditions, we establish mixing time behavior which agrees with the diffusive scaling prediction, with bounds that are tight up to logarithmic corrections. The analysis rests on some new coupling ideas which allow us to show that the relaxation pattern roughly follows a deterministic mean curvature motion.

AN ESTIMATE OF THE EFFECT OF NONLINEAR TERM IN THE STOCHASTIC NAVIER-STOKES EQUATION CHARACTERIZING THE ENERGY CASCADE" IN A TURBULENT FLOW

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In this paper, drawing inspiration from the theory of Kolmogorov and Obukhov of 1941, we study the problem of turbulence through the stochastic Navier- Stokes equations. In particular, we consider the stochastic Navier-Stokes equations on the bi-dimensional torus $\mathbb{T}_2$ and its invariant measure. The choice of $\mathbb{T}_2$ allows us to make use of Fourier series. To study turbulence, we examine relations between the local average $\overline{v}$ of velocity v and the fluctuation $u = v - \overline{v}$. And for this purpose, we introduce a family of local average operators parametrized by the characteristic width $\delta > 0$, more precisely the convolution with a function $\Theta_\delta = \mathcal{F}^{-1}\left(\frac{1}{1+\delta|\varepsilon|^2}\right)$ The main result of this paper is the following theorem.

Theorem: We suppose that v is a solution of the Navier-Stokes equations

$$dv = [-P_H(v\nabla)v + v\Delta v]dt + dW$$

realizing an invariant measure. We set $\overline{v} = \Theta_\delta * v$. Then there exists a function $f(\delta), \delta > 0$, such that $f(\delta) \to 0$ for $\delta \to 0$ and that $v\mathbb{E}\|\nabla v\|^2_{L_2(\mathbb{T}_2)} + N_\delta = \frac{1}{2}\sum_{(j,k)\in L} \frac{1}{(1+\delta\|k\|^2)^2}\lambda^2_{j,k}$

$|N_\delta| = Cf(\delta)\sum_{(j,k)\in L} \lambda^2_{j,k}(\sum_{(j,k)\in L}\|k\|^2)^2\lambda_{j,k}\frac{1}{2}$

This theorem gives an estimate of the eventual energy "cascade" from motion of big length to motions of small length. This estimate of the energy transfer depends on , in such a way that it tends to 0 when δ tends to 0.

A HYBRID METHOD FOR THE SOLUTION OF AN INVERSE PROBLEM IN SIZE-STRUCTURED POPULATION MODEL

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**Instituto de Matemática Pura e Aplicada, Brasil.

In this work we survey the methods developed by many authors to reconstruct the division rate from the measured stable size distribution of cell densities in certain structured population models. We focus in the case when the cells grow at a variable rate (usually we consider the linear or the exponential grow behavior) but also divide into two cells of equal size when mitosis occurs. These techniques are implemented to validate the theoretical and numerical results, taking into account the specific nature of the equation. Particularly, we present the results obtained by using a hybrid regularization method in the numerical solution of the mentioned inverse problem. In this method we perform filtering and apply the quasi-reversibility technique. The analysis of convergence of the method is also presented.
Keywords: Structured population; cell division; regularization method; inverse problem

NON-PARAMETRIC ASSESSMENT OF SOCIO-ECONOMIC PERFORMANCE OF COUNTRIES

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In this study we cover evaluation of the relative effciencies of countries worldwide with regard to their socio-economic performance. We provide a comprehensive, multi-dimensional and multi-period analysis of efficiency of public sector. The analysis also investigates distinct efficiency differences across development groups and geographic regions. We employ a two-stage input-oriented, variable returns to scale Data Envelopment Analysis model to obtain an initial evaluation of country efficiencies under economy, social development, education, and health aspects. Governments that succeed are on the frontier, while those that do not optimize the use of their inputs are inefficient to a variable extent. The data set used for the analysis is obtained from derived from widely recognised data sources. We use DEA results for identifying the relatively efficient countries, determining the benchmark points for reaching full efficiency. We also evaluate the efficiency variations across groups and identified the leading factors that determines the priorities of governments.
Keywords: Public sector efficiency, Data Envelopment Analysis, Determinants of efficiency

WHAT IS THE USE OF MY TAX? DEA FOR TAX EFFICIENCY ASSESSMENT

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The provision of public service is manly financed through taxation. The paper analyses the role of taxes and government spending in improving countries socio-economic indicators. In this study, we attempt to identify the relationship between taxes and overall efficiency of governments. In order to analyze the performance and efficiency of the public sector we apply a non-parametric approach, Data Envelopment Analysis (DEA).Our analysis includes tax levels as a set of inputs to assess efficiency regarding socio-economic measures that could be interpreted as outputs of public spending. We identified five different groups outputs as education, health, economy, social development, and safety and security, each of which has been identified as a foundation of prosperity.
Keywords: Socio-economical Efficiency, Data Envelopment Analysis

POTATO DEMAND OPTIMIZATION USING NEURAL NETWORKS

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Neural Network models applications have had a fast growth thanks to their ability to model and forecast nonlinear variables with more accuracy than traditional methodologies like linear regressions. This Neural Network property is a consequence of its similitude with the human brain functionality, which maps inputs and outputs through a set of interconnections of small operational units called neurons. This work uses a Neural Network methodology to estimate the potato demand in Mexico and determine the optimum price and quantity offered to market to maximize producers earns. In order to achieve this objective, we will follow the economic theory which establishes that the demand of any good is a function of its price and the price of complementary and supplementary goods. The demand is also affected by the consumer budget and the quantity of produced goods. The potato demand model was also obtained by using a liner regression methodology with the same variables than the Neural Network model. Results show that the Neural Network model is highly more accurate than the linear regression model to forecast potato demand in Mexico given the future value of the model variables. About the optimum price, the value given by the Neural Network model is closer to the market price and the maximized earns are higher than the linear regression model. These results show the potential of Neural Network techniques to obtain better economic models which can be used by governments to improve the effect of laws and regulations on the society welfare.
Keywords: Neural Networks; Demand Optimization

RECONSTRUCTION OF POTENTIAL ENERGY PROFILES FROM MULTIPLE RUPTURE TIME DISTRIBUTIONS

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We explore the mathematical and numerical aspects of reconstructing a potential energy profile of a molecular bond from its rupture time distribution. While reliable reconstruction of gross attributes, such as the height and the width of an energy barrier, can be easily extracted from a single first passage time (FPT) distribution, the reconstruction of finer structure is ill-conditioned. More careful analysis shows the existence of optimal bond potential amplitudes (represented by an effective Peclet number) and initial bond configurations that yield the most efficient numerical reconstruction of simple potentials. Furthermore, we show that reconstruction of more complex potentials containing multiple minima can be achieved by simultaneously using two or more measured FPT distributions, obtained under different physical conditions. For example, by changing the effective potential energy surface by known amounts, additional measured FPT distributions improve the reconstruction. We demonstrate the possibility of reconstructing potentials with multiple minima, motivate heuristic rules-of-thumb for optimizing the reconstruction, and discuss further applications and extensions.

A REMARK ON ARBITRAGE FREE PRICES IN MULTI-PRIOD ECONOMY

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We study the properties of the set of arbitrage-free prices for a multi-period financial exchange economy. We provide sufficient conditions for the set of arbitrage-free prices to be convex and show that a financial exchange economy with non-convex set of arbitrage-free prices can be equivalent to a financial exchange economy with convex set of arbitrage-free prices.
Keywords: Financial exchange economy, arbitrage-free prices, equivalent financial structure

A COMPUTATIONAL TOOL FOR PERFORMING PRODUCTION AND WAREHOUSE BUDGETS IN AN ENVIRONMENT WITH UNCERTAINTY AND SEASONALITY

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In this work is it proposed a computational tool for performing production and warehouse budgets in an environment with uncertainty and seasonality. The problem is framed in a multi-product, multi-period and a limited production and storage capacity. It is intended that the generated budget is robust to fluctuations and seasonality of demand subject to the limitations of the system and legal requirements. It is proposed a method that consists of three stages: in the first stage the demand is time-disaggregated; in the second stage objective stock levels are calculated with a fuzzy linear programming model with the aim of providing a long-term vision to the third stage models; the last stage consists of developing the budget structured in a set of scenarios as a consequence of a simulation/optimization in rolling horizon. Finally, it is showed the architecture of the tool and its validation.
Keywords: Budgets, Warehouse, Production Planning, Stochastic Disaggregated, Fuzzy Set, Mixed-Integer Programming.

AUTOREGRESSIVE PERIODIC MODEL APPLIED TO THE GENERATION OF SYNTHETIC SCENARIOS, INCORPORATING THE IMPACT OF CLIMATE PHENOMENA THROUGH SOI INDEX

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Taking into account the predominance in Brazil of hydraulic energy generation, the strong dependence of the hydrological regimes makes evident the uncertainty of this problem; this suggests the stochastic modeling of the affluences, aiming at the optimization of the performance of systems operations, with the consequent reliability improvement and costs reduction. Currently, to the modeling and simulation of the affluences, it is used a Periodic Autoregressive Model, PAR(p), to each month of the four subsystems that compound the Interconnected National Energy System. That said, this study aims at estimating a hybrid model that integrates the advantages of PAR(p) model in apprehending the seasonal effects of the hydrological series, and adds the exogenous variable SOI, that is relevant in the modeling of the incorporation of the climate phenomena El Niño and El Nia. The proposed here includes, in an exogenous way, both the influence of the phenomena mentioned, through the estimation of a linear regression among the residues of the traditional models, and the SOI index series, incorporating this regression's coefficient in the traditional modeling. The results showed that the SOI index impact was statistically significant only to the South subsystem, showing a high irregular

and cyclic component, probably as a result of long term impacting phenomena. It seems that the use of the model proposed in this study to the subsystem mentioned has obtained a significant reduction in the MAPE performance evaluation metrics, which justifies the continuity of the research.

Keywords: Electric Sector; South Subsystem; Hybrid Model PAR(p) + SOI

A CHOICE FUNCTION HYPERHEURISTIC FOR GUIDING ENUMERATION IN CONSTRAINT PROGRAMMING

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In Constraint Programming, selection of a variable and a value of its domain (i.e. the enumeration strategy) are crucial for resolution performances. We propose to use a Choice Function Hyperheuristic for guiding enumeration: we exploit search process features to dynamically adapt a Constraint Programming solver in order to more efficiently solve Constraint Satisfaction Problems. The main novelty of our approach is that we reconfigure the search based solely on performance data gathered while solving the current problem. We report encouraging results where our combination of strategies outperforms the use of individual strategies.

Keywords: Constraint Solving, Constraint Programming, Constraint Satisfaction Problems, Hyperheuristics.

SHORT SEA SHIPPING AS THE BACKBONE FOR MULTIMODAL FREIGHT TRANSPORT IN THE CARIBBEAN AREA

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The constantly increasing quantitative and qualitative requirements for freight transport in the Caribbean area calls for new approaches. In the foreground here is the Short Sea Shipping (SSS) which due to the de facto monopoly is of significant importance for the region. That does not only affect the links between the islands but also the connection to the continental mainland. However, the SSS should not be considered as an isolated mean of transport. It should be rather see as an integral part of multimodal transportation chains. To achieve sufficient capable structures extensive improvements and extensions of the infrastructure as well as an efficient design of transportation and transshipment processes are necessary. As a starting point the technical and logistical framework as well as the necessary terrestrial hinterland connections will be presented and with the help of advantages and disadvantages critically analyzed. On this basis possible measurements will be developed to sustainably improve existing structures. It will be shown in this context where and to which extend quantitative methods can be applied to attain efficient and long-term sustainable solutions.

EVOLUTIONARY OPTIMIZATION TO REACH CONSISTENCY IN MULTICRITERIA DECISION MAKING

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Decision matrices can be considered an effective method to structure and represent relevant information of a strategic problem. Inconsistency in the results is a real and frequent possibility, making them ineffective considering the objectives of the model, which means no gains in decision making. In this study, it is recommended the

use of genetic algorithms to deal with inconsistency issues in multicriteria decision making. Genetic algorithms are probabilistic search computer models which are based on the mechanics of natural selection and genetics, combining the concepts of selective adaptation and survival of the fittest. They are considered to be a powerful technique of stochastic optimization and probably the most important evolutionary computer technique. Its application to the Analytic Hierarchy Process (AHP) matrices case allows the detection of inconsistent matrices, while offers alternative solutions to the decision-maker.

Keywords: Multicriteria Decision Making, Inconsistent Matrices, Genetic Algorithms, AHP.

MULTICRITERIA METHODOLOGY TO CREATE A MODERN AND COHERENT JUDGMENT MODEL FOR THE SCHOOLS OF SAMBA OF RIO DE JANEIROS CARNIVAL

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One of the most important popular expressions of Brazilian culture is samba. After almost one century of existence, the Schools of Samba Parade keeps its vitality, continuously adapting to worlds constant transformation, adjusting itself to reality and enhancing every year. Thousands of Brazilians and foreigner tourists gather to see the parade and over 180 countries receive television transmission images. Rio de Janeiros Carnival involves over 500 million dollars e generates around 83 thousand direct and indirect jobs. Nowadays, the Schools of Samba in the Special Group of Rio de Janeiros Carnival are becoming more and more professional, heading to better results and LIESA the Independent League of Schools of Samba has been trying to improve the judgment, making it more fair e straight. The efforts can be pointed out by the 22 times the rules have changed over the last 30 years. In this article, we bring a multicriteria analysis perspective to present a new judgment method, adding to each aspect of the judgment priorities to its criteria.

Keywords: Schools of Samba, Multicriteria Methodology, Carnival, AHP.

MODELING WORK TEAMS TROUGH SIGNED GRAPHS

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We present a method to count the different ways to form work teams in large corporate companies for projects with specific requirements. The teams are formed by employees and according to the ability of the employees for satisfying the requirements of the project.

We model this problem through signed graphs, where each node represents an employee and an edge defines a restriction between its nodes (the employees). A team leader define the restrictions for every project, and it is translated in a Boolean Formula Σ in two conjunctive form.

The logical one values in a satisfied assignment of Σ determine what employees can be part of an adequate team, while the logical zero values in a satisfied assignments of Σ indicate the employees that they have not to be part of the team.

In this model, $SAT(\Sigma)$ contains the set of different teams that can be formed to develop effectively the project. And $\#SAT(\Sigma)$ will show us how many different teams can be formed to develop the project. In order to compute $\#SAT(\Sigma)$, a signed extended graph is formed and recurrence equations are applied. We show for what class of signed graphs the computation of $\#SAT(\Sigma)$ can be done in polynomial time.

