1st Balkan Workshop

# Mathematics for Industry

Thessaloniki, Greece, 14 November 1998

Organized by

Aristotle University of Thessaloniki
(Research Committee)

assisted by

Democritus University of Thrace
and
University of Thessalia

Thessaloniki, November 1998

1st Balkan Workshop

# *Mathematics for Industry*

**With the major Contributions From:**

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Research Committee
GR - 54 006, Thessaloniki
Greece

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**Advisory Board**

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**Local Organizing Committee**

G.L.Bleris- Professor, Secretary
I.Vlahavas- Associate Professor, Workshop Administration
F.Kyritsi - Assistant Secretary

## Program

***Morning* 09.00 -13.30**

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|---|---|
| 09.00 -09.15 | Opening by the Vice Rector of the Aristotle University<br>Professor: J.G.Antonopoulos.<br>Short interventions by various bodies (governments ,institutes, industrial associations) |
| 09.15 -09.45 | Short interventions a European Commission senior officer Dr. Simon Bensasson |
| 09.45 -10.00 | Coffee break |
| 10.00 -11.30 | Keynote speeches (15 min. each ) covering the landscape of Industrial Mathematics in the Balkans, trends and relations to industry<br>Chairman: Prof. Th. Christidis<br><br>1. D. Christozov: Decision making for technology transfer<br>2. D. Vandev: On approximate calculating of Robustified Maximum Likelihood<br>3. M. Kon-Popovska: On the Equivalence of Some Classes of the .....<br>4. Y. Istefanopulos: Automatic Control and Industrial Automation in Turkey<br>5. Et. Alpaydin: Computer infrastructure at Bogazici University<br>6.H. Georgescu: Formal Notations for UML Models |
| 11.30 -11.45 | Coffee break |
| 11.45-13.30 | Keynote speeches (15 min. each) covering the landscape of Industrial Mathematics in the Balkans, trends and relations to industry<br>Chairman: Prof. P. Tsalidis<br><br>7.S. Marcus: Exploring the Industrial World by means ...<br>8. S-M. Tataram: Industrial Mathematics, Researches and Future Trends |



9.F. Premti: Linear and network program.....
10. L. Puka: Sampling survey in Albania .....
11. G. Milovanovic: Generalized Polynomial systems and applications.
12. O. Beyhan: Mathematics for Water...
13. Z. Markovic:Applications of Kripke...

| | |
|---|---|
| 13.30-14.30 | lunch, coffee |

***Afternoon* 14.30-18.00**

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|---|---|
| 14.30-16.15 | Keynote speeches (15 min. each ) on the Balkan Collaboration in the frame of Industrial Mathematics<br>Chairman: Prof. I.Vlachavas<br><br>14. Y. Skarlatos:The State of Turkish Industry...<br>15. Z. Mijajlovic: Scientific cooperation in mathematics for industry and information technologies<br>16. M. Petrescu: Data Modeling-Certain Practical....<br>17. I. Dimitriyadis: Mathematics for Regional Development of Socio-Economic Systems<br>18. S. Markovski: On the Balkan Cooperation.<br>19. I. Antoniades:Virtual Institutes, secure...<br>20. K. Karanikas: An Industrial Mathematics Association or Institute in Balkan Peninsula |
| 16.15-16.30 | Coffee break |
| 16.30 -17.00 | Short interventions of participants with comments on the forum or virtual institute proposal, and operational ideas suggestions.<br>Chairman: Prof. G.L.Bleris |
| 17.00 -17.30 | Conclusions by the organizing committee and next steps:Chairman:Dr.I. Antoniou |
| 17.30 -18.00 | Election of a Coordination Committee to prepare the next steps.<br>Chairman:Dr.I. Antoniou |
| 21.00 | Official Diner |

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# 1st Balkan Workshop
# *Abstracts*

## Computer infrastructure at Bogazici University. Pattern recognition and machine learning

Ethem Alpaydin
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It will briefly presented the computer infrastructure we have at Bogazici and the network we have to other research institutes and industry in Turkey as well as to the outside world.

It will also presented our results on pattern recognition and machine learning problems in the hope that a Balkan collaboration on the topic may be possible.

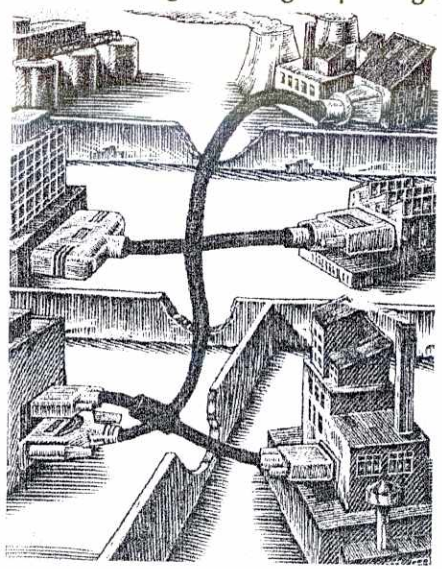


## Virtual institutes, secure communications and non-linear coupled oscillators

I. P. Antoniades1, A. N. Anagnostopoulos1 and G. L. Bleris2
Physics Department1, and Department of Informatics2,
Aristotle University of Thessaloniki, Thessaloniki, 54006 GREECE.