Keywords: Satisfiability Problem, #SAT Problem, Counting Models, Signed Graphs

COMPARISON OF PERFORMANCE BETWEEN THE ALGORITHMS VMO, DE AND ODE

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Variable Mesh Optimization (VMO) is an evolutionary population meta-heuristic where a set of nodes that represent potential solutions to an optimization problem, form a mesh (population) that grows dynamically and moves through the search space. This paper provides a performance comparison between the algorithms Differential Evolution (DE), Opposition-based Differential Evolution (ODE) and VMO for seven functions (F1 - F7) proposed for the CEC-2008 special session and competition on large scale global optimization. Interestingly VMO performs better than the other two algorithms using functions F1 and F3 with dimension 500 and F1, F3, F5 and F7 with dimension 1000 so it is recommended to test VMO in more complex searches spaces. The details of the methodology used for the comparison, as well as the final results, are also presented.

Keywords: Variable Mesh Optimization (VMO), Opposition-based Differential Evolution (ODE), Differential Evolution (DE), Large Scale Optimization.

THE USE OF CLUSTERING IN THE TEST ARE YOU ASERTIVE?

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UH, Cuba.

The problem of the assertiveness reviews an important problem in the area of the psychology. An investigation in the characteriza- tion of a social compound group for 81 individuals was carried out. Were evaluated 20 items. . . The questions expounded by the psy- chologist determine a scienti.c problem that could be analyzed using methods of cluster analysis. In this paper, the author introduces the most employed methods that appear in the bibliography. The author exposes and argued the results obtained in their application.

Keywords: assertiveness, cluster analysis.

SOLVING THE BALANCED ACADEMIC CURRICULUM PROBLEM USING THE BEST-WORST ANT SYSTEM

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The Balanced Academic Curriculum Problem consists in the assignation of courses to academic periods with the purpose of the academic load is balanced, i.e., all the periods has a similar credits load. This is a Constrain Satisfaction Problem but in this work we propose to solve it using Ant Colony Optimization, more specifically Best-Worst Ant System, because this model incorporates elements that help to explore in a better way the search space like the mutation and a restart of the pheromone trails. We will describe the problem with its constraints, the design of the solution, the experimentation using benchmark instances and a real instance, and finally the conclusions are given.

Keywords: Balanced Academic Curriculum Problem, Ant Colony Optimization, Best-Worst Ant System.

UTILIZACIÓN DEL BMA (BAYESIAN MODEL AVERAGE) Y SU COMPARACIÓN CON OTROS CRITERIOS DE SELECCIÓN DE MODELOS EN UN ESTUDIO SOBRE LA PRESENCIA DE PREECLAMPSIA DURANTE EL EMBARAZO EN GUERRERO, MÉXICO.

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**Universidad de La Habana, Cuba.

La problemática de la incertidumbre es inherente a todo modelo estadístico y vinculado a ella esta el tema de selección de modelo. En este trabajo presentamos un procedimiento para la selección de modelos en presencia de incertidumbre llamado BMA (Bayesian Model Average) el cual se aplica en un estudio sobre la presencia de preeclampsia durante el embarazo en Guerrero, México y también se comparan los resultados con otros criterios de selección de modelos.
Palabras claves: BMA, selección de modelos, regresión logística.

APLICACIÓN DEL MODELO DE REGRESIÓN MULTINOMIAL EN UN ESTUDIO SOBRE CAPACIDAD FUNCIONAL DE ADULTOS MAYORES DE 65 AÑOS DEL PROGRAMA PENSIÓN GUERRERO EN MÉXICO

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El presente trabajo se aplicó a una población de adultos mayores de 65 años de los municipios de Acapulco, Chilpancingo, Iguala, Taxco y José Azueta, debido a que en estos municipios se implementó el programa Pensión Guerrero desde su inicio en el 2003. Fueron utilizadas preguntas demográficas, de seguridad social, estado de salud, disfunciones físicas y estado anímico. El objetivo de este estudio es determinar la asociación entre el deterioro funcional con factores socio demográficos. Se aplicó un análisis de Regresión Logística Multinomial para investigar los factores asociados al estado funcional de los adultos mayores.
Palabras claves: Adulto mayor, Capacidad funcional, Actividades Básicas, Actividades Instrumentales, Regresión Multinomial.

GLOBAL OPTIMIZATION ALGORITHM BASED ON INTERVAL ANALYSIS

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This work makes a study of a prototype algorithm for solving global optimization problems, both restricted and unrestricted, based on Interval Analysis techniques. For this purpose, the fundamentals of Interval Analysis are introduced, paying special attention to interval arithmetic and inclusion functions, since these two elements form the basis for the optimization theory discussed; the algorithm is exposed in detail, and its convergence properties are analyzed. The work includes an analysis of the algorithm aimed at identifying steps that could benefit from the application of some acceleration scheme, like a parallel processing scheme or a numeric optimization technique, and a design for an improved version of the algorithm that incorporates these improvements. An implementation of the prototype algorithm was made as part of this research, including the improved variant that implements the acceleration schemes mentioned above, using the MATLAB programming language, and the INTLAB library to support the interval arithmetic operations. Furthermore, the results of several test problems,

both restricted and unrestricted, are analyzed, in order to draw conclusions regarding the effectiveness of the prototype algorithm and the acceleration schemes when solving them, and to gauge the possibility of validating its effectiveness in treating the parameter estimation problem that arises when modelling epidemics as a dynamic system by using Ordinary Differential Equations.

VIRAL ENTRY INTO HOST CELLS

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Successful viral infection of a healthy cell requires complex host-pathogen interactions. In this talk we focus on the dynamics specific to the HIV virus entering a eucaryotic cell where genetic material from the virus must penetrate, transform, and reach the nucleus to allow for viral replication. We model viral entry as a stochastic engagement of diffusing receptors and coreceptors on the cell surface. We also consider the transport of virus material to the cell nucleus by coupling microtubular motion to the concurrent biochemical transformations that render the viral material competent for nuclear entry. We discuss both mathematical and biological consequences of our model, such as the formulation of an effective integrodifferential boundary condition embodying a memory kernel and optimal timing in maximizing viral probabilities.

SISTEMA INFORMÁTICO PARA LA CONFECCIÓN DE HORARIOS DOCENTES.

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En la actualidad asignar horarios en la mayoría de las instituciones universitarias cubanas es una actividad manual, en donde un conjunto de encargados verifican que no haya conflictos en la confección de los horarios. El problema de asignación de horarios de clases consiste en asignar lo mejor posible las clases para los estudiantes y profesores en bloques de tiempo semanales, en determinadas aulas, bajo ciertas restricciones. Estos problemas son muy complejos y de naturaleza combinatoria, comúnmente clasificados NP-completo, lo cual ha motivado la utilización de técnicas metaheurísticas para tratar de encontrar buenas soluciones en un tiempo computacional razonable. En el presente trabajo se presenta la modelación de este problema para el caso de la Universidad de Cienfuegos "Carlos Rafael Rodríguez" como un problema de programación lineal binaria y se resuelve el mismo utilizando para ello una heurística tipo Tabú, en base a lo cual diseña e implementa como producto final un sistema informático para la solución automática del problema a nivel de la Universidad.

PROFESSIONAL TRAJECTORIES OF WORKERS USING DISCONNECTED SELF-ORGANIZING MAPS

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Using the Panel Study of Income Dynamics (PSID) collected on the period 1984-2003, we study the situations of American workers with respect to employment. The data include all heads of household (men or women) as well as the partners who are on the labor market, working or not. They are extracted from the complete survey by computing a few relevant features which characterize the workers situations.
To perform this analysis, we suggest to use a Self-Organizing Map (Kohonen algorithm) with specific topologies. Self Organizing Maps (SOM) have been successfully applied in a lot of real world hard problems since their

apparition. In this paper we present a new topology for SOM based on a planar graph with disconnected components (called D-SOM) which is especially interesting for clustering. Each component takes the form of a string and corresponds to an organized cluster. We will show how to build such maps and learn their parameters and we will use them to cluster the dataset in meaningful classes. This algorithm operates on elementary observations that are pairs (year, individual). It allows us to group the data into some clusters. Each cluster can be described by its mean features (good situation, precarious, no job at all, etc.) as well as the personal descriptors of the individuals it contains. From this clustering, we study the dynamics at the individual level, that is the trajectories of the individuals among the classes during the observed period. Then we estimate the transition probability matrices for each year and the corresponding stationary distributions. Finally, we try to detect possible change-points during the 19 years under study, and in particular we try to give an answer to the question: is there a significant change in 1992 (new economic policies after the Reaganomics).
Keywords: Kohonen algorithm, planar graphs, labor market, Markov chains

QUICKEST DETECTION OF CHANGES ON MORTALITY TREND
N. El Karoui, S. Loisel, Ch. Mazza, and Y. Salhi

The evolution of longevity is of remarkable importance to life insurance, reinsurance companies and pension funds. There are several components of risk for an insurance company: financial risks, including interest rate risk and credit risk (difficult to handle because the long-run durations), risks that longevity for the portfolio oscillates around the average trend, or shows a trend that is different from the one observed over the past historical data. The latter is the main component of the insurance part of longevity risk, and it is hard to handle for insurance and reinsurance companies as it is complex: long-term and systemic (not diversifiable on contrary to some other insurance risks). In this paper we construct a probabilistic proxy that a risk manager can establish to allow online detection of any deviation of the longevity trend from the current assumed trend. The optimal detection rule is assumed to be optimal with regard to an optimization criterion and permit to sound an alarm of change in the drift as quick as it occurs. The effectiveness of the methodology is assessed using real world data depending on the available information.

METHODS AND TOOLS OF CREATING THE DECISION SUPPORT SYSTEMS FOR DIAGNOSTICS OF COMPLEX OBJECTS
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This report describes the methods and basic tools of creating the real time decision support expert systems (RTDSS) on the example of a prototype for diagnostics of some complex objects (of the type of a nuclear power block), implemented on the basis of the tool complex G2. The necessity of creating RTDSS is caused by continuously growing complexity of controlled objects and processes with simultaneous time reduction, yielded by decision making person (DMP) on problem situation analysis and acceptance of necessary managing actions. RTDSS are hardware-software complexes, intended for the help to the DMP at diagnostic and management of complex objects and processes of a various nature in conditions of rigid temporary restrictions. When searching the decisions, expert models, constructed on the basis of expert knowledge, and heuristic methods of decision search, are used. According to a modern classification of software, RTDSS are a class of integrated intelligent (expert) systems of a logic-linguistic type, combining strict mathematical decision search methods with unstrict, heuristic methods, based on expert knowledge. The work was supported by RFBR (projects No 11-01-00140 and No 11-07-00038).
Keywords: diagnostics; decision making; decision support system; complex object

A GRANULAR VARIABLE NEIGHBORHOOD TABU SEARCH METAHEURISTIC FOR THE CAPACITATED-LOCATION ROUTING PROBLEM

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We address the Capacitated Location-Routing Problem (CLRP) in which the aim is to determine the depots to be opened, the costumers to be assigned to each open depot, and the routes to be performed to fulfill the demand of the costumers. The objective is to minimize the sum of the cost of the open depots, of the used vehicle costs, and of the variable costs associated with the distance travelled by the vehicles. In this paper, we propose a Granular Tabu Search (GTS) with different diversification strategies within a Variable Neighborhood Search (VNS) to solve the CLRP. A shaking procedure is applied whenever the best solution found so far is not improved for a given number of iterations. Computational experiments on benchmark data sets yield high quality solutions within short computing times, illustrating the effectiveness of the proposed approach.
Keywords: Location Routing Problem; Variable Neighborhood Search; Granular Tabu

PENALIZATION METHOD APPILED TO VEHICLE ROUTING PROBLEM WITH SIMULTANEOUS PICKUP AND DELIVERY USING A HETEROGENEOUS FLEET

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Vehicle Routing Problem with Simultaneous Pickup and Delivery using a Heterogeneous Fleet (VRPSPDHF) is an extension of Capacity Vehicle Routing Problem. Given a set of n customer with known demands of pickup and delivery of certain goods and a fleet of m heterogeneous vehicles in terms of capacity and fixed cost, the goal of the VRPSPDHF is to find the optimal set of routes which satisfy all customers demands and vehicle capacity constraints. The huge number of variables and constraints of VRPSDPHF prevent the use of exact algorithms to solve it. In this paper we present a penalization method for obtaining good quality VRPSPDHF solutions.
Keywords: Vehicle Routing Problem, Simultaneous Pickup and Delivery, Penalization Method, Subgradient Method, Simulated Annealing.

A TRAJECTORIAL INTERPRETATION OF ENTROPY DISSIPATION AND NON-INTRINSIC BAKRY-EMERY CRITERION

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We develop a pathwise description of the dissipation of general convex entropies for continuous time Markov processes, based on simple backward martingales and convergence theorems with respect to the tail sigma field. The entropy is in this setting the expected value of a backward submartingale. In the case of (non necessarily reversible) Markov diffusion processes, we use Girsanov theory to explicit its Doob-Meyer decomposition, thereby providing a stochastic analogue of the well known entropy dissipation formula, valid for general convex entropies (including total variation). Under additional regularity assumptions, and using It calculus and some ideas of

Arnold, Carlen and Ju, we obtain a new Bakry Emery criterion which ensures exponential convergence of the entropy to 0. This criterion is non-intrinsic since it depends on the square root of the diffusion matrix, and cannot be written only in terms of the diffusion matrix itself. We provide an example where the classic Bakry Emery criterion fails, but our non-intrisic criterion ensuring exponential convergence to equilibrium applies without modifying the law of the diffusion process.

GENERACIÓN ALEATORIA DE MATRICES DE $GL_4(GF(2^r))$ CON RESTRICCIONES EN SUS ELEMENTOS

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En este trabajo se presenta un nuevo algoritmo para la generación aleatoria de matrices en $GL_4(GF(2^r))$ con restricciones en sus elementos y donde las operaciones que se realizan son multiplicaciones de polinomios definidos en el campo $GF(2^r)$ módulo polinomios primitivos, adems de multiplicaciones y sumas en este campo. En el caso que se muestra, las restricciones consisten en obtener elementos distintos de un subconjunto dado de $GF(2^r)$ con un cardinal menor que 2^{r-2}.
Palabras Claves: Generación de matrices aleatorias, campos finitos.

NUEVO ALGORITMO PARA LA MULTIPLICACIÓN DE MATRICES BOOLEANAS

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En el presente artículo se muestra un algoritmo para la multiplicación de matrices booleanas cuadradas $n \times n$ invertibles. El algoritmo tiene una complejidad menor que $O(n^3(lognloglogn))$ y las operaciones que se realizan en este algoritmo son sumas y multiplicaciones en el campo finito Z_2 y multiplicación de polinomios módulo un polinomio primitivo, los polinomios pertenecen a $Z_2[x]$.