Virtual enterprises can be characterized as cooperative structures of independent institutions, which contribute their core competencies towards a common goal and benefit from reduced hierarchical and organizational structures due to the extensive use of modern communication and information technology. The idea of virtual enterprises has been used in commercial environments and recently it has found application in the context of university teaching and research leading to virtual universities, colleges and institutes.

Modern companies engaged in production activities that are extremely diverse and are not part of their original priorities. For example, there are companies producing everything from computer components to underarm deodorants (both billion dollar businesses). For sure you have some of their products on your shelves and almost certainly you have never heard their names. The processes used are driven by two main developments: a growing concentration by original manufacturers and technological changes spinning off parts of the value chains without losing control of the product. The first development literally corresponds to the notion of virtual enterprise and the second to the dissemination of modern technology achievements. In both cases, secure communications have to be used to avoid undesirable information leakage.



Recent developments in digital technology enable the (on-line/off-line and interactive) multimedia exchange of information introducing activities such as teleconferencing, tele-teaching, remote interactive seminars, telemedicine. The integration of differ-

ent computer technologies in order to achieve the best cooperation between the constituent parties of virtual enterprises/institutes is also an important part of the game. The integration of database technology and electronic networks to form distributed databases unifying and simplifying the database infrastructure of several cooperating enterprises through Electronic Data Interface (EDI) applications is such an example. EDI's are a key technology behind the operation of systems that link industries with their supply and customer chains (extranets).

The crucial issues of paramount importance for the realization the electronic information exchange using any digital communications network infrastructure (LAN, WAN, GAN or other) are the issues of security and privacy of communications. The innovative application of active mathematical fields of research can contribute greatly towards the solution of these issues. The necessity of international cooperations among mathematicians and scientists of other fields (physics, electronics, informatics) is obvious. We have used ideas developed in the field of non-linear systems and specifically in the design of coupled non-linear systems generating hyperchaotic signals as well as the phenomenon of synchronization of such systems and applied those ideas for an innovative system of secure representation of information in digital communications. Present results are encouraging. Further research is required in order to improve speed, reliability and fidelity of security offered.



## Mathematics for Water Resources Management

by Beyhan Oguz and Bihrat Onoz
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In water resources management problems a river basin is considered as a system, with inputs to and outputs from the system. This system becomes even more complex if there are single or numerous reservoirs within the basin. Thus such system analysis studies must be carried on by a team coming from different diciplines. In this paper general information will be given about the design and operation of reservoirs. Data analysis and processing, risk analysis, time series analysis, modeling of flow series, data generation and estimation of hydrologic random variables are techniques commonly used in water resources management problems.

## Decision making for technology transfer

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Any process of decision making includes the phase of chosing an option from a given set of alternatives. The process of Technology Transfer includes decision making and implementation.

The process of decision making includes the phases: Selecting relevant and excluding irelevant options. It depends on initial knowledge of the receiver, the knowledge of the receiver accumulated in the screening process, information loaded into the message;Choosing the bested option among members of the set of relevant options. It can be done in two ways by evaluating every option, according to an integral criteria by short-listing. Let assume that all options are described according to a common list of single indicators (further only indicators). An indicator measures the quality of every option according to a given property. The preferences are presented as indicators' weights Direction (sign) of an indicator shows whether the quality of options grows with increasing the value of the indicator.

An integral indicator is a measure combining a set of single properties. To illustrate the idea of constructiong such an indicator, let us consider the case of comparing two engines A and B, measured by two indicators power ("+") and weight ("-i) and let A = {100, 100}, and B = {90, 90}. The ratio power-per-pound (an integral indicator) of the two are equal. Let us consider another option C = {85,80} and let "weight" is the independent indicator. The expected value for the "power" of C is 80, but the actual value is 85, the sign of power is "+", and we can argue that the quality of C is higher than the quality of the two A and B.

The idea is to choose one of the indicators, which measures the shift among the options, and to use it to define the "expectation" for the shift of the value of an other indicator. Regression between every ordinary indicator and the selected indicator is established. Expected value of this indicator for every option is calculated. The residuals define the quality of the options. To the simple linear regression some models which could be reduced to linear are added.

The procedure for constructing the integral indicator starts with establishing the relation between any pair of indicators as the regression with the highest correlation coefficient. The second step is to select the



main indicator. It can be chosen either by the user or as the one with the largest sum of correlation coefficients, when serves as the independent variable.

Quality of the options, according to any of the indicators are calculated.The integral quality of an option is evaluated as weighted average of the above values, weights includes also correlation coeficients. The main indicator represents the quantitative shift among the set of options and correlation coefficients show how a given indicator fits to this tendency.Short-listing is a natural way, a human choosing the "best" option among a given set of alternatives. On every step, a subset of the unsuitable options are excluded from further consideration. Such exclusion is made on the basis of a single criterion.

An interactive step-by-step procedure to simulate the process of extracting the best option is developed. On every step, the set of options are split into two subsets "good" and "bad", according to the values of one indicator. Splitting is done either by an user-defined threshold or by splitting the set into two clusters i cutting between the two most distant values. This procedure can be applied to define the order (ranks) of the options.

Conclusions

1.The following properties of the proposed integral indicator are highly important, when apply to evaluate quality of options in a decision making process: Simplicity: From user's point of view:

-natural way of presenting data, preferences, and relations;
-easy to interpret;
-capable for simulations.

From developer's point of view simple and clear algorithm with limited computational problems.Data requirements: The method does not require difficult for proving preconditions, e.g. independence between indicators. Because simple models are used for regressions, only small number of observations are needed.Applicability:

The area of the most useful application of the proposed method is a set of options, providing alternative solutions to a given problem. The presented approach allows existence of small quantitative shifts among the options.

2. The sequence of indicators applied in the selection procedure is critical. Indicators can be ordered according to heir weights, but in general the problem of defining a feasible sequence is open.

## Mathematics for Regional Development of Socio Economic Systems

Dr.Irini Dimitriyadis
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Establishing a forum where collaboration for regional development will be the main issue is surely of great interest. One however should be able to define the course of action well so that maximum benefit is achieved. The workshop seems to be mostly oriented towards dealing with problems in the production sector rather than the service sector or with socioeconomic systems in general. I believe that considering sectors like banking, insurance or health care systems might even be more beneficial since the development of these sectors depends more on increasing the number of high standard personnel rather than needing capital for changing the technology of a certain industry.Turkey for example has shown a great success in developing its banking sector and that was highly due to the fact that some of the top Turkish universities saw the need in time and trained the personnel that is now running the banking sector in Turkey. All sectors whether it is the production or the service sector are aware of the need of up to date technology. Everybody knows that a computer based system is definitely a must for operation in our days, but the question lies in whether the established computer system is efficiently used or not. The most important mission that the forum we are considering to establish in this Workshop should have I believe, would be to create an awareness of the existence of scientific methodologies that will lead to a maximally efficient use of existing techology and will thus lead to better and more economical solutions for the industry. In doing so however one should be in a position to give tangible proof of such success so that suggestions seem credible. This implies that we should perhaps start with developing a training system where not only students or even professors will be trained but also managers and decision makers in the industry will be presented with new methodologies. To be able to have some success in what will be done depends on creating a demand for enhancement. This surely is possible through the interaction of the two parties namely the academics and the people in industry.

To have any word in the world market depends on being able to create new technology and to reach international standards. Meeting international standards however does not only mean to update your industry by buying modern know-how or by developing new tecnologies, it also depends on creating the work force that will grasp the new know-how and will be in a position to suggest alterations or enhancements that will meet the needs of the specific environment one is operating in. This involves defining new standards of operation, creating strategic quality management systems, developing information systems within the organisation, increasing the awareness of managers of the benefits of simulating their decisions whether these involve the formation of investment portfolios or the pricing of a product. We cannot thereforethink of a technological upgrading independent of the upgrading of the related operational system, just as we cannot expect any practical utility in the development of a mathematical model without the close interaction of the model designer and the potential user.

The paper gives an overview of the mathematical tools that are used for the dynamic control of socioeconomic systems with reference to some specific examples, and suggests some potential areas of action from which all of us would benefit.

## Formal Notations for UML Models

by Horia GEORGESCU1, Marian GHEORGHE2, Cristina VERTAN1
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In the last years it may be observed a growing interest in object-oriented analysis and design techniques due to their modular approach, separation of concerns and generality. The highly incremental development approach of these techniques promotes and supports the use of rapid prototyping, reducing the overall development time. Many methods were developed and their evolution was regularly reimproved by incorporating each other techniques and concepts - Booch method, Rumbaugh OMT method, Jacobson OOSE approach , Coleman Fusion method -. Most of them have been improved by referring to real problems in industry.

Recently a new method called the Unified Modelling Language (UML), integrating most of the facilities offered by Booch method, OMT and OOSE and developing a coherent frame for expressing different views of a system, have been presented.

Some criticisms related to the lack of a formal basis for the object-oriented methods leading to possible ambiguous behaviour specifications appeared. Approaches integrating different formal notations with object oriented methods have been defined. The Z notation has been proposed to be integrated with Fusion and HOOD object oriented analysis, or with object modellind and functional modelling for OMT; timed CSP notation has been integrated with the dynamic modelling specifications for OMT; a rigorous object oriented analysis method integrating formal description techniques based on LOTOS, with standard object-oriented analysis methods has been investigated, a formal semantics using an algebraic specification has been provided for the OMT object model notations enabling a rigorous assessment of the requirements.

This paper presents an integrated approach to the Unified Modeling Language (UML), providing an extension of Z for expressing the class diagram model elements such that the modular way of specifications and the scope of the involved elements to be provided, according to the UML rules. The dynamic behaviour expressed by some UML models is integrated with a Petri net description in order to obtain more rigour for the dynamic specification provide.



## Automatic Control and Industrial Automation in Turkey

"There is not much truth in sciences
that do not use mathematics" - Leonardo Da Vinci

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Perhaps one of the most important areas of applied mathematics is the general field of automatic control, based on well established and elaborate results of system theory. Considering the wide applications of automatic control in industry one is tempted to use the term "mathematics for industry" to describe the approaches for modeling industrial processes, the statistical methods used for parameter estimation and system identification, the optimization techniques employed in the design of controllers, the extensive simulations that are usually performed before actually implementing the control strategy, as well as the methods of adaptive control and the newly developed techniques of knowledge based intelligent control.

Control theory is primarily concerned with physical applications. A control system is considered to be any system which exists with the purpose of regulating or controlling the flow of energy, information, money or any other physical quantity in some desired fashion. The analytical approach to many control problems consists of three major stages: The analytical approach to many control problems consists of three major stages: 1) develop an idealized mathematical representation of the actual physical system or process, 2) apply mathematical analysis and design techniques to the model, and 3) interpret the mathematical results in terms of implications on the actual physical system. Non-analytical approaches such as fuzzy logic control or soft computing still use mathematical tools and methods for their implementation.