MATHEMATICAL MODELLING OF THE MOTION OF ATMOSPHERE WITH PHASE TRANSITION OF WATER

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We propose a mathematical model of the motion of atmosphere, which takes into account the phase transition of water in the atmosphere, that is, formation and evaporation of clouds, rain and snow. The physical quantities which we consider in this equation system are the density of dry air , the density of vapour π, the density of liquid water $\sigma_1(m)$ contained in the drops of mass m, the density of solidified water $\sigma_s(m)$ contained in small ice bodies of mass m, the velocity of the air $v = (v1; v2; v3)$, the velocity of the water drops of mass m, $ul(m) = (ul; 1(m); ul; 2(m); ul; 3(m))$, the velocity of the small ice bodies of mass m, $us(m) = (us; 1(m); us; 2(m); us; 3(m))$, the temperature T and the pressure p. This equation system contains some parabolic equations (essentially for v and T) and some transport equations (essentially for ρ, π, σ_1 and σ_s,) while $p, u_1(m)$ and $u_s(m)$ are considered as function of other quantities (ρ, T, v, m). We prove the existence and the uniqueness of that local solution to a slightly modified equation system. The method of the proof is based on a standard fix point argument, but the estimation of $\sigma_1(m)$ and $\sigma + s(m)$ for linearised equation is delicate. In order to remove the unnatural condition of this our result, we consider the stationary solution to

the transport equation for σ_1, reducing it to a Smoluchowski-type equation under the gravitation. We prove the existence and the uniqueness of the stationary solution under a horizontal wind". This technique can be used also for the global solution. Another important aspect of the atmosphere physics is the efiect of the radiation. We consider the equation of the radiation and of its thermic effects and we prove the existence of a stationary solution.As far as the numeric methods, we develop a simulation of the wind which goes over the mountains. As the coefficients on the terms of first derivatives are much greater than those on the terms of second derivatives, we use the finite difference method. The diminution of the temperature on the mountains obtained in this simulation coincides very well with what the physical theory predicts.

Keywords: Motion of the atmosphere, phase transition of water, parabolic equation, transport equation.

OPTIMAL GROWTH FOR LINEAR PROCESSES WITH AFFINE CONTROL- APPLICATION TO A PROTEIN AMPLIFICATION TECHNIQUE

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We consider the controlled dynamical system $(G + \alpha F(t)$; where G and F are given matrices with nonnegative extra-diagonal terms. We show the existence of an optimal Perron eigenvalue with respect to parameter α under some assumptions. Then we prove the existence of an eigenvalue (in the generalized sense) for the full optimal control problem when $\alpha = \alpha(t)$ is a time dependent control. Surprisingly enough, the two eigenvalues appear to be numerically the same.

AUTOMATIC SELECTION OF WAVELET DECOMPOSITION LEVEL TO COMPUTE VELOCITY IN NOISY ELECTRO-OCULOGRAPHIC RECORDS

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Analysis of eye movements is a valuable tool for the evaluation of the condition of patients in several neurological diseases, ataxia SCA2 amongst them. Conventional filtering has proven to be inadequate in the cancellation of biological noise associated to this disease, presenting a considerable problem in the computation of ocular velocity in electro-oculographic (EOG) records. In this work, discrete wavelet transform (DWT) is used in the velocity signal denoising and a method for the automatic selection of the wavelet decomposition level is presented. Saccadic EOG records of five healthy subjects and five patients of ataxia SCA2 were processed. Several mother wavelets, up to level 8 of decomposition, were applied to the velocity profile, which it was calculated by means of an algorithm of 8 points central difference. In order to select the mother wavelet and the approximation level to be used, the resultant waveform was evaluated analyzing residuals between the original position profile of the EOG and the numerical integration of the wavelet approximation coefficients. Very promissory results were obtained, in comparison with other filtering techniques widely used.

Keywords: wavelet; saccade; denoising

COSTO-EFECTIVIDAD DE INTERVENCIONES CLÍNICAS FRENTE AL PROBLEMA DE MUERTE NEONATAL EN TABASCO

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El último Informe sobre la Salud en el Mundo de la Organización Mundial de la Salud (OMS), revela que cada ao mueren ms de 4 millones de nios durante el período neonatal, etapa de la vida que comprende los primeros 28 días de nacido. Asimismo, las principales causas de muerte neonatal originan también graves discapacidades y secuelas físicas. Así, se estima que en el mundo cada ao ms de un millón de nios sobreviven a la asfixia, pero malviven con secuelas de parlisis cerebral, discapacidades físicas y retrazo en el aprendizaje. En México, entre 1979 y 2003 ocurrieron 722,799 muertes neonatales. Si bien los programas de salud pública y el uso de ms y mejor tecnología se han traducido en una reducción sustantiva en las tasas de mortalidad, su nivel sigue siendo alto en comparación con algunos países de América Latina. Las principales causas de muerte neonatal son la hipoxia y asfixia al nacer, la prematurez, el bajo peso, la membrana hialina, la sepsis bacteriana del recién nacido, las malformaciones congénitas y algunos defectos al nacimiento.

En Tabasco, en estos últimos 6 años se han registrado 2,752 defunciones neonatales, con un promedio anual de 458 muertes, y una tasa media de 9.38, superior a la nacional. Las principales causas son: hipoxia; problemas congénitos; corta gestación y bajo peso; sepsis bacteriana; retardo en el crecimiento, y poca ocurrencia a las unidades médicas. Las tres primeras explican el 75 por ciento de las defunciones, por lo que en la investigación se incluyen como alternativas a evaluar.

BRANCHING PROCESSES: ILLUSTRATION IN THE PROPAGATION OF THE SPINOCEREBELLAR ATAXIA TYPE 2

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The spinocerebellar ataxia type 2 (SCA-2) is a neurodegenerative disease which is characterized by the progressive destruction of the nervous cells of the spinal marrow and of the cerebellum, presenting an autosomal and dominant genetic transmission. No consulting investigation has been carried out to model the ataxia progressive evolution in Cuba, where more of the ataxia cases have been found, therefore it would be interesting to estimate the growing parameter r of the disease and analyze their behavior for predict his evolutional future.
Keywords: branching processes, Bienayme-Galton-Watson processes, spinocerebellar ataxia type 2

QUANTITATIVE TECHNIQUES IN THE DESIGN OF PRODUCTION LINES

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Quantitative techniques make viable the design and management of production systems as a result of their dissimilar potential. Usually there is a problem to decide the type and amount of equipment to acquire and to predict their levels of use, number of defective products and workers to hire. In this sense, this paper's main

objective is to design a production line using optimization techniques to balance processes and the Analytic Hierarchy Process (AHP) to facilitate the decision-making. In particular, the balance of the process depending on demand and system capacity, was achieved by using OptQuest tool from professional simulator Arena. This technique allowed us to evaluate the behavior of the system, defining the resources associated to each activity, the variables and the inputs and outputs that occur during the become of raw materials into finished goods. There were simulated a variety of design alternatives and once obtained the outcomes, AHP was used to select the most appropriate option by previously established weighted criteria. These procedures made possible, through the dynamic study of the production system, to choose the specific design that fits the lines profile. It was also able to confirm that when the decision is based on mathematical techniques and heuristic capabilities of decision makers, the result tends to engage the minimum resources to achieve the proposed goals, increasing the efficiency levels.

Keywords: Quantitative techniques, optimization, AHP, decision-making, production lines.

LOGARITHMIC SOBOLEV INEQUALITY APPLIED TO NON-LINEAR CAUCHY PROBLEMS
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In a forth coming preprint we prove the existence of a weak solution of a general reaction-diffusion equation. The logarithmic Sobolev inequality is one of the main tool of this work.

ON DIRECTIONAL (SUB)REGULARITY AND OPTIMALITY CONDITIONS IN NONSMOOTH OPTIMIZATION
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The development of optimality conditions for nonlinear programs is ultimately related with the validity of some constraint qualification condition. A widely used constraint qualification is metric regularity or subregularity, respectively. We introduce directional versions of metric regularity and subregularity and present very sharp characterizations of these properties. Then we apply the theory to a general nonlinear program, possibly non-smooth and obtain in a very natural way first order optimality conditions stronger than the known ones. For the existence of a nontrivial multiplier it is sufficient that the constraint mapping is metrically regular (or subregular) with respect to one critical direction. Actually, we show that with every critical direction where the constraint mapping behaves regular or subregular, some multiplier is associated fulfilling some additional condition. As common in non-smooth optimization, these optimality conditions are formulated in terms of coderivatives. We also discuss the possibility of replacing the coderivative of the constraint mapping by the coderivative of its contingent derivative, which seems to be easier to calculate. We also can formulate second order optimality conditions for a certain class of non-smooth optimization problems which generalize the well known conditions from the smooth case.

NONPARAMETRIC ESTIMATION OF COVARIANCE FUNCTIONS BY MODEL SELECTION (FULLY DATA DRIVEN PROCEDURE)

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We propose a model selection approach for covariance estimation of a stochastic process. Under very general assumptions, observing i.i.d replications of the process at fixed observation points, we construct an estimator of the covariance function by expanding the process onto a collection of basis functions. We formulate the problem of estimation by a matrix model of linear regression, considering (like is usual in practice) that the variance error is unknown. We study the non asymptotic property of this estimate and give a tractable way of selecting the best estimator among a possible set of candidates. The optimality of the procedure is proved via an oracle inequality which warrants that the best model is selected.
Keywords: model selection, covariance estimation, oracle inequality, stochastic process.

CLASSICAL SOLUTIONS FOR A NONLINEAR FOKKER-PLANCK EQUATION ARISING IN COMPUTATIONAL NEUROSCIENCE

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We analyze the global existence of classical solutions to the initial boundary value problem for a nonlinear parabolic equation describing the collective behavior of an ensemble of neurons. These equations were obtained as a diffusive approximation of the mean-field limit of a stochastic differential equation system. The resulting Fokker-Planck equation presents a nonlinearity in the coeffcients depending on the probability flux through the boundary. We show by an appropriate change of variables that this parabolic equation with nonlinear boundary conditions can be transformed into a non standard Stefan-like free boundary problem with a source term given by a delta function. We prove that there are global classical solutions for inhibitory neural networks, while for excitatory networks we give local well-posedness of classical solutions together with a blow up criterium. Finally, we will also study the spectrum for the linear problem corresponding to uncoupled networks and its relation to Poincare inequalities for studying their asymptotic behavior.

NON-MONOTONE DEPENDENCES IN VINE ESTIMATION OF DISTRIBUTION ALGORITHMS

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A Vine Estimation of Distribution Algorithm (VEDA) is a recently proposed optimization procedure built on top of a probabilistic graphical model called vine. In this work, we deal with non-monotone de- pendences in VEDA. In problems where the dependence relationships between the variables are nonlinear and complex, those statistical tools that rely on assumptions of linearity and/or normality are commonly not suitable in these cases. Therefore, we look for an appropriate partition of the non-monotone bivariate data into subsets for which the dependence structure is simpler to model, and then a conditional gluing copula technique is applied to build the joint distribution for the whole bivariate data set. The experi- mental results show that this strategy is a promising alternative to deal with nonlinearity and departures from the normal distribution in VEDA.

CONVERGENCE OF THE PRICE OF DOUBLE BARRIER OPTIONS IF BARRIERS GO TO INFINITY AND ZERO

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In this paper, we use Fourier Transform and Saddle Point Method to obtain some asymptotic expansions. These expansions show convergence of double barrier option to standard European option if the value of the upper barrier goes to infinity and the value of the lower barrier goes to zero. The formulas obtained give a good approximation for price of Double Barrier Options if the value of barrier is large (small) enough. Moreover, we propose a rule to change standar share option for a double barrier share option.
Keywords: Black-Scholes Model, Barrier Options, Saddle Point Method, Residue Theorem.

ASYMMETRIC BIPARTITE CUT FOR AN IMAGE CLASSIFICATION PROBLEM

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Spectral methods have shown great promise for the clustering problems. However, their use for image clustering requires special attention including the specific formulation of the task to be boarded. In this paper, we propose a novel spectral technique to find, given an image database, the subset of images that is similar to a given image I. We consider the number of image classes in the database is unknown and the interest is only in one class (the subset with relevant information for the image I). The algorithm proposes a novel definition for the pairwise affinities that involved information on image I and defines an asymmetric cut to be maximized. A spectral solution is proposed for the optimization problem and an efficient numerical implementation is presented. Experiments illustrate the results of the proposed algorithm.
Keywords: Spectral clustering, image classification, normalized cut, asymmetric cut

SUSTAINABLE DISPATCHING OF TRANSPORTATION SERVICES ON THE BASIS OF MULTI AGENT COORDINATION

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The commercial traffic has a significant share of the traffic in the Federal Republic of Germany. Given the limited traffic capacity of the German highway infrastructure and the dynamic growth of commercial freight traffic, a major concern of the Federal Government of Germany is the improvement of commercial freight forwarder dispatch concepts in order to lower the burden on the given infrastructure. Fulfilling a given amount of orders with fewer kilometres to drive comes along with a competitive advantage: freight forwarders in a highly competitive environment face a fierce pressure to reduce costs by optimizing their dispatch planning processes - a highly complex task predominantly done manually. In recent years this planning process got further complicated and difficult to optimize due to the mandatory application of the European Community Social Legislation for drivers working hours, which rendered the manual dispatch planning a prohibitively complex optimization challenge. In this context the objective of the project AMATRAK is to reduce traffic and a more efficient vehicle capacity utilization in the procurement and distribution logistics on the basis of autonomous multi-agent transport coordination. The transfer partner of the project, Stute Verkehrs-GmbH,

is a logistics service provider. The initial situation is as follows: The logistics service provider maintains a number of offices in Germany and every branch has its own customers and conducts its own dispatch process. The customer and cargo structure is very heterogeneous. Parts of the orders are less than truckload others are full truckload shipments and the cargo ranges from bulk goods to steel coils to palleted goods. So far there is little coordination between the different branches. The whole system is subject to high dynamics primarily due to the short planning horizon and the current traffic situation. By the intelligent logistics and autonomous cooperating system via software based multi-agents more efficient dispatch processes, greater transport efficiency, more intensive vehicle capacity utilization by reduction of redundant traffic and improved grouping of small goods in highly complex networks will be enabled.

DESARROLLO DE UN SISTEMA DE AGENTES AUTÓNOMOS PARA ESTUDIOS DE MODELOS DE COMBATE.

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Una de las técnicas que actualmente estn ganando mayor ímpetu en la investigación de operaciones y en los estudios de sociología computacional es la llamada modelación basada en agentes autónomos. Esta consiste en la generación de diferentes individuos con características únicas que interaccionan entre ellos y con su ambiente. Esta técnica es conveniente para el estudio de diferentes problemas en los que el factor humano debe ser tomado en cuenta.