The Turkish National Committee on Automatic Control (T.O.K.), established as early as 1985 as the National Member Organization of IFAC, the International Federation of Automatic Control founded in 1957, is the official agent in Turkey responsible with the promotion of the latest developments in control theory and industrial automation in coordination with the academic curricula of Turkish universities and in encouraging university - industry - government cooperation concerning the application of the latest technology.

Towards this aim the Turkish National Committee on Automatic Control is organizing annual national conferences on automatic control and industrial automation where participants from universities, the private industrial sector and from related government organizations present and discuss papers on original research or novel applications. Similarly the National Committee also organizes in Turkey international symposia or workshops, the latest two being "The 4th IFAC International Symposium on Advances in Control Education" and the "The 12th IEEE International Symposium on Intelligent Control," both held in Istanbul in July 1997.

The National Committee also arranges contacts with industrial companies requiring continuing education courses or training programs and organizes for faculty members of various universities to participate in such activities. Some of the most successful programs in this respect were continuing education courses and training related with "Programmable Logic Controllers", "Microprocessor Applications", "Digital Control of Industrial Processes" and "Flight Simulators".

Members of the IFAC National Member Organization are also involved with research and development projects funded by industry ranging from robotic applications to fuzzy control in the operation of washing mashines with brushless DC motors, from optimization of pattern fitting in the cloth industry with the purpose of minimizing material loss to predictive control in regulated yeast fermentation, from pneumatic position control to neural network based autopilot, from H-infinity control of missiles to vision base quality control.

We hope that the 1st Balkan Workshop on "Mathematics for Industry" will be the catalyst for creating new and meaningful cooperation of scientists whose interests lie in control theory and applications towards the creation of regional projects in this particular field.



## An Industrial Mathematics Association or Institute in Balkan Peninsula

C. Karanikas
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Today mathematics, in partnership with computing, became essential insolving many real-world problems. Mathematical methodologies are needed,for example,(i) in modeling physical, chemical, and biomedical phenomena; (ii) in designing engineered parts, structures, and systems to optimize performance; (iii) in planning and managing financial and marketing strategies; (iv) and in understanding and optimizing manufacturing processes.All these observations lead to the necessity to promote in our areaindustrial mathematics.

Our neighborhood ( the Balkan Peninsula) presents certainparticularities:(a) the memories of the cold war and of some recent real wars; (b) the under developing industry and the weak economy in several ofour countriesbut from the other hand our neighborhood has also some advantages (c) a serious international interest (after 1992) for industrialinvestments and commercial activities in this area; (d) a remarkable human capital in mathematics, mathematicalphysics, computer science, engineering , computational science andstatistic, which can be easily transformed in a determinant factor toserve industrial mathematics; (e) the common memories of our ethnic to live together in a multiethnicstate (Roman, Byzantine and Ottoman)The initiative of this meeting is a provocation to all of us for apeaceful and creative European integration. Today we have to respond intwo main questions:(a) can we promote industrial mathematics by exploiting our advantagesto remove the particularities we mentioned ? (b) how is it possible to establish either an association or aninstitute ?

We hope that this meeting can easily describe the aims of theforthcoming association or institute, its name and seat; to exploreemerging technologies, which can be incorporated in this association,and to investigate possible financial sources.

## On the Equivalence of Some Classes of the Linear Programs with System Matrix Parameterization

Margita Kon-Popovska
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Abstract Parametric linear programming with a system matrix parameterization has proved to be highly complex. The most of the previous studies have allowed only one coefficient, a row (column), or few rows (columns) to be linearly dependent on a parameter. This talk considers a more general case where all the coefficients are polynomial (in the particular case linear) functions of the parameter. For such problems, assuming that some non-singularity conditions hold and that for some particular value of the parameter tTR an optimal base matrix is known, corresponding explicit optimal basic solution in the neighborhood of the is determined by solving an augmented LP problem with real system matrix coefficients. Linear parametric programming; parameter-dependent constraint matrix; polynomial parameterization.



## INDUSTRIAL MATHEMATICS UNDER THE EMERGENCE OF INFORMATION AND COMPUTATION PARADIGMS

Exploring the Industrial World
by means of Formal Grammars and
the Mathematics of Imprecision
by Solomon MARCUS

Is it obligatory to have, between mathematics and the practical life, a lot of intermediate steps. Traditionally, the answer to this question was affirmative. This situation was characteristic for the classical science, based on the matter-energy paradigms and on continuous mathematics (mathematical analysis, differential equations etc.). Situation began to change with the emergence of the information and computation paradigms, leading to an attenuation of the borders between the cognitive and the utilitarian function, between science and engineering. Automata and formal grammars as well as the mathematics of imprecision are just such fields. According to our critical survey (Marcus [3]), formal grammars permit to explore the distinction between economic and industrial competence, on the one hand, and economic and industrial performance, on the other hand; they also permit to bridge them, by using the results related to complexity of grammars. This fact is a consequence of a more general situation (Calude-Marcus-Paun [1]).We argue in the favor of language paradigm as a universal tool of investigation of both theoretical and practical aspects ( Marcus [4], [8]).

The device we introduced 30 years ago (Marcus [2]) under the name ofcontextual grammars, has been developed in many directions; these grammars challenge now all the other types of grammars competing in the field of linguistic engineering; see Marcus [6], Marcus - Martin-Vide - Paun [9],Paun [11].

Another direction where mathematics is expected to have an importantimpact in the world of industry is the mathematical typology of imprecision, as it was developed in the last 20years in fields like AI and cognitive sciences. Some results were already obtained. However, as I already argued, the phenomena of imprecision (some of them being strongly related to learning processes (Marcus [5]) can be kept under control only with some compromises (Marcus [7]); the most difficult problem we have to face in the near future is the fact that most available mathematical models of imprecision are concerned with only one type (approximation, randomness, fuzziness, roughness, ambiguity etc), while in practical life they occur invarious combinations, most of which

being not yet investigated. In Marcus-Tataram [10] such aninvestigation is proposed in respect to communication processes.

Mathematicians' interaction with people in industry is really efficient when the formers convey to the latters not only a result or a tool, but together with them something of what we call mathematical way of thinking (what means to formulate correctly a problem, what is mathematical rigor, why we need it, how to elaborate a conjecture etc.) To some extent, mathematical thinking can be developed in absence of mathematical jargon; may be, this is the most important part of implementing mathematics in industry.

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## APPLICATIONS OF KRIPKE MODELS

Zoran Markovic

Kripke models are, as it is well known, an important tool in studying different non-classical logics, most notably intutionistic and various modal logics. However, Kripke models may be also very useful in practical applications. One such example is the so called "default logic". Default logic is an attempt to account for practical reasoning in real-life situations. Such reasoning always has to deal with incomplete information, i.e. it has to start without the complete description of a given situation. Therefore, the standard deductive logic usually cannot describe how one arrives at any conclusion. Default logic adds some common sense assumptions, "defaults" which are presumed to be true in the absence of the information to the contrary. This means that the additional information may render some of the conclusions false, requiring the revision of beliefs which makes this logic non-monotonic. Attempts to formalize this type of logic produced very cumbersome systems involving procedures like taking the least fixed point among all possible theories extending the given theory etc. D. Gabbay gave a very elegant formulation of a default logic, based on intuitionistic logic, using Kripke semantics. Intuitionistic logic is a natural choice for the basis of default reasoning as it allows undecided proposition.

Namely, in a Kpipke model for intuitionistic logic, besides propositions which are true and propositions whose negation is true, there are proposition for which neither hold. Introducing a straightforward modal operator which applies to such propositions, permits formulation of default rules of inference within a standard framework of intuitionistic logic, making this default logic just possible to apply the well developed modell theoretic and proof theoretic apparatus of intuitionistic logic to the study of default logics.

## ON THE BALKAN COOPERATION "MATHEMATICS FOR INDUSTRY"

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1. The mathematical community of high level in the Republic of Macedonia (RM).There are two universities in RM, in Skopje and Bitola, and all research in mathematics is made in the mathematical departments at these universities (mostly in Skopje). In RM there is no a mathematical institution whit a mathematical research only (like the Institute for mathematics and informatics in Sofia, for example). The two most important mathematical institutions in RM are the Institute for mathematics and the Institute for informatics at the faculty of Sciences and mathematics in Skopje. The number of mathematicians with Ph.D. in RM is about 40, and there are also about 50 younger researchers. There is a dozen of researchers at the faculties for electrical engineering, civil engineering, physics,... which are using mathematical tools at, let say, enough high mathematical level.

2. The areas of interest of the mathematicians in RMThe areas of interest of the mathematicians in RM are mostly the following ones\: universal algebras (n-ary and vector valued structures, free structures,...), groupoids, nets, operator theory, functional analysis, differential equations, Steiner triple systems, numerical analysis and numerical methods, algebraic topology, knots theory, differential geometry, functions of complex variables, queuing theory, mathematical statistics, linear programing, chaos theory, ...

3. Cooperation of the mathematicians of RM with industryIt cannot be said that there is a cooperation of the mathematicians of RM with industry. The kind of mathematical research made in RM is mostly on theoretical level. On the other hand, all of the researchers have a lot of teaching duties (usually 6 -10 hours weakly, with about 200 - 500 of students). The kind of industry in RM allows application of mathematics for many purposes, but the number of factories of a same profile is quite small. No factory in RM has a research institute, their technology is usually an old one, and many factories are using abroad license in their productions. As much as I know, only a linear programing in the factory for concrete production was applied. On the other hand, there are some



results of the researchers of RM which where applied for solving industrial problems in other countries ( optimization of the water streams for the hydroelectric powers in the Republic of Slovenia, for example). Also, there are mathematical results suitable for designing software packages which can be applied for many different purposes, but there is no "interface capacity" that software to be sold.

4. What is the interest of the mathematicians in RM to cooperate in a Balkan project "Mathematics for industry"?I find out that the three most important interests are\: the development of the mathematical research in RM especially in its applications, the benefits of doing joint research with the mathematicians of the Balkan countries, the possibilities of actualrealization of their results in industry.

5. What is the interest of the mathematicians of the Balkan countries to accept the mathematicians from RM in the project "Mathematics for industry"?

Without doubt, one principal reason is that RM is a Balkan country, but it is not the most important one. I have state some facts on the mathematical and industrial capacity of RM, which correspond to the whole position of RM these days. Although small, the mathematical community in RM (cooperating with the other Balkan mathematical communities) is capable to produce results suitable for industrial applications. On the other hand, the obtained mathematical results all over the Balkan countries can be applied into the industry of RM as well, in such a way spreading the field of application in more industrial items.