Hemos desarrollado un programa que basado en el uso de agentes autónomos permite la investigación de diferentes conceptos de historia y táctica militar, pero no se encuentra limitado a esa función. El sistema consiste de un programa para los cálculos y una interfaz gráfica de usuario para analizar los resultados de manera visual y generar distintos análisis. Actualmente se tiene implementado un sistema de combate, diferentes algoritmos de movimiento y un algoritmo para permitir la visión de los agentes. Entre los avances proyectados se encuentran establecer y analizar algoritmos para simular comunicación mono y bidireccional, el uso de diferentes objetivos de manera dinámica, el uso de sistemas de clasificación para evolución de estrategias y técnicas de recorte de árboles de decisión para estudios de planeación y estrategias. Además se proyecta el desarrollo e implementación de diferentes indicadores visuales y numéricos que permitan hacer análisis detallados.

MIS-PARAMETRIZATION SUBSETS FOR A PENALIZED LEAST SQUARES MODEL SELECTION

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When identifying a model by a penalized minimum contrast procedure, we give a description of the over and under fitting parametrization subsets for a least squares contrast. This allows to determine an accurate sequence of penalization rates ensuring good identification. We present applications for the identification of the covariance for a general time series, and for the variogram identification of a geostatistical model.

Keywords: least squares contrast ; penalized contrast ; model selection ; misfitting ; AIC ; BIC ; mixture models ; geostatistics

URBAN SEGREGATION: STOCHASTIC MODELING ENRICHED BY STATISTICAL PHYSICS

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Combinations of multi-agent stochastic simulations and analytical solutions from statistical physics spin models have recently provided new insights into segregation phenomena described via Schellings classic model. We explore various types of segregation dynamics on the square lattice, paying particular attention to the effects of localalized quick-change operations, with a view to identifying courses of action leading to less-segregated environments which are stable in the long-run.

COMPARISON BETWEEN ACO AND PSO WHEN APPLIED TO FDI IN THE DC MOTOR BENCHMARK

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In this work, we are concerned on the application of stochastic algorithms for fault diagnosis on industrial systems. With this in mind we have considered, as initial step, the algorithms Ant Colony Optimization and Particle Swarm Optimization, in their classic formulation. This works shows a comparison of these two algorithms when diagnosing faults in the DC Motor benchmark. The diagnosis is obtained by faults estimations which is formulated as an optimization problem. The results indicate how exploration and exploitation influence some important requirements of the diagnosis: robustness, sensitivity and diagnosing time.

Keywords: Ant Colony Optimization; Particle Swarm Optimization; fault diagnosis; robust; sensitive; DC Motor.

ESTIMATION OF THE SOIL MOISTURE BY MEANS OF DATA ASSIMILATION TECHNIQUES

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The soil moisture variable is significant for issues that arise in Soil Science, Agricultural Engineering, Environmental Engineering and Hydrology. Typically it is estimated through punctual estimations, remote sensing or the models themselves. However, using a single technique is not appropriate given the lack of representativeness, high cost, time to read or other drawbacks. Alternatively the combination of techniques can lead to an improvement in the estimation of moisture, that is, to consider the model and updates of its variables captured through remote sensing or punctual estimations. This is the general idea of data assimilation techniques. This paper compares three forms of solution with a real profile of the variable. The first variant is to solve the Richards model by means of the finite difference method. The remaining two are data assimilation techniques: Direct Insertion and Kalman filter combined with the first variant. The final result is to determine which of these variants achieves the best estimate of the soil moisture variable.

Keywords: Soil moisture, data assimilation techniques,

DISTINTOS MÉTODOS DE ALMACENAMIENTO DE LAS MATRICES SPARSES.APLICACIONES A LOS SISTEMAS DE ECUACIONES LINEALES Y NO LINEALES.

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La efectividad del trabajo con matrices dispersas se mide no sólo en términos de los algoritmos que les manipulan sino también en la forma en la que el ordenador se integra dentro del proceso que generan estos algoritmos.

Entonces es lógico pensar que cuanto más eficaz sea el esquema según el cual se almacenan las matrices dispersas en un ordenador y cuanto más ágilmente se pueda recuperar la información relativa a los mismos, mejores serán los resultados que se obtienen cuando se manipulan los algoritmos.

El objetivo fundamental es el reordenamiento de la matriz, explotando su dispersión y controlando el efecto fill-in.

Dentro de las alternativas para el almacenamiento de matrices dispersas veremos el método de la banda y sus variantes así como el método de la envolvente o del perfil, uno de los cuales es utilizado en esta tesis. También existen otros esquemas de almacenamiento para matrices que no tengan ninguna estructura especial como veremos ms adelante.

COMPROMISE UTILITARIAN SOLUTIONS IN MULTI-CRITERIA OPTIMIZATION PROBLEMS AS A GUIDE FOR EVOLUTIONARY ALGORITHMS

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Multi-criteria optimization problems are considered where the decision maker is unable to determine the exact weights of importance of the criteria but can provide some imprecise information about these weights. Two solution concepts are studied in this framework: the optimistic min-max solution and the compromise utilitarian solution, both of which can be exactly computed for linear problems. For general problems, it is shown that these solutions can be approximated by means of a slight modification of the evolutionary algorithm NSGA-II.

Keywords: Multi-criteria optimization problem, partial information, utilitarian solution, min-max solution, evolutionary algorithms.

THE ROLLING HORIZON PROCEDURE IN THE SOLUTION OF AN OPTIMAL REPLACEMENT PROBLEM OF n-MACHINES WITH RANDOM HORIZON

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This paper consider a system consisting of independently operating n-machines, which follow a deterioration processes with an associated cost function. It is assumed that the system is observed at discrete time and the objective function is the total expected cost. Also, it is considered that the horizon of the problem is random with the infinite support. In this case, the optimal replacement problem with the random horizon is modeled as a nonhomogeneous optimal control problem with the infinite horizon and solved by means of the rolling horizon procedure. Then a replacement policy is provided which approximate the optimal solution. Also, a numerical example through a program in Maple is presented.

Keywords: Optimal Stochastic Control; Dynamic Programming; Markov Decision Process; Optimal Replacement Problem.

LOCAL LINEARIZATION ADAPTATIVE CODES FOR ODEs

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The aim of this work is to construct adaptive integrators for Ordinary Differential Equations based on the High Order Local Linearization method and to study its numerical behavior. Embedded Runge-Kutta formulas of Dormand and Prince are used to define Local Linearization-Runge Kutta integrators. Different orders of the involved Padé approximation are considered and their effect on the adaptive integrators is studied. The results show that the locally linearized formulas produces a significative improvement of the accuracy of the original ones, which implies a substantial reduction of the number of time steps and, consequently, a sensitive reduction of the overall computation cost of their adaptive implementation. **Keywords:** Numerical integrators, Adaptive codes, Local Linearization, Runge Kutta method, Padé approximation.

ON CONTROL CHARTS FOR ZERO TRUNCATED NEGATIVE BINOMIAL DISTRIBUTION

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The negative binomial distribution (NBD) is extensively used for the description of data too heterogeneous to be fitted by Poisson distribution. Apparently, very little work has specifically addressed control charts for the NBD. See, for example, Kaminsky et al. (1992), Ma and Zhang (1995), Hoffman (2003) and Schwertman (2005). Observed samples, however may be truncated, in the sense that the number of individuals falling into zero class can not be determined, or the observational apparatus becomes active when at least one event occurs. Chakraborty and Kakoty (1987) and Chakraborty and Singh (1991) have constructed CUSUM charts for zero-truncated Poisson distribution. Recently, Chakraborty and Khurshid (2011 a, b) have constructed CUSUM charts for zero-truncated binomial distribution and doubly truncated binomial distribution respectively. The purpose of this paper is to construct CUSUM charts for zero-truncated negative binomial distribution (ZTNBD). Average run length (ARL) of the chart is studied for different values of the parameters of the distribution for different control limits. The method of Johnson (1961) is used for constructing the CUSUM chart.
Keywords: control chart, Average Run Length (ARL), zero truncated negative binomial distribution (ZTNBD)

ENVIRONMENTAL LIABILITY LAW AND INVESTMENTS INTO ENVIRONMENTAL PROTECTION TECHNOLOGIES

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According to the polluter pays principle, environmental liability law allows for internalisation of the cost of pollution. In order to adjust to these policy instruments under the conditions of im-perfect markets, this paper presents an approach to valuing investments in environmental protec-tion technologies and to examining the determinants of their price ceiling. Since these invest-ments affect production, the payments required for a financial valuation have to be derived from production theory and production planning. Applying duality theory allows one to identify and interpret the determinants of the maximum payable price for the investment. Generalizing the well known concept of net present values from perfect markets to the conditions of imperfect markets, it can be shown that this price ceiling depends on the (corrected) net present value of the payments

and on the interdependencies arising from changes in the optimal investment and pro-duction programmes. Though we can confirm the well-established results of environmental eco-nomics for a single investment, using sensitivity analysis demonstrates that a tightened scheme of environmental liability does not always encourage environmentally beneficial investments. In particular cases, it may even lead to the paradoxical situation that: 1. it is unprofitable to invest in an environmental protection; 2. the marginal incentive to invest is negative; and 3. the harm for the environment even increases. In effect, all the (sometimes contradictory and unexpected) con-sequences of such policy changes can be interpreted in an economically comprehensible manner.

STATISTICAL INFERENCE FOR STRUCTURED POPULATIONS ALIMENTED BY TRANSPORT-FRAGMENTATION

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We investigate inference in simple models that describe the evolution in size of a population of bacteria across scales. The size of the system evolves according to a transport-fragmentation equation: each individual grows with a given transport rate, and splits into two offsprings, according to a binary fragmentation process with unknown division rate that depends on its size. Macroscopically, the system is well approximated by a PDE and statistical inference transfers into a nonlinear inverse problem. Microscopically, a more accurate description is given by a stochastic piecewise deterministic Markov process, which allows for other methods of inference, introducing however stochastic dependences. We will discuss and present some very simple results on the inference of the parameters of the system across scales. Real data analysis is conducted on E. Coli experiments.

LOGISTICS-AS-A-SERVICE: ONTOLOGY-BASED ARCHITECTURE AND APPROACH

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Cyber-Physics System (CPS) is a relatively new term assuming tight integration of physical systems and cyber (IT) systems interacting in real time. Such systems aim at providing a flexible and extensible infrastructure supporting a variety of inputs (e.g. sensor-based and customer needs) and outputs (actuators or indicators/displays). CPSs rely on communication, computation and control infrastructures to provide for efficient utilization of logistics infrastructure resources. In this context, Logistics-as-a- Service (LaaS) is a logistics network of organizations, people, information and resources supported by service-oriented cyber-physical systems. Intelligent multimodal logistics network is an important node in the worldwide logistics, involved in moving a product from supplier to customer or providing an accompanying service. The paper presents a generic architecture scheme for LaaS, which is based on representing elements of the logistics networks as services. In this environment, the role of an application ontology and integration of individual and organizational competences is investigated and the use of ontology matching for finding suitable resources in a multi-lingual logistics network is discussed.
Keywords: Cyber-Physics-System, Logistics-as-a-Service, ontology matching, competence modeling

AN INSURANCE RISK MODEL WITH ORDERED CLAIM ARRIVALS

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The present paper is concerned with an insurance risk process defined on a fixed time interval (0; t). It is said to be ordered as the claim arrival times satisfy an order statistic property. First, the variability and the covariance of an aggregate claim amount process are discussed. The distribution of the aggregate discounted claims is also derived. Then, a closed- form expression for the non-ruin probability is obtained in terms of a special family of Appell polynomials. These results allow us to generalize several recent works in the literature.
Keywords: Risk process; finite time horizon; order statistic property; aggregate claim amount; non-ruin probability; Appell polynomials.

APPLICATION OF GENERALIZED LEAST SQUARES FOR VECTORIAL FUNCTIONS TO A RETARD MODEL

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Since last century, understanding the response of ionosphere to geomagnetic storms is one of the most challenging tasks solar-terrestrial physics has been facing up to (Lazo et al. [2008]). In this communication, it is exposed an application of vector-valued data fitting by generalized least squares for modeling two parameters of Spatial Geophysics, in order to forecast them. The shown application uses a model that includes lags. The first parameter is , the critical frequency of the ionosphere layer; from the point of view of high frequency radio communications, this layer is the most important. The geomagnetic index Dst (Disturbance storm time) is designed to represent the magnetic effects of the ring current (Vassiliadis [2007]); this is just the second geophysical parameter that is forecasted in this paper. On the other hand, , among other factors, is also influenced by the magnetic field; hence we must consider the existing correlation between and Dst. Accordingly, the software to be used should take into account this important feature. To perform the fitting, it was created an algorithm where (variance-covariance matrix corresponding to vectorized observation matrix) may be an arbitrary symmetric and non-negative definite one. Moreover, another created algorithm estimates . Both algorithms are implemented on MATLAB Version 7.3; this software considers the correlation between the two parameters. It can scarcely found software that uses this vector approach and that is suitable for this application to Spatial Geophysics.
Keywords: Generalized least squares, multivariate methods, Spatial Geophysics, data fitting

A RESISTANT INDEX ISSUE FOR INDIVIDUAL PREFERENCES AGGREGATION. APPLICATION IN THE ENVIRONMENTAL VALUATION OF VIÑALES NATURAL PARK

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A lot of multicriteria modelling methods are based on relative importance valuations from several criteria given by expert groups, which should be aggregated to obtain weights as a final result. The present investigation gives a modelling for the economic valuation of Environmental Goods and Services (EGS) in Viales National Park by means of multicriteria methods and Exploratory Data Analysis (EDA). The Analytic Hierarchy Process

(AHP) is used to get the individual preferences and for their aggregation, resistant and robust statistics. The procedure allows how to estimate an indicator of the Total Economic Value (TEV) and its different components: Direct Use Value (DUV), Indirect Use Value (IUV), Option Value (OV), Existence Value (EV) and Bequest Value (BV), so a simultaneous incorporation of natural, economic and social approaches is guaranteed in the protected natural area.

Keywords: Total Economic Value (TEV), Analytic Hierarchy Process (AHP), Exploratory Data Analysis (EDA).

MULTIVARIATE MA(∞) PROCESSES WITH HEAVY TAILS AND RANDOM COEFFICIENTS

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Many interesting processes share the property of multivariate regular variation. This property is equivalent to existence of the tail process introduced by B. Basrak and J. Segers to describe the asymptotic behavior for the extreme values of a regularly varying time series. The tail process can be defined as the conditional distribution to have an extreme value in the past or in the future, given that there is an extreme value today. By construction, the knowledge of the tail process enables researchers and practitioners to know the probabilistic distribution of the spatio-temporal dependence between extremes. We apply this theory to multivariate MA(∞) processes with random coefficients. The multivariate process with representation $X_t = i \geq 0$, $C_i(t)\varepsilon ti$ is considered, where $\{C_i(t)\}$ is an array of random matrices and $\{\varepsilon t\}$ is a sequence of i.i.d. regularly varying random vector. We show that under a moment condition on the matrix $C_i(t)$, the finite-dimensional distributions of X are regularly varying with the same tail index of εt. We compute the associated limiting measure. The finite-dimensional distributions of tail process of (X_t) can be derived explicitly in terms of the tail index and the spectral measure of εt. An application is a characterization in terms of the tail process of a variety of indices and objects describing the extremal behavior of the series: the extremal index, tail dependence coefficients, the extremogram and the point process of extremes.