# GENERALIZED POLYNOMIAL SYSTEMS AND APPLICATIONS IN APPROXIMATION THEORY AND SYSTEMS IDENTIFICATION

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Polynomial systems are very attractive in many applications in mathematics, physics, and other computational and applied sciences (electronics and communication, control system theory, process identification, etc.).The orthogonal polynomial systems, especially classical orthogonal polynomials, play very important role in many problems in approximation theory and numerical analysis. Some of them found very important applications in applied sciences and have become the main tool in several methods and procedures. In this survey we consider generalized polynomial systems and their applications. Let be a complex sequence. A linear combination of the system is called polynomial, or a Lambda-polynomial. By Lambda we denote the set of all such polynomials, i.e., where the linear span is over the real (or complex) numbers. Such generalized polynomials can be orthogonalized and applied to several approximation problems including quadrature problems, as well as the problems of system identification.

General Properties: We investigate two Muntz systems which are orthogonal with respect to some inner products. Beside the general properties including some representations and recurrence relations, we consider a few interesting special cases of generalized systems. In particular, the systems regarding to the real sequence Lambda, as well as the case when some of lambda's are equal, are also considered. Zero distribution of such systems is investigated.

Problems in Numerical Computation of Muntz Polynomials: A big problem is how to compute the values of orthogonal Muntz polynomials in a finite arithmetics. As a rule, such polynomials are ill-conditioned. We discuss such problems regarding to single, double, and Q-arithmetics. A few approaches in numerical evaluation of these polynomials and their derivatives are given.

Applications in Approximation Theory and System Identification: We investigate some approximating properties of Muntz systems in the uniform norm and norm and give certain applications. Also, we connect



orthogonal Muntz systems with Malmquist systems of orthogonal rational functions in the complex plane. We prove that one class of orthogonal M\"untz polynomials can be interpreted as the inverse Laplace transform of some transfer functions (impulse response of the linear time-invariant systems). Several interesting results in this directions are presented. Using the previous facts, we give a numerical method of system parameter identification.

Generalized Gaussian Quadratures: A numerical algorithm for the construction of generalized Gaussian quadratures was originally introduced over three decades ago by Karlin and Studden, and recently investigated by Ma, Rokhlin and Wandzura cite. Using theory of orthogonality for Muntz systems, we present an alternatively numerical method for constructing generalized Gaussian quadrature rules which are exact for each in M. Here is a given nonnegative measure on. Our construction is quite different from the corresponding procedure for the classical Gaussian integration formulae with an algebraic degree of precision. Numerical examples are included.

## Scientific cooperation in mathematics for industry and information technologies

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The workshop is organized having in mind that mathematics for industry may serve as a vehicle for the regional development in the Balkan's countries in the 21st Century. However, I believe that we are not well acquainted with situations in this field in our neighboring countries. Therefore, I would like first to present in short the position of Yugoslavia in this field.

Scientific work in Yugoslavia is organized generally through scientific projects funded by the Government. At this moment, in mathematics and computer science there are three, rather broad projects. Due to their wideness, they are divided into smaller units subprojects which correspond to particular fields in mathematics and computer science. Altogether, there are about 400 hundred researchers participants of these projects. Their work is, I would say, well presented not only to domestic but also to international scientific and professional public, since about 40\% of scientific papers are published in international journals, according to the SCI list of journals of AMS (American Mathematical Society). Until recently most of the activities in the projects were of the pure scientific nature with little attention paid to possible applications. But few years ago it was recognized by both, the Government and mathematicians themselves, that mathematics, beside information technologies is key to numerous industrial applications. Namely, the core of algorithms is mathematics, not only in their design, but also in their analysis, improvements and proofs of correctness. Their program implementation, on the end, is just their translation into another language. Of course, the art of computer programming is not of less importance, especially if one really wants to use them. Therefore, two of the the mentioned projects got into their names additions which should reflect the applicative side of mathematics, as "information technologies" and "industrial mathematics". New professional societies were established as the "Society for industrial mathematics" and the "Society for pure and applied logic". New journals were started as the "Journal for Operational Research". But the most important is probably the new Governmental initiative in funding new kind of projects, so called technological projects. They are small projects, better funded than pure scientific projects, dedicated to the research of definite problems. It is expected that results of the projects could be applied immediately in industry, and generally outside of science. Up to now several projects of this class were granted to mathematicians.



Now, I shall present several themes that were, or they are, parts of our project activities. I believe that at least some of them could promote the possible cooperation between our institutions.

THEME: Application of mathematical logic in intelligent reasoning

The main subject of the theme is the research of possible applications of mathematical logic in modeling of human reasoning. Beside classical logics, modal logic and fussy logic are considered as possible bases for this modeling. Algorithms and particular software are developed, or is planned to develop, based on these systems. Special attention is given to the parallelization in the software implementation.

THEME: Computational mathematics

This is rather wide area, therefore I will present only few topics current in our research. The first one concern parallel algorithms for multiplication of large numbers and primality tests of integers.The focus is on the Schonhage-Strassen "fast Fourier multiplication" algorithm of the complexity integers. Some enhancements are done, and parallel version are implemented for multi-processors computers (16 processor T800 farms). Good results were obtained, for example in testing of primality of so called Fermat primes. Possible applications could be in development of programs for data security. In fact, Cryptography is another field of interest, due to tremendously fast growth of Internet/Intranet communication and keen need for protection of data. Of special interest are systems with public key, of which RSA is the most well known. Development of systems of this kind is of rather high interest for other reasons, too. For example the use of the existing systems is protected and limited due to law regulations in countries where the system (software) is produced. For example, Microsoft Internet browser Explorer, European version admits only 40-bit key protection, comparing to 128-bit key protection in American version. Therefore, development of similar but independent system would yield the true protection of data and autonomy. Another interesting project whose results have been used

for years, is nautical almanac, based on heliocentric coordinate system, and numerical integration of differential equations.

THEME: Digital image and signal processing with biomedical

The project is focused on upgrading of optical microscope. The enhancement consists of use of PC computers, CCD cameras, and image acquisition, archiving and analysis tools for use in human genetics, prenatal diagnostic, hematology, oncology and pathology. The system is still in developing, but is is also experimentally used in several our hospitals.

THEME: Computer archiving and multimedia presentation of cultural values

The main assumption of the project is that the cultural heritage is the essential aspect of relationships between countries, people and individual subjects. The interchange of information on cultural heritage should rise indispensably the mutual connection and better understanding. Therefore, the role of institutions which deal with the cultural values is not resided only in collecting and preserving archive collections, but also in organization, processing and displaying data on collections to specialized and general public. The contemporary computer technology permits efficient organization of information systems of this kind of data, and therefore it opens new possibilities in building archives, search, retrieving and presentation of records of relevant documents to the general audience and scientific community.The project consists of two parts.The first part deals with the computer information infrastructure, standards and methodology of design and the architecture of data concerning cultural heritage and cultural values.The second part of the project deals with design, frame and building of computer archives of participants of the project, together with mathematical and program implementation.Our investigation is based on SGML (Standard Generalized Markup Language) which is now the standard in this area (ISO 8879\:1986). Let us mention that one derivative of this language is HTML (Hyper Text Markup Language) which is today the main tool for making Internet presentations. Results of the project are already used in archiving and presenting of some museum collections.



THEME: Data Mining

Automated detection of patterns from large amount of data is often called data mining. As computing and communication are increasingly converging to each other, mining data, stored in distributed databases with adequate attention to security related issues, is of growing interest. Distributed data mining (DDM) systems are finding an increasing number of applications in popular Intranet/Internet environments, data mart based warehousing architectures, network intrusion detection, geographical information systems and many others. This theme will provide a platform for discussing theoretical and applied research issues in DDM. The topics of interest include, but are not limited to:

1. Theory and foundation issues in DDM: Problem decomposability and data distribution; complexity issues in DDM; representational issues.
2. Methods and algorithms: Distributed algorithms for popular data mining techniques (e.g. association rules, classifiers, clustering); techniques for communication minimization, cooperative learning.
3. Software agents and DDM: Agent based approaches in DDM. Agent interaction\: cooperation, collaboration, negotiation,organizational behavior.
4. Applications of DDM: Application of DDM in business, science, engineering, and medicine.
5. Distributed data mining on the Internet.

# DATA MODELLING - CERTAIN PRACTICAL AND CONCEPTUAL ISSUES

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This presentation attempts to overview a number of problems connected with data modelling,regarding both the generalized use of information processing in scientific investigation and technological deve- lopment and the specialized research in some particular fields of information technology.The generalization of information systems in all branches of activity of human community and and theadvancement towards the information society asks for the expansion of research which can stimulatethese processes. The reasons for this kind of action are both conceptual and, especially, practical.Looking backward along the way covered by the information technology during the last decades , wewill find out that mathematics has considerably helped the progress of computer systems and telecom-munication systems.It is well understood that in the near future we should expect, taking into accountthe same practical reasons,a contribution of the mathematical research to the development of compu-ting techniques,to the design of information systems and of applications,at least at the same level ofimportance as the contributions made in the past.If we accept that applications in general make exten-sive use of databases, we are almost automatically led to the idea that data modelling will continue tohave a central place in practice.The paper points out, in the first line, that one of the directions in which the efforts should be extendedis the applied research regarding the databases. The relational model of data organization continues to be dominant, but the enlargement of ist applications requires significant improvement, so new research is needed. For example, in numerous applications, certain components of tuples should not have atomic values. As a consequence, the schemes of certain relations cease to be expressed in the first normal form, and this fact has effects on the whole design of the database.

Consequently newapproaches are necessary in the field of the relational theory.As a rule, the applications of the information technology are "data intensive" , from computer aideddesign to the real time com-



puter controlled surgery and to the large databases. This is a powerfulargument which emphasizes the importance of research in data modelling. It is instructive to remind,in this context, that most data models have evolved intuitively and were not formallydefined, at leastat the beginning. It foilows that a more intensive basic and applied research should be conducted inthe data modelling field, in strong connexion with the practical applications.A more active research in this area is demanded by the actual development in the database technologies,but not only. The future progress of artificial intelligence, of expert systems, of data discovery in databases ("data mining"), and many others, calls for a broader mathematical support, practically oriented.In many cases, the developments in these fields have happened without a strong formal basis. The theoryof relational databases is one of the few examples which has relied substantially on special chapters ofmathematics (set theory, algebra, predicate calculus etc).