Keywords: extremes; heavy tails; regular variation; tail process.

CORRELATIONS BETWEEN PENALTY MEASURES

S. Loisel

In this talk, we recall some results on optimal surplus allocation in insurance. We then study correlation between penalty measures for different levels for risk processes of correlated lines of business of an insurance company. This enables us to quantify the level of redundancy between several potential natural risk indicators at group level and at entity level.

MODELO DE SIMULACIÓN RETARDO PARA EL CONTROL DE LA TRANSMISIÓN DEL DENGUE

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En este trabajo se presenta un modelo matemático que muestra la dinámica de transmisión del dengue, con el objetivo de estudiar el comportamiento de las poblaciones del Aedes aegypti y de las personas afectadas. Este

modelo puede ser tenido en cuenta por los programas de vigilancia y control a la hora de tomar decisiones. El modelo matemático propuesto est representado por ocho ecuaciones diferenciales con retardos constantes. Cada ecuación representa la variación de cada subpoblación tanto en los humanos como en el mosquito transmisor. Se presentan dos escenarios de simulación del modelo matemático resueltos mediante un algoritmo implementado en el software MATLAB, con datos obtenidos del Departamento Nacional de Estadísticas de Colombia (DANE), la Organización Mundial de la Salud (OMS) y la revisión de literatura. En cada escenario se analizan tanto la población humana como la del mosquito, con la utilización o no de controles. El modelo matemático propuesto es capaz de simular la dinámica de transmisió del dengue, muestra el comportamiento de las poblaciones del Aedes aegypti y de las personas afectadas y puede ser una herramienta a tener en cuenta para apoyar de forma científica la toma de decisiones en los programas de vigilancia y control.

DIRAC MASS DYNAMICS IN PARABOLIC EQUATIONS

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Nonlocal Lotka-Volterra models have the property that solutions concentrate as Dirac masses in the limit of small diffusion. Is it possible to describe the dynamics of the concentration points and of the mass of the Dirac? We will explain how this relates to the so-called 'constrained Hamilton-Jacobi equation' and how numerical simulations can exhibit unexpected dynamics well explained by this equation. Our motivation comes from 'populational adaptive evolution' a branch of mathematical ecology which models the darwinian evolution

A NEW VIEW TO UNCERTAINTY IN ELECTRE III METHOD BY INTRODUCING INTERVAL NUMBERS

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In classical MADM methods, the performance values for criteria are known precisely, whereas in many types of real world decision making problems it is an unrealistic assumption that the knowledge and representation of a decision maker or expert are so precise. Often a decision-maker can evaluate the performance of various alternatives in relation to considered attributes by interval numbers. In such situation the comparison of two actions leads to the comparison of two interval numbers. By such a concept we can use Electre III for decision making problems with interval numbers. Electre III is a widely accepted multi attribute decision making model, which takes into account the uncertainty and vagueness. Uncertainty concept in Electre III is introduced by indifference, preference and veto thresholds, but sometimes determining their accurate values can be very hard. In this paper we represent the values of performance matrix as interval numbers and we define the links between interval numbers and concordance matrix. Without changing the concept of concordance, in our propose concept, Electre III is usable in decision making problems with interval numbers.
Keywords: Electre III, concordance, interval numbers.

BIO-INSPIRATED ALGORITHMS TO THE IMAGE RESTORATION PROBLEM WITH NON CONVEX POTENTIAL FUNCTION

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In this paper we propose the application of two novel bio-inspired algorithms to the image digital restoration problem when that problem is formulated with the topics of vision computational: estimation Bayesian and Markov random fields. We utilize firefly algorithm and artificial bee colony algorithm because the objective function is non convex and we are interested in find the global minimum. Experimental results demonstrate that both proposed algorithms are functional when are applied to image restoration problem with non convex potential function.

Keywords: Image restoration, bio-inspired algorithms, firefly algorithm, artificial bee colony algorithm, estimation Bayesian, Markov random fields, non convex potential function

SPIKE PATTERNS IN REACTION-DIFFUSION-ODE SYSTEMS

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In this talk we explore a mechanism of pattern formation arising in the processes described by a system of a single reaction-diffusion equation coupled with ordinary differential equations. Such systems of equations arise for example from the modelling of the interactions between cellular processes and diffusing growth factors. We focus on the models of early cancerogenesis proposed by Marciniak-Czochra and Kimmel, but the theory we develop applies to the wider class of pattern formation models with an autocatalytic non-diffusing component. Such models can exhibit diffusion-driven instability (Turing-type instability). However, they are very different from classical Turing-type models and the spatial structure of the pattern emerging from the destabilisation of the spatially homogeneous steady state cannot be concluded from a linear stability analysis. The models exhibit qualitatively new patterns of behaviour of solutions, including a strong dependence of the emerging pattern on initial conditions and quasi-stability followed by rapid growth of solutions. We prove that, under very general assumptions on nonlinearities, all Turing-type patterns, i.e., regular stationary solutions, are unstable in the Lyapunov sense. In numerical simulations, solutions having the form of periodic or irregular spikes are observed.

AN EQUATION TO DESCRIBE ACOUSTIC WAVES IN A ROTATING COMPRESSIBLE IDEAL FLUID WHICH HAVE A SPIRAL MOVEMENT ALONG THE ROTATION AXIS

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Based on the fundamental equations of the Hydrodynamics we develop a model which leads to a non-classical-fourth-order partial differential equation to describe small amplitude waves in a rotating compressible ideal fluid with a spiral movement along the rotation axis. First, we develop an equation for the incompressible case and after that we obtain a similar equation for the case of compressible fluid, which contains, as a particular case, the first one. We apply to the equation well-know Physic-mathematical methods to obtain fundamental solutions, dispersion relations and further solution methods to boundary-value problems.

USE OF A CLEARING OPERATOR TO ENCOURAGE DE DEVELOPMENT OF DIVERSITY IN THE METAHEURISTIC BASED ON SWARMS OF PARTICLES (PSO)

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Heuristic methods have been developed because of the high complexity that many optimization problems have. Intensifying the search on environments close to good solutions and a good exploration of the search space, are essential factors for quality solutions. In order to accomplish this, models that intensify these factors have been developed. On one side, metaheuristics of a single trajectory which exploit solutions significantly and on the other side, population methods, which are based on the use of a set of solutions, known as population, allow a better exploration of the search space. Currently, population methods are the most used. However, a problem in the search performed by metaheuristic populations is that the population may converge, so that all members of it have a strong resemblance, which makes the search limited to a very specific area of the solution space, thereby reducing the exploration capability of the method. This research aims to study their effect on the quality of solutions incorporating an operator to encourage the development of diversity in the metaheuristics based on swarms of particles (PSO).
Keywords: Exploration; metaheuristics

TIME SENSITIVITY OF THE OPTION DELTA

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In the recent financial crisis the problem of the proper regulation of financial derivatives trading emerged.. One of the reasons for the regulations is due to high risks of such instruments. In financial derivatives markets different strategies for reduction of risk can be applied. In this article the well known technique of delta hedging used in derivatives markets is considered. The hedging error is studied, which is defined as the difference between the return to the portfolio value and the the return to the riskless investition. It is shown, that for the appropriately adjusted delta incorporating the frequency of hedging, the mean absolute hedging error and the average loss of hedging can be reduced.
Keywords: options, delta hedging

OPTIMAL PATHS IN GRAPHS, POWERS WITH AN IDEMPOTENT OPERATION, AND AN APPLICATION TO ANALYSIS OF AGGLOMERATIONS

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A dynamic model with a finite set of states without and with discounting is considered here from perspectives of dynamic programming and idempotent (tropic) mathematics. The scheme of dynamic programming was studied by many authors, however, some natural and principally important conclusions have been missed. Firstly, under natural conditions, similarly to the initial part of the optimal path with sufficiently large horizon, the final part of the path can be constructed backward (in the inverse time) stepwise by use of a function which is referred here as the second value function. This function corresponds the left eigenvector of the matrix of utilities in an algebra with an idempotent operation, while the usual value function corresponds the right eigenvector. Secondly, the T-step optimal path under a sufficiently large horizon T has a three-part structure. A representation of the T-th power of the matrix of utilities with the idempotent operation corresponds this three-part structure. As an application of the results we study some questions of modeling spatial agglomerations. A peculiarity of a

spatial system is a presence of two sets of agents: stationary agents which possess stable links with other agents in the same area and free agents which are able to move their activity to another area, i.e. break old links and establish new ones.

Keywords: Oriented graph, dynamic programming

ALGORITMO HÍBRIDO BASADO EN OPTIMIZACIÓN POR ENJAMBRE PARTÍCULAS Y RECOCIDO SIMULADO PARA LA SOLUCIÓN DE UN PROBLEMA DE PLANIFICACIÓN DE MÚLTIPLES PROYECTOS CON RECURSOS LIMITADO

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La Optimización por Enjambre deLa Optimización por Enjambre de Partículas (PSO) es una técnica bio-inspirada muy competente para la solución de problemas de optimización con espacios de búsqueda continuos. En este trabajo se propone para la solución de un problema de planificación de múltiples proyectos de producción de software un algoritmo basado en PSO que emplea el mecanismo de aceptación del Recocido Simulado para aceptar los rasgos que adquieren las partículas en su actualización. Las partículas en el algoritmo diseado se mueven simultneamente en dos conjuntos que forman el espacio de solución del problema: el conjunto de los vectores reales que almacenan los valores de las proridades de las actividades de cada solución y el conjunto de vectores enteros que contienen la asignación de recursos a cada solución. Se emplean cuatro instancias para estudiar el comportamiento del algoritmo propuesto. Los resultados son comparados con los algoritmos Recocido Simulado y Búsqueda con Vecindad Variables y con un Algoritmo PSO sin hibridizar diseados para el problema.

Palabras Claves: Software Project Scheduling, Particle Swarm Optimization, Hybrid Algo- rithms.

APPLICATION OF FUZZY LOGIC IN HIV/AIDS DYNAMIC IN CUBA.

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Estimate the rate of population infected with HIV-AIDS epidemic is a problem that has become common worldwide, and is the most important to draw a proper prevention policy in society. Until 1990 was virtually no published articles on the application of fuzzy logic in biomedical applications, but since then has been significant interest in the study applied to epidemiological models. Fuzzy logic is tolerant of imprecise data and can model nonlinear functions of arbitrary complexity, allowing its use in these systems. In the modeling of an epidemic, some values of parameters that characterize its dynamics can be described by fuzzy terms but usually when the information is used as a possibility and not as a given the information can be useful and more realistic, taking into account different levels of uncertainty. This paper presents a first approach to the application of fuzzy logic to a model describing the dynamics of the HIV AIDS epidemic in Cuba. We selected one model defined by ordinary differential equations and we applied the Mandami method of fuzzy logic to build the rulers, considering that the behavior of the source of infection could be considered fuzzy.

Keywords: Fuzzy logic; epidemiological models; HIV-AIDS.

OPTIMIZED KEYWORD SEARCH IN XML DOCUMENTS

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There are many algorithms that allow to identify data nodes in XML documents where the documents are seen like trees and the algorithms return subtrees that contains an input set of keyword. Keyword search for smallest lowest common ancestors (SLCAs) in XML data has recently been proposed as a meaningful way to identify interesting data nodes in XML data. In this paper first, we analyze the most used semantics to carry out this kind of searches, later some algorithms are explained that use one of these semantics, emphasizing more in the algorithm Multiway-SLCA, due to its good performance. To conclude we outline a problem so as not to return alone all the minimum subtrees, like they do all the algorithms that had been previously seen. Only the minimum subtree that bigger in weight is will be returned.
Keywords: keyword search, weight function, XML

SISTEMA DINÁMICO Y POLINOMIO PREDICTOR PARA ESTIMAR LA RELACIÓN DE DENSO-DEPENDENCIA HOSPEDANTE-PARASITOIDE.

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En los agroecosistemas se establece la relación compleja cultivo-plaga-bioregulador-entorno y los modelos matemáticos han tratado de aislar determinados componentes para interpretar algunas de las relaciones causa-efecto que se producen. El sistema más estudiado ha sido plaga-bioregulador sobre la base de sistemas dinámicos de predicción. El presente trabajo muestra un sistema dinámico para interpretar la relación hospedante-parasitoide. También, se muestra una regresión polinomial de grado 3 que logra predecir la densidad de los adultos del parasitoide Tamarixia radita a partir de las poblaciones de ninfas de Dipahorina citri. El coeficiente de determinación del modelo resultó 0.90 demostrando que un gran por ciento de los cambios en la densidad del parasitoide se atribuye a las variaciones que ocurren en la población del hospedante. Un algoritmo simple permite calcular la densidad del parasitoide estimando la densidad del hospedante a partir de su relación con los componentes del ambiente.
Palabras claves: Regresiones polinomiales, relación hospedante- parasitoide, sistema dinámico, Diaphorina citri, Tamarixia radiata.

MODELACIÓN DEL BALANCE DE CARGA DOCENTE EN LA UNIVERSIDAD DE CIENFUEGOS

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El problema de balance de carga docente consiste en dosificar en cada grupo de clases una cantidad de horas-clases aproximadamente igual en cada semana para cada asignatura planificada en el semestre. La solución a este problema radica en, a partir de un fondo de tiempo disponible por cada asignatura, de la disponibilidad de tiempo semanal para cada grupo de clases y de una planificación inicial elaborada por cada profesor, asignar la cantidad de turnos de clases que debe tener cada asignatura en cada semana. Dada la naturaleza combinatoria de este tipo de problemas, el mismo pertenece a la clase NP, por lo que su solución resulta de una complejidad elevada, más aún cuando, en la actualidad, el proceso de cálculo para la obtención de dicho balance en las

instituciones universitarias cubana se realiza de forma manual, como parte del proceso de planeación de horarios que se ejecuta antes de iniciarse cada semestre en las mismas.

En el presente trabajo se presenta una propuesta de solución para este problema, basada en la modelación y resolución de dicho problema empleando para ello un modelo de programación lineal en enteros, para el cual se codifica finalmente un producto informático que facilita la automatización de todo el proceso.