Unfortunately, there are fields in which lessattention was given to the advantages of the mathematical foundations; an example could be the databases with incomplete information. On the same line, the author believes that a stronger interactionbetween mathematics and data modelling is required by the need of growing the reliability of large andvery large information systems, containing very large databases. Concerning this subject, it is possiblethat a stronger mathematical support in ensuring the integrity of data or in determining the entropy ofsuch systems, would lead to higher performances and to a better costeffectiveness.In the authors opinion, deeper applied research is needed in the area of programming languages devotedto the definition of systems - for instance, industrial systems -, or to the coding of algorithms used forsolving some practical problems. At ist time, FORTRAN was a remarkably successful experience in thisregard. This kind of reseaech should include a more complete reffection of the nature of different typesof applications in the structure of languages, up to their grammar. Studies of this type should be basedon adequate data models used for describing the sets of objects and the links established in such appli-cations.In Romania, in the academic and industrial environment, the preocupations connected with the mathe-matical foundations of information processing, with data modelling in particular, have been extendednotably during the last decades. The contributions belonging to professor Grigore Moisil, in the fieldof polyvalent logic theory was recognized worldwide. Many of his students, the mathematics departments of some universities, the departments of computers, some research laboratories inindustry, have been

involved in research on programming languages, databases, pattern recognition,data modelling, etc. Consequently, there is a promising basis for the extension of the future researchin these fields, in the context of a broader regional co-operation and in the frame of the associationwith the European Union.



## Lincar and network programming models in practice albanian experience

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Many OR models have been widely used in albanian practice. Among them, linear and network programming models are the most used. Starting from 1971, when the first computers were installed in Albania and the Computing Center was founded, these methods obtained a greater interest. We focus here in some of these models.

A. Linear Programming Models

1. Cutting stock problems

Were the first LP models to be applied in albanian practice. Most of them were unikimensional or bidimensinal regular (cutting rectangles from rectangles) cutting stock problems, but, at the same time, some irregular shape bidimensional cutting stock problems were solved. The unidimensional or regular bidimensional models were used for cutting different materials such as glass, timber, paper, etc. Resutling in a reduction of trim loss by 3-8% .In most of the cases, for these models, the automatic generation of patterns was used. For the solution of these models, firstly, an algorithm for automatic pattern-layoit generation was used (based on anodimensional or bidimensional knapsacks) followed by a Simplex algorithm or by any heuristics (such as exhaustive enymeration). The irregular bidimensional cutting stock problems were used in garment and shoes industry. In these cases, the patterns were manually laid down by experts of the respective field and, afterwards, an LP solution followed. In these models the same reduction of trim loss as in the other models was observed. For these last models, some attemps were undertaken in order to automatically generate patterns and some encouraging results are obtained based on stochastic algorithms (simulated annealing).It must be said that even in the most simple model of unidimensional cutting stock problem, ther are many variations imposed by the practice. Let mention two of them:

- cutting of the aluminium bars with holes. This is an unidimensional cutting stock problem but with some auxiliary constraints raised by the objects to be produced - stairs or balcony handrails. The solution of this problem by a special algorithm for pattern generation sensibly reduced thw loss of this costly material.
- cutting of pipes in different angles. The pipes under consideration are

of a costly matirial and are cut in different angles in order to produce different configurations. \if we cut the pipes and open them, the resulting problem is a unidimensional knapsack with irregular left and right borders. The automatic pattern generation in this case is the only solution taking into consideration that thw cutting machine is numerically controlled.

For some of this problems we have cooperated with the Enterprise "ALMA"- Grenoble, France which has an immense experience in treating cutting tock problem with all the other problems (sometimes even more difficutl to be solved than just setting stock problem itself) accompanying it.

2. Blend mix problems

These models were used in tobacco, copper, coal and chromium industries. As an examplel, we are speaking about chromium industry. As it is known, Albania is a rich country in chromium ores, which represents a large part of albanian export. Chromium ore is produced in some 20 mines mainly in the north-east part of Albania. The ore is designed for export through the port of Durres or to be processed int ferro-chromium plants in Burrel or Elbasan. Considering the different content of every ore, the output and blend requirements of ferro-chromium plants, the different export prices according to the contents of Gr2O3 in chromium mix, which is the best way of mixing the chromium ores in order to increase the export profit? This was formulated as an LP model (the largest LP model ever solved in Albania) and the results were very encouraging.

B. Network programming models

1. Generalized Networks (Networks with Gains and Losses)

This model was used to optimally assign trucks to different destinations. Disposing of a park of trucks of different type and capacity, an enterprise has some destinations to serve. In these destinations there are different goods which influence the truck turn-over. How to assign the trucks to different destination in order to transport all the goods under consideration with the least cost? This problem was formulated and solved as a Generalized Network model. The results for a truck park show a 3-8% reduction of fuel consumption.

2. Optimal Design of a Regional (Tree-like) Aqueduct Pipeline

Regional acqueducts usually are three-like i.e. they are represented by a network without circuits. Knowing the piezometer (pressure) at the source and in all the consumer points, the length of each branch, as well



as the different pipe diameters at our disposal with their respective costs, which is the optimal (least cost) design i.e. which pipe diameter to assign in each branch so as to minimize the pipe cost? In some cases, when pumping in the source is needed, the same model can be used to minimize the total (investment and operation) cost. This model is used in the design of many regional acqueducts throughout. Albania with good results.

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# SAMPLING SURVEY IN ALBANIA EXPERIENCES AND NEW CHALLENGES

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Albania is undergoing a fundamental transformation from a centrally planned socialist order to one aspiring to become a pluralistic, market oriented one. This necessary involves a major overhaul of institutions and ways of thinking. In some spheres of life, the hold of previous patterns is more tenacious and difficult to change than others. This concerns also methods