NEW APPROACH OF THE NEURAL NETWORK FOR THE FORECASTING OF TOURISM DEMAND IN TOURISM DESTINATIONS

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This article proposes a new approach of Artificial Neural Networks (ANN) for forecasting tourism demand, which includes time series from different seasons of arrivals, and group the similar behavior of neighboring months. The model was validated on a forecast of unconsolidated destination and seasonality, resulting in higher quality results in advance and superior to those obtained with ARIMA models and RNA used in the literature. Was obtained similarly high accuracy results in destinations such as Portugal, which proves its validity for mature destinations.
Keywords: forecasting, tourism demand, artificial neural networks

CLUSTERING ALGORITHMS FOR REDUCING THE TRAINING SET IN TEXT CLASIFICATION

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Nearest neighbors classifiers has been widely used in text mining for its relative simplicity of implementation and good performance. A negative point of these classifiers is the need for a large number of samples in the training set to obtain good results. Due to this need, the calculation of the nearest neighbors is computationally expensive and may restrict its application in some real problems which require a rapid response by the classifier. In order to eliminate this inconvenient, in this work we propose employ a clustering algorithm to reduce the size of the training set of the classifiers based on neighborhood. To test the proposal, a large number of experiments were conducted using international reference document collections. The results obtained in text categorization and adaptive document filtering, show that our proposal, when compared to traditional condensing algorithms, obtains similar or better results in classification, and additionally it achieves a better reduction of the initial training set.
Keywords: clustering algorithms, nearest neighbors classifiers, text categorization.

STOCHASTIC SCHRÖDINGER EQUATIONS WITH UNBOUNDED COEFFICIENTS

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We will focus on stochastic partial differential equations of Schrödinger type. These stochastic evolution equations describe the dynamics of quantum systems interacting with heat baths. The talk will address basic properties of the linear and non-linear stochastic Schrödinger equations, like the well-posedness of solutions and existence of invariant measures (see, e.g., [1, 2, 3]). Moreover, we will discuss the relation between the stochastic

Schrödinger equations and the operator equations describing the evolution of quantum observables (see, e.g., [4]). Using the connection between the stochastic Schrödinger equations and the quantum master equations (see, e.g., [5]) we will obtain the existence of regular stationary solutions for the quantum master equations.

ON GENERAL INSURANCE RISK PROCESSES: AN OVERVIEW AND NEW MODELS

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Expressions for the expected discounted penalty function now exist for a wide range of models, in particular for a general class of Levy insurance risk processes [Biffis and Morales (2010) and Biffis and Kyprianou (2010)]. Indeed, the EDPF encapsulates relevant information about ruin related quantities that are of potential interest in risk management applications. Yet, in order to realize this potential, two main conditions are needed. First, these expressions must be computationally tractable enough as to allow for the evaluation of associated risk measures such as VaR or CVaR. Second, the models themselves must account for different levels of complexity as found in real applications. Now, most of the models studied so far offer few interesting examples for which computation of the associated EDPF can be carried out to the last instances where evaluation of risk measures is possible. Moreover, currently available Levy risk insurance models refer to an over-simplified reality accounting only for premium in-flow and claims out-flow. In this talk we address these two issues with two different models. First, we introduce examples of risk insurance processes for which numerical evaluation of the EDPF can be readily implemented. Second, we discuss a Markov additive risk model that accounts for the possibility of background long-term market conditions. Some numerical illustrations will be presented.

FUZZY REGRESION ANALYSIS. AN ECONOMICAL APPLICATION

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In this paper, in summary, aspects of the theory of fuzzy sets, fuzzy regression and some indices of goodness and adjustment are presented.In any case, it was not intended to be exhaustive because there is only interest in exposing the mathematical tools necessary to carry out the development of fuzzy regression which combines classical regression techniques with the theory of fuzzy logic. These theoretical foundations and practice may have applications in many other fields, and therefore they go beyond the scope of this work. These techniques are applied to two practical problems. The first application is based on simulated examples in order to determine when it may or may not use fuzzy regression techniques and what is the most effective index to evaluate the quality of the adjustment between the observed and estimated data by the fuzzy regression. Finally, there are studied the fluctuations of the Euro exchange rates against the CUC according to changes in the prices of different exportable and importable products.

Keywords: fuzzy regression, fuzzy sets, goodness and adjustment

CUBIC A-SPLINE VISUALIZER: A COMPUTATIONAL TOOL FOR VISUALIZATION OF CUBIC A-SPLINE CURVES

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In this talk we present a set of algorithms and their software implementation, providing solutions to several important problems of Computer Aided Geometric Design (CAGD) using cubic A-spline curves. Additionally

we discuss new algorithms to generate hierarchically points on these A-spline curves and consequently to obtain efficiently approximations to the graph of the A-spline curves, of their curvature plot and of the graph of their d-offset. The presented results may be applied to free form design of generatrix curves of revolution surfaces and their structural computation, smoothing of polygons, fitting contours of digital images and design of trajectories with restrictions.
Keywords: Cubic A-spline, blossom, quadtree, d-offset, curvature plot, fairness.

A NEW APPROACH TO THE CREATION AND PROPAGATION OF EXPONENTIAL MOMENTS IN THE BOLTZMANN EQUATION

C. Mouhot, R. Alonso, J. Ca nizo, and I. Gamba

We study the creation and propagation of exponential moments of solutions to the spatially homogeneous Boltzmann equation. In particular, for hard spheres or hard potentials with cutoff, we prove the appearance of exponential moment with optimal exponent. We propose a novel method of proof based on a single differential inequality for the exponential moment with time-dependent coeffcients and taking advantage of a discrete convolution-like structure.

THINKING IN PARALLEL: MANYCORE TECHNOLOGY FOR SOLVING COMBINATORIAL OPTIMIZATION PROBLEMS

M.J. Negreiros Gomes, R. Holanda-Nobre, and T Carneiro-Pessoa L. P. Bondi de Souza
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This talk considers the introduction of the manycore technology based on Graphic Processing Unities (GPU), which permits the availability of hundreds to one thousand processors simpler than actual Core units to solve numerical problems in an affordable price. This technology, once introduced to accelerate graphic processes to games in desktops and special units, have been used to accelerate many other computational approaches such as statistics, mathematics, physics and, recently, in optimization. We develop experiments on some basic computer problems, as searching and sorting, and for optimization we consider problems like Spanning Trees, Knapsack and the Asymmetrical Travelling Salesman Problem over the GPU/NVIDIA, using novel computational strategies for the greedy, dynamic programming and B&B typed methods. The methods were implemented in different way of thinking algorithms in parallel for these problems. We report the results of these experiments considering scalability, time complexity, and the benefits of obtaining a much faster solution in a lower cost. The group is now developing a book to introduce the concepts thinking in parallel to solve optimization problems.
Keywords: GPGPU, Combinatorial Optimization, Parallel Computing.

FUTURE ASYMPTOTICS OF HOMOGENEOUS COSMOLOGICAL MODELS

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The late-time behaviour of the Einstein-Euler system with Bianchi symmetry is well understood. Sometimes it is of advantage to use kinetic theory to describe the matter content of the universe. In particular, collisionless matter is often used in astrophysics and has some nice mathematical properties. We will present some results concerning the late-time behaviour of the Einstein-Vlasov system with Bianchi A symmetry. The results imply in particular that collisionless matter is well approximated by the Einstein-dust system.

A MATHEMATICAL MODEL FOR THE EXPORT DEVELOPMENT PROCESS OF FIRMS USING RELIABILITY APPLICATIONS

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The lifetimes of machine components in industrial reliability are considered failure times. For example, ball bearings are tested under cycles of different stresses and failure time is the number of cycles to failure. Failure time have the complicating feature of containing censored observations and explanatory variables that change over time. A right censored failure time for a ball bearing might arise if the ball bearing is still in operation at the end of the time period set aside for observation. A left-censored observation is one in which the unit is known only to have failed prior to some time. In addition, failure time depends on the stress applied, so it is necessary to incorporate explanatory variables that change in value over the observation period (covariates) in the model. Meanwhile social scientists and economists are facing similar problems in analyzing data on the export development process of firms. In this case, failure time is the length of time between the birth of the firm and the year of its first export (pre-export stage). If the firm has not exported yet (has not failed) at the end of the observation period, it will be referred as a right-censored observation. If the firm has already exported at the beginning of the observation period and the date of its first export is unknown, it will be referred as a left-censored observation. The length of the pre-export stage may be influenced by several covariates. The object of the present paper is to fit a mathematical model to the export development process of Spanish manufacturing firms using reliability applications.

Keywords: Reliability, right-censored observation, left-censored observation, export development process, psychic distance, entry mode, duration model, manufacturing firms.

SS_vIR MODEL WITH PARTIALLY EFFECTIVE VACCINATION

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The classical SIR model is formulated, including a vaccine that provides partial protection of susceptible population (population of susceptible vaccinated) and we are consider that the total population is constant and two-way of transmition with standard incidence. We analyze the stability of dynamic system using the Routh-Hurwitz criteria, solve the eigenvalue problem and obtain the expression of the basic reproductive number R_0 and the region of epidemiological sense. The exploration of the different solutions for $R_0 < 1$, and $R_0 > 1$ is obtained and performed a sensitivity analysis of R_0 for all parameters. Finally, simulations are performed using Matlab and make a conclusion about appropriate vac- cination strategies to achieve greater effectiveness in controlling the epi- demic.

Keywords: SIR model; R_0; Incidence; Routh-Hurwitz criteria; stability.

RECOVERING OF THE CONSUMER MULTIATTRIBUTIVE UTILITY MAXIMIZATION PROBLEM WITH UNIDENTIFIED NUMBER OF ATTRIBUTES

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This article contains a prediction model for the demand for the product with all-time demand. Consider the classical model of the consumer utility function maximization in a given budget constraint where there is two products, one for which the demand is being estimated, and the rest of the consumer basket which is the second

product. As the utility function is introducedmultiattributive utility function with an unidentified number of attributes. Proposed an approach to estimate the exact number of attributesand the parameters of the model in a given class of utility functions for each attribute. The estimation is derived through the optimization of corrected Akaike information criterion, where the parameters of the utility function are continuous and the number of attributes isinteger andpositive. This model was used to predict demand for the buckwheat with the observed Giffeneffect.

Keywords: Demand estimation, multiattributive utility function, unidentified number of attributes

PROBLEM SOLVING IN INTEGER LINEAR PROGRAMS

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This work makes an analysis of the application of advanced techniques in solving problems in Integer Linear Programming (ILP), the branching and dimensioning method combined with Gomory cuts and Gomory-Chvatal. Through the program Integer Linear Programming v.1.0 and SPSS v.11.0 is carried out the implementation and analysis of alternatives used in the method of Branch and Cut for small problems, using the above cuts and applied to different levels of the tree $(1, 2, 0 - 1, 1 - 0)$. We use the best strategies for variable selection and branching nodes. A total of 11 strategies were analyzed for ILP problem solving.

Keywords: integer linear programming, branch and cut algorithm.

IMPLEMENTATION OF CONSISTENT METHODS FOR STRUCTURAL IDENTIFICATION OF NONLINEAR SYSTEMS

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This paper is devoted to the approach of the choice of input variables in the model, based on a maximal and generalized correlation moments, software development and simulation modeling. In real systems, when there is no exact description of the facility and the processes occurring in it, the input and output variables of the model are treated as random variables or random functions. When studying the dependence between random variables its necessary to determine not only the equation of relation between them, but the degree, closeness of that relation. This is a fundamental difference from the deterministic approach, where there is a functional single-valued dependence between the variables.

In this paper we develop the ideas of G. Gebeleyn, O.V. Sarmanov, A. Renyi and use a class of generalized (functional) correlation functions and statistical moments, which limiting cases on the one hand are the classical correlation functions and moments, and on the other hand - the maximal correlation function and the correlation ratio.

Modifications of classical methods of inclusion of variables such as forward inclusion, stepwise regression method, exclusion method has been developed.

With the help of a software product developed to calculate the eigenvalues and the maximum and the generalized correlation coefficient were conducted simulation experiments and comparative analysis of classical linear and a modified approach to the selection of significant variables in the model.

Keywords: the maximal coefficient of correlation, identification, simulation.

CONSISTENT METHOD OF IDENTIFICATION OF NONLINEAR STOCHASTIC SYSTEMS

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Subjects of modeling of nonlinear stochastic systems are observed. Problems appearing in the process of identification of nonlinear systems with use of traditional correlation methods are investigated. The issues related to the problem of identifiability in wide and narrow senses are analyzed. Usually we suppose that the structure of system is known but in a real situation the structure of model is usually unknown. In current work it is shown that ignoring of this fact leads to mistakes at application even with such universal methods as Wiener-Hopf method. For the decision of arising problems it is offered to use the mathematical device of the generalized correlation functions which are consistent measures of dependence. On the basis of these functions the consistent method of identification which allows to define the presence of the stochastic or determined dependence is constructed. This method allows to estimate quantitatively this dependence, to solve the problem on existence of model and to receive the mathematical description of model of system in parametrical or nonparametric form. Consistent analogues of the equation of Wiener- Hopf and the method of the least squares for nonlinear stochastic systems are constructed.

Keywords: identification, consistent measures of dependence, modeling of nonlinear systems, method of functional transformations.

THE NON-HOMOGENEOUS GENETIC ALGORITHM

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Genetic Algorithms (GAs) are algorithms developed to search for optimal points of functions, when differential techniques are not allowed. Those algorithms are characterized by two parameters, which define the dynamics of the algorithm. These parameters are called mutation and crossover. In order to study the behavior of those algorithms it is common to look at them as a stochastic process called homogeneous Markov Chain (and its ergodic behavior). In almost all papers that use GAs to find those optimal points, the above parameters are kept fixed throughout the algorithm's evolution. Recently, Pereira et al [1,2,3] allowed those parameters to vary along the evolution of the algorithm, obtaining this way a non-homogeneous Markov Chain. In [1], conditions were given under which the algorithm converges in a probabilistic sense. As in the case of the canonical GAs , the algorithm does not converge almost surely to a set, which has the optimal point. The paper [2] defined a version of the GAs as it is used in practice, namely: an additional position is created where the best solution found till the current iteration is updated only when a better solution is found. Under this change, the algorithm was proved to converge almost surely to a set, which has an optimal point. Finally, in [3] many examples were developed so that these two versions of the GAs were compared to each other. In those examples were analysed the role played by the size of the population, and how fast those algorithms were in getting the optimal point.

Keywords: Stochastic Processes, Homogeneous Markov Chain, Non-Homogeneous Markov Chain, Genetic Algorithms.

COMPOSITE INDICATOR FOR SUSTAINABILITY ASSESSMENT. THE CASE OF CUBAN NATURE-BASED TOURISM DESTINATION

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This paper shows a methodology to build a composite indicator for evaluating the sustainability of nature-based tourism destinations. It combines Principal Component Analysis (PCA), the distance to a reference point and Data Envelopment Analysis (DEA) to allow us the reduction of some aspects that represent objections to the aggregation procedure. The obtained synthetic index is based on a representative series of sub-indicators of the concept of sustainable tourist development of the World Tourism Organization (WTO). We apply it for evaluating Cuban nature tourism destination. The results let to identify the strengths and weaknesses of destinations according to sustainability, and serve as a guideline for tourism planning in the future.
Keywords: Composite indicator, Data envelopment analysis, nature based tourism, sustainability.

TEACHING LINEAR PROGRAMMING IN SOCIAL SCIENCES

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Teaching Operations Research to Social Science students involves different strategies than those that work with Science or Engineering students. The Linear Programming technique is particularly useful when teaching Management and Economics, especially when dealing with situations that involve limited resources and the objective is getting optimized results. These are the specific types of problems that the powerful Linear Programming method is ideal for solving. This paper aims to establish that teaching the Linear Programming technique to Management and Economics students should focus mainly on:

1. Identifying that a given situation can be solved through the application of Linear Programming

2. Systematizing the information required for using the L P model

3. Constructing the model

The next step is solving the model, for which we propose using the existing L P software rather than attemping to break down the mathematical structure of the algorithms involved, such as simplex method. This will allow students to concentrate on correctly interpreting numerical results. This strategy will allow teachers to focus on helping their students develop skills for identifying types of problems that can be solved using L P, as well as establishing the model and interpreting the results in terms of the real problem without losing themselves in the effort of understanding and working out the mathematical algorithm.

MULTI-OBJECTIVE PROJECT PORTFOLIO SELECTION UNDER UNCERTAINTY

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Decision makers usually have to face budget and other constraints when deciding which projects to undertake in order to reach their goals and ensure profitable growth. Our purpose is to assist them in the task of selecting

and planning projects portfolios. We have approached this problem by proposing a general nonlinear binary multi-objective mathematical model, which takes into account all the most important factors mentioned in the literature (interrelation between projects, transference of remaining resources to the next period for some categories, precedence relationships, etc.) related with Project Portfolio Selection and Scheduling. Due to the existence of uncertainty in different aspects involved in the aforementioned decision task (costs, risks, available resources,), we have also incorporated into the model some random variables, which allow representing information not fully known by the decision makers. So, the resulting problem is solved using stochastic multiobjective programming. Finally, the applicability of the model is shown by means of a set of instances. The solution of the problem has been approached using a metaheuristic procedure based on Scatter Search (SSPMO). The results show the potentiality of the proposed model as well as its utility in a great variety of situations.

MULTI-STAGE TECHNIQUE FOR GROUP-SORTING MULTI-ATTRIBUTE OBJECTS

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The paper describes the new multi-stage technique PAKS (the abbreviation of Russian words: Consistent Aggregation of Classified Situations) that provides group sorting multi-attribute objects on a complex criterion. This technique is based on decision maker preferences and uses a hierarchical aggregation of large number of initial attributes into a small number of criteria with step by step reducing the multi-attribute space dimension by various tools of verbal decision analysis. The consistent aggregation of attributes allows us to generate manifold lists of complex criteria with quantitative and/or qualitative attribute, find the most preferable solution, and diminish essentially time for solving the problem. The suggested technique was applied to evaluate efficiency of R&D projects, which were estimated by several experts on many qualitative criteria and subsidized by the Russian Foundation for Basic Research.
Keywords: decision aiding, group sorting, multi-attribute objects, complex criterion, hierarchical aggregation, reduction of attribute space, verbal decision analysis, project efficiency

NON DIFFERENTIABLE PERTURBED NEWTON'S METHOD FOR SOLVING VARIATIONAL INCLUSIONS

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This paper deals with variational inclusions of the form $0 \in f(x) + g(x) + F(x)$ where f is a Frechet differentiable function, g is a Lipschitz function and F is a set-valued map acting in R^n. First we recall some existing results and after we focus on the case where the set valued map F is a cone. In this case we introduce a new algorithm to approximate a solution x of the variational inclusion. We show the convergence of this algorithm without metric regularity assumptions.
Keywords: Set-valued mapping, variational inclusion, non differentiable functions, Zincenko's method.

SIMULACIÓN Y SENSIBILIDAD DE UN MODELO PARA EPIDEMIAS DE DENGUE

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Se formula un modelo de simulación para la dinámica de incidencia del dengue clásico, acoplando dos procesos estocásticos continuos, corre- spondientes a la dinámica en la población humana constante, con tasa de natalidad igual a la tasa de muerte natural y tasa de recuperación constante, acoplada a la dinámica de crecimiento poblacional del ciclo de vida del mosquito Aedes aegypti. Se modela la incidencia de humanos y de mosquitos portadores del virus de forma estándar con saturación. El modelado matemático se realiza mediante un sistema de ecuaciones diferenciales ordinarias no lineales y las simulaciones se hacen para difer entes escenarios, utilizando el software MAPLE con valores para los parámetros estimados y referenciados por otros autores.
Keywords: Dengue, Modelo simulación, Saturación, Proceso estocástico, Aedes aegypti, Incidencia.

EMPIRICAL TESTS OF ACCEPTANCE SAMPLING PLANS

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Acceptance sampling is a quality control technique applied as an alternative to 100% inspection. A random sample of items is drawn from a lot to determine the fraction of items which have a required quality characteristic. Both the number of items to be inspected and the criterion for determining conformance of the lot to the requirement are given by an appropriate sampling plan with specified risks of Type I and Type II sampling errors. In this paper, we present the results of empirical tests of the accuracy of selected sampling plans reported in the literature. These plans are for measureable quality characteristics which are known have either binomial, exponential, normal, gamma, Weibull, inverse Gaussian, or Poisson distibutions. In the main, results support the accepted wisdom that variables acceptance plans are superior to attributes (binomial) acceptance plans, in the sense that these provide comparable protection against risks at reduced sampling cost. For the Gaussian and Weibull plans, however, there are ranges of the shape parameters for which the required sample sizes are in fact larger than the corresponding attributes plans, dramatically so for instances of large skew. Tests also confirm that the published inverse-Gaussian plan is flawed, as reported by White and Johnson (2011).
Keywords: Quality and reliability, inspection, sampling, requirements

MODELING OF TRANSPORT SYSTEM OF A AGRO-INDUSTRIAL SECTORS COMPANY IN THE DEPARTMENT OF MAGDALENA

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This paper presents a mathematical model for the optimization of transport system of an enterprise of the banana sector in Colombia. The company is responsible for marketing the fruit to customers outside the country, which should carry the fruit from the farms associated and affiliated to the boarding area in the port city of Santa Marta for onward shipment to end customers, however the scope of this investigation is limited to analysis of internal transport (plantations - port). For the definition of guidelines for improving the efficiency of the transport process by the company, it is necessary to determine the number of vehicles required to ensure the collection of all orders made by the marketing fruit, is also required to establish routes collection according to the estimated production of each farm, the location of each planting, distances between planting, the capacity of existing vehicles and the effective time of receipt of fruit in the harbor. This research seeks to contribute

to the improvement of logistics activities in the banana sector, which has been characterized as one of the most organized and strengths in research, however, these results are primarily focused on the cultivation and development of varieties more resistant to disease and the implementation of "green processes". This paper is a product of the project "supply chain configuration Agroindustrial Sector of the Department of Magdalena, including Reverse Logistics approach" adopted by Colciencias (national department for the innovation and the research of Colombia) framework of Young Scientists and Innovators 2010.

Keywords: Modeling, agro-industries, banana, optimization, and transportation.

EPIDEMIAS SIR Y SEIR

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Se presentan modelos de simulación con distribución espacial y saturación en la incidencia, inmunidad permanente y estado latente. Las simulaciones se realizan en MAPLE utilizando valores hipotéticos para los parámetros.

Keywords: Modelo SIR, Modelo SEIR, Distribucion espacial, Saturación, Inmunidad permanente, Estado latente.

NONPARAMETRIC ESTIMATION OF THE DIVISION RATE OF A SIZE-STRUCTURED POPULATION

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We consider the problem of estimating the division rate of a size-structured population in a nonparametric setting. The size of the system evolves according to a transport-fragmentation equation: each individual grows with a given transport rate, and splits into two ofspring of the same size, following a binary fragmentation process with unknown division rate that depends on its size. In contrast to a deterministic inverse problem approach, as in (Perthame, Zubelli, 2007) and (Doumic, Perthame, Zubelli, 2009), we take in this paper the perspective of statistical inference: our data consists in a large sample of the size of individuals, when the evolution of the system is close to its time-asymptotic behavior, so that it can be related to the eigenproblem of the considered transport-fragmentation equation. By estimating statistically each term of the eigenvalue problem and by suitably inverting a certain linear operator (see previously quoted articles), we are able to construct a more realistic estimator of the division rate that achieves the same optimal error bound as in related deterministic inverse problems. Our procedure relies on kernel methods with automatic bandwidth selection. It is inspired by model selection and recent results of Goldenschluger and Lepski.

COMPARISON OF ALGORITHMS FOR THE COMMON SHORTEST SUPERSEQUENCE

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In this paper is presented the Shortest Common Supersequence Problem, which is an NP problem and has applications in data compression, mechanical engineering and planning among others. To solve this, we apply some heuristics based on the classic Majority Merge heuristic, that differ from it in the way of choosing the next symbol to add the supersequence. Several experiments were performed to compare the results of the heuristics with the Majority Merge.
Keywords: shortest common supersequence, Majority Merge, heuristics.

TURING-HOPF PATTERNS NEAR THE ONSET

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Diffusion-driven instabilities in reaction diffusion systems generated by the limit cycle which appears due to a Hopf bifurcation are considered. Conditions under which the limit cycle destabilizes are weaker than the conditions destabilizing the steady state, for instance it is not necessary that the diffusion coefficients be different enough. Twinkling patterns are to be expected provided close enough, or even equal, diffusion coefficients. Finally, we consider the wave initiation of twinkling pattern via a travelling wave of change of phase type for the cycle amplitude

SOLUTION OF A WAVE PROPAGATION PROBLEM USING SAFEM ON VARIABLE RESOLUTION TRIANGULAR MESHES

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Guided waves ultrasonic modes propagating along large bars have great potential as a non-destructive evaluation method. In this context it is very important to obtain the dispersion curves, which depend on the cross-section of the bars. In this talk we obtain dispersion curves for bars with an arbitrary cross-section using the semianalytical finite element method (SAFEM). Beginning with a coarse mesh, the cross-section of the bar is discretized, computing a variable resolution 4-8 triangular mesh. The method used to construct the mesh is very simple and it is based on local topological operators. The resulting mesh has a multiresolution structure and it is denser near the boundary curves. Starting with the principle of the virtual work, the differential operators are approximated on the triangles of the mesh by the finite element method. The result is a generalized eigenvalue problem. For a prescribed wave number, the solution of this problem is the nodal displacement vector and the frequency of the guided wave.
Keywords: guided waves, SAFEM, dispersion curves, variable resolution triangular meshes.

LINEAR REGRESSION MIXED MODELS IN A STUDY OF INMUNODEFICIENCY IN PEDIATRIC PATIENTS

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The study of recurrent infections in children and its relationship with immunodeficiency is a subject of great and current importance. Recurrent or relapsing infections of the respiratory and gastrointestinal tractus still have high morbidity although mortality has decreased; however these infections continue to be the first sign of immunodeficiency. In the Hospital Pediátrico de Centro Habana, in Havana, Cuba, we obtained a sample of patients attending a pediatric consult due to the presence of recurrent respiratory and digestive infections. With the application of statistical models, in particular the linear regression mixed model, we were able to establish the relationship of immunoglobulin A (IgA) with some variables that characterize these patients, such as, age and birth weight. This paper explains how to analyze whether mixed models are suitable for this purpose and how to fix them.
Keywords: Recurrent infections, immunoglobulin A, statistical modeling

ADMINISTRACIÓN Y CONTROL DE REPUESTOS PARA EL MANTENIMIENTO DE COSECHADORAS CAÑERAS

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Starting from the efficiency study of industrial processes of a private company, the need of improving the control on the machine parts stock of cane harvesters has been identified. In the search of maximizing the production at a lower price, the company acquiered mechanized harvesters to achieve quality demands on the cane harvest. One of the factors that most incides in costs is maintenance, given it's key to have available parts to solve any problems, malfunctioning or machine breakdowns. It has been proved that, if there's a lack of parts and related free time for both machines and workers, the stock management can be improved with the application of Operative Investigation techniques. There also are registered parts leftovers which, considering that the harvesting period goes for 5 months in a year, implie an elevated cost per movilized capitals. Work has been done based on the programmed and corrected maintenances, classifying the parts by its nature, whether independent or not of its demand. The stock of parts with a non-independient demand was treated with determined models, while those of independent demand where modeled with waiting lines. It has been achieved, this way, to increase the profitability of the harvesters costs center throughout the availability of parts and the correct fulfillment of the maintenance plan
Keywords: stock - waiting lines maintenance

USER SATISFACTION OF BUAP LIBRARIES: A MULTIVARIATE ANALYSIS

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This paper presents the application of different multivariate methods to surveys of Customer Satisfaction which holds by Libraries Department of the Autonomous University of Puebla, Puebla, Mexico. In particular, we show the results of the application in 2011 to six libraries: Library A. Aguirre for area of administration, Library L. Barragán for area of social science, Library Niels Bohr for area of natural and exact sciences, Library J.

Izquierdo for area of medicine and the Library for region of Tehuacan. These surveys generate multiple tables of data and we are interested to define framework simultaneously between different libraries and to identify similarities and differences between them. To achieve this objective it was necessary to apply at first, principal component, and later, Multivariate Analysis of Variance.

Keywords: Library service quality; Principal Component; MANOVA;

ON THE DETERMINATION OF SYNTHETIC SUSTAINABILITY INDICATORS: A REFERENCE POINT BASED APPROACH

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In 1987, the Brundtland Commission defined Sustainable Development as the development that meets the needs of the present without compromising the ability of future generations to meet their own needs. This is, by nature, a multicriteria concept. As a consequence of this definition, several aspects (traditionally, economic, social and environmental) have to be taken into account when measuring the sustainability of a territory. Typically, sustainability indicators are used to measure different individual aspects. The question is how to aggregate all the information given by a large number of individual indicators into a single measure. In this work, we propose a scheme, based on the double reference point method, to develop two synthetic indicators: one weak (allowing compensation among the different measures) and one strong (not allowing compensation). To this end, a panel of experts is asked to provide, for each individual indicator, two reference levels: a reservation level (that is, a level regarded as acceptable), and an aspiration level (that is, a level regarded as desirable). These two levels allow us to build individual achievement functions that measure the position of each territory with respect to these reference levels. Next, the experts are asked to assess weights to each indicator, and the individual achievement functions are combined into a single measure using these weights. Preference aggregation procedures are used to obtain single reference values and weights making use of the information provided by the different experts. This scheme is applied to the municipalities of the Spanish region of Andalucia.

Keywords: Reference point; sustainability; synthetic indicators.

ESTIMATING THE NUMBER OF REGIMES OF NON-LINEAR AUTOREGRESSIVE MODELS.

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Autoregressive regime-switching models are being widely used in mod- elling financial and economic time series such as business cycles (Hamilton, 1989; Lam, 1990), exchange rates (Engle and Hamilton, 1990), financial panics (Schwert, 1989) or stock prices (Wong and Li, 2000). When the number of regimes is fixed the statistical inference is relatively straightfor- ward and the asymptotic properties of the estimates may be established (Francq and Roussignol, 1998; Krishnamurthy and Ryden, 1998; Douc R., Moulines E. and Ryden T., 2004). However, the problem of select- ing the number of regimes is far less obvious and hasnt been completely answered yet. When the number of regimes is unknown, identifiability problems arise and, for example, the likelihood ratio test statistic is no longer convergent to a 2-distribution. In this paper, we consider mod- els which allow the series to switch between regimes and we propose to study such models without knowing the form of the density of the noise. The problem we address here is how to select the number of components or number of regimes. One possible method to answer this problem is to consider penalized criteria. The consistency of a modified BIC crite- rion was recently proven in the framework of likelihood criterion for linear switching models (see Olteanu and Rynkiewicz 2012). We extend these results to mixtures of nonlinear autoregressive

models with mean square error criterion and prove the consistency of a penalized estimate for the number of components under some regularity conditions. keywords time series, switching regimes, mean square error, asymptotic statistic, models selection, multilayer perceptron

SOLVING STOCK PROBLEMS USING QUEUE THEORY MODELS - APPLICATION ON SPEAR PARTS MANAGEMENT OF HARVERSTER MACHINE IN CANE INDUSTRIES

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There is a close relationship between the control of existences and the phenomena of waiting, which is known as The Theory of Queue. The knowledge of the last one basic concepts allows to develop models to solve stock particular problems. Stock models can be seen as a reflect of the theory of queue in which the entrance of products is the only controllable variable and it is equivalent to the rate of the queue arrival. The number of demandants, that is to say servers, in each time instant equals one. The demand corresponds to the product of the service rate multiplied by the bulk service effect. Values of the traffic coefficient superior to the unit are proposed. The stock model becomes in this way a Monoqueue / Monochannel system with client limitation to avoid the accumulation of products on stock. This limitation is set according to the product demand, to find a harmonious relationship between the resources which in average, are kept fixed on the stock together with an adequate attention to the demand, maintaining the lack of existences within the economic limits which are reasonably tolerated by the demanding clients. A simulation was done to determine the best values of the traffic factor, of the R factor which relates the costs of fixed capital on stock and the lost sales, and of the X factor from which it is set the maximum stock, and from the data obtained, a graphic which relates these three factors. In conclusion, by knowing the R factor and the demand, it can be established the optimum values of the replacement lot and the maximum stock allowed, balancing the losses costs and the storage for a certain product of which the demand responds to a normal distribution.

Keywords : Queue; Stock; Client Server; Factor / Traffic Coefficient; Arriving rate / Demand; Service rate / Replacement rate; R Relation; X Factor; Maximum Stock; Costs;

PATTERN-BASED KNOWLEDGE ARCHITECTURE FOR INFORMATION LOGISTICS

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Accurate and readily available information is a crucial basis for decision making, problem solving, or performing knowledge intensive work. In networked organizations with geographically distributed work force and processes, like logistics networks or SME clusters, quickly finding the right information for a given purpose often is a challenge. An improved information supply would contribute significantly to saving time and most likely to improving productivity. The paper aims at contributing to improved information logistics by bringing together experiences from knowledge modeling and pattern based reuse in information system development. We propose a pattern based knowledge architecture with several interworking layers of services for implementing information logistics in networked organizations. The knowledge architecture forms a framework for selecting and configuring suitable resources for a given problem situation. The knowledge architecture principle and three types of knowledge patterns within the architecture framework are discussed: task patterns for representing enterprise knowledge of member organizations in a networked organization, information demand patterns addressing the information demand of typical roles in a networked organization, and ontology design patterns for capturing context information for decision support.

Keywords: Information Logistics, Knowledge Architecture, Knowledge Pattern

A BIOECONOMIC MODEL FOR BEEF PRODUCTION SYSTEMS ANALYSIS IN URUGUAY.

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A bio-economical model for livestock production was developed to evaluate the impact of several variables on productivity and profit of livestock production systems in Uruguay. The model allows the simulation of stages of breeding, stocking and fattening either independently or as an integrated process. Considering technical coefficients and pasture characteristics, it simulates processes at the individual level, generating a monthly growth rate, thus the evolution into the next category, which are integrated at a herd level. So, a sale volume is produced, valued at market prices and determines the systems income. The model has been validated with success at several levels, including animal performance, farm and country level. The results of applying the model highlight the importance of key variables with a great impact, such as age at first mating. The high sensitivity of all the systems to sales prices is also relevant. Complex interactions have been detected between variables like pregnancy rate and profit. Referring to productive orientation, fattening is the alternative of greater economic return since its a more efficient process than cow-calf systems. However, its potential is highly sensitive to the availability of feeding resources. Pregnancy diagnosis and culling of barren cows still seem to be low cost and high impact alternatives, mostly in extensive herds. The model allows simultaneous evaluation of many variables affecting beef production systems. Its a useful tool to be used as a research and extension support in livestock production systems and also for policies evaluation at a regional or national level.
Keywords: Simulation model, livestock, production system.

QUANTILE REGRESSION TO IDENTIFY OUTLIERS IN TIME SERIES

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Time series observations are often subject to interruptive events or even unnoticed errors of typing or recording. Such observations which appear to be inconsistent with the rest of the sample set are referred to as outliers. The presence of those suspicious events could easily mislead the time series analysis procedure resulting in erroneous conclusions. There are two major approaches associated with outliers. The first approach is to identify the outliers, remove them and use a classical method for analysis. The second issue is to use a robust method that would be insensitive or less sensitive to their influence. The main goal of this paper is to consider quantile regression for identifying outliers in time series. Several approaches have been considered in the literature for handling outliers in a time series. In the majority of previous work, it is assumed that the errors have a symmetric distribution. In this work, we choose to model time series by using Gaussian mixture distributions for the noise components. The effectiveness of the least absolute deviation estimation is shown first from a simple example and then with a generalization in time series.
Keywords: time series, Gaussian mixture, outliers, quantile regression.

OPTIMAL TRANSPORT FROM LEBESGUE TO POISSON

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We study couplings q^* of the Lebesgue measure and the Poisson point process, μ^* i.e. measure-valued random variables $\omega \to q^\omega$ s.t. for a.e. ω the measure q^ω on $\mathbb{R}^d \times \mathbb{R}^d$ is a coupling of L^d and μ^d. For any given $p \in (0; \infty)$ we ask for a minimizer of the mean L^p-transportation cost $C(q^*) = \sup_{B \subset \mathbb{R}^d} \frac{1}{L^d(B)E} \mathbb{E} \int_{\mathbb{R}^d \times B} |x - y|^p dq^*(x, y)$ The minimal mean L^p-transportation cost turns out to be finite for all p provided $d \geq 3$. If $d \leq 2$ then it is

finite if and only if $p < d/2$. Moreover, in any of these cases we prove that there exist a unique translation invariant coupling which minimizes the mean L^p-transportation cost. In the case $p = 2$, this 'optimal coupling' induces a random tiling of $\mathbb{R}^d$ by convex polytopes of volume 1.

STABILITY PROPERTIES OF KKT POINTS IN VECTOR OPTIMIZATION

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***Kanpur

In this talk we introduce the notion of approximate KKT points for smooth, convex and nonsmooth, nonconvex vector optimization problems. We study a kind of stability of these points and KKT points of vector optimization problems. In the convex case we also introduce and study the notion of modified approximate KKT points motivated by Ekeland's variational principle. We present stability properties of these points for several optimization problems.

THE PLS APPROACH FOR SYSTEMS OF STRUCTURAL EQUATIONS: A DETAILED PRESENTATION

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A comprehensive description of the Partial Least Squares approach to Structural Equation Modelling is presented. A comparison to the maximum-likelihood approach is done and its advantages and disadvantages are stated. All of the above is applied to a classical example concerning the satisfaction index.
Keywords: Partial Least Squares, Structural Equation Modelling, Client Satisfaction Index

ESTIMATION OF THE PROBABILITY OF TOXICITY FOR INSUFFICIENT SAMPLE SIZES USING SIMULATION TECHNIQUES

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Many of the Phase I clinical trials in Oncology are conceived to find the maximum tolerable dose, that dose where the probability of toxicity is close to the acceptable maximum toxicity value, or the highest dose level with tolerable toxicity. At general, this type of studies incorporates a reduced number of patients, between 12 and 25. However, due to some practical considerations (e.g. no drug availability, slow inclusion rhythm, changes in strategy priorities) the study has to be re-evaluated although the whole number of patients planned don't have been completed in view to response the initial hypothesis. For the sponsor this can represent an economic (previous high logistic costs) and scientific (necessary information to start efficacy studies) problem. In this work we propose a mathematical solution to this problem through a novel simulation technique that estimate the probability of toxicity, even under different possible scenarios. To demonstrate it we used the data from a clinical trial sponsored by the Center for Genetic Engineering and Biotechnology where the safety of the intratumoral application of CIGB-300 peptide at three different doses was evaluated in patients with diagnosisof

stage IB2-II epidermoid cervical carcinoma. Using Dose Schedule Finder, version 2.2.0", software developed in the University of Texas is possible to answer the hypothesis with an appropriate precision, obtaining a higher efficiency and a more rapid entrance of the product in advance clinical phases.

Keywords: probability of toxicity, simulation techniques.

LOGISTICS DECISION SUPPORT SYSTEMS

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Trac congestion is one of the main problems which aect urban areas. In particular focusing on the eects of freight transportation, the concept of Logistics has been developed, based on developing and performing strategically and tactical operations aimed at guarantee people and freight mobility in an eective way, in terms of social and environmental costs. Tactical operations are based on the regulation of the access of vehicles in the city. Logistics decision support systems (LDSS) model are proposed to design of freight distribution. The aim is to dene the structure of a LDSS optimizing, the size of dierent vehicle eets (urban trucks and city freighters) and the related routes on mathematical model. The problem has been modeled as a mathematics model (multilevel). At the best of our knowledge, multilevel location-model problems have not yet been addressed either with exact or heuristic methods. The problem concerns the ow of products. In this case the products do not generate and/or attract ows, but they intercept ows traveling on the network, these facilities can be used by the ow units of the network or proposed to/imposed on them along their pre-planned path, from an origin to a destination, This is a path-covering problem which nds many applications in LDSS, in particular the location of trac monitoring and control, applications can be found also in the eld of communication networks to locate monitoring devices which, placed inside the routers or deployed as a stand-alone box on the communication network, summarize and record information about trac ows, in order to prevent attack to network infrastructures. We conclude than a sensitivity analysis is in function of several settings and characteristics of the problems, from the performed experimentation, we can define the heuristics return good solutions, they require computation simulation, in this case we used MATLAB software simulation, therefore we have to carefully consider the settings of the problem and the trade o between quality of solution and the efficiency mathematics model.

Keywords: logistics decision support systems, multi-evel location-model, vehicle fleets

KEEP-TO-THE-PATH TEST, A HAND MOVEMENT COORDINATION TEST: COMPUTATIONAL AND MATHEMATICAL IMPLEMENTED METHODS

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The Spinocerebellar Ataxia type 2 is characterized by an ataxic gait, diminished saccade velocity, cerebellar dysarthria and dysmetria of the upper and lower limbs, and reach the highest world prevalence rate in Holguín, Cuba. Quantify the upper limbs coordination is a part of the neurological examination, the computer system NeuroScreening Coordination offers a set of test to this purpose. Keep-to-the-path test is one of them, it consist in draw a superposed path to mathematical curve as quick and accuracy as possible. To support the design, performance and analysis of the Keep-to-the-path test were used different computational and mathematical methods. An Interpreter of Mathematical Functions based in part of the compiler theory is responsible of create, edit and evaluate mathematical functions used as stimulus in the mentioned test. Besides, a Processor

of Movement Signals is used to process and obtain relevant data of patients responses, it implement spline cubic interpolation techniques, mean value algorithm, numerical integration and numerical differentiation. This implemented methods guaranty the correct test design and the reliability and accuracy capturing and processing data, making to Keep-to-the-path test a good tool for quantify hand movement coordination.

Keywords: Quantify coordination, hand movement coordination, movement disorders, ataxia quantifications, computational and mathematical methods.

META-ANALYSIS TO EVALUATE THE EFFICACY AND SAFETY OF NIMOTUZUMAB IN PATIENTS WITH BRAIN TUMORS.

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The Center for Molecular Immunology (CIM) is one of the centers of the Scientific Pole in Cuba devoted to research, development, production and marketing of human biotechnology. CIMAher (nimotuzumab) is a humanized monoclonal antibody that recognizes the receptor of epidermal growth factor with high affinity for the treatment of cancer, a type of inhibitor of EGF-R, which represent a promising class of new drugs against cancer. In center we have three completed clinical trials in brain tumors: Phase II, Phase II / III and Phase IV treated everyone with the same product CIMAher. Objectives: Evaluate the effectiveness of CIMAher in patients with brain tumors. Evaluate the safety of CIMAher in patients with brain tumors. Data Analysis: This work consists in the pooling of 3 data bases of different clinical trials in Cuban patient with brain tumors who have received the same monoclonal antibody CIMAher. 154 patients with brain tumors were included in 3 Clinical Trials with the following distribution: Phase II (29 patients), Phase II/III (70 patients) and Phase IV (55 patients). Two groups of variables were included in the data base: Primary efficacy endpoints: survival time, number of subjects who survive to a given time and type of response and Secondary endpoints of safety: adverse events, intensity and causation. We applied meta-analysis routines, either for individual data and / or additions, to assess the homogeneity or CIMAher not in all studies. We analyzed the survival time from Cox models give us the log hazard ratio for entering into the meta-analysis. We estimated the number of subjects who survive to a point Poisson regression which gave us the log Relative Risk. Finally, we performed a logistic regression analysis for the variable type of response, and the log odds ratio as an estimate of efficacy.

BOUNDS FOR THE EXPECTED TIME TO EXTINCTION AND THE PROBABILITY OF EXTINCTION IN THE GALTON-WATSON PROCESS

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Upper bounds for the expected time to extinction in the Galton- Watson process are obtained. We also found upper and lower bounds for the probability of extinction of this process. These bounds improve some bounds previously obtained by other authors.

DEVELOPMENT OF AUTOMATED EMOTION-RECOGNITION SYSTEM

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The article deals with the actual direction - definition of emotional reactions on human facial expressions, movements and voice. Brief description of current systems for recognition human emotional responses given. Describes the authors' approaches and solutions to build the system automatically determine the emotional reactions. Describes the authors' approaches and solutions to build an automated system for recognition human emotional reactions.

Keywords: recognition of emotional reactions, automated systems, emotion-recognition system, multicriterial choice.

LIST OF PARTICIPANTS

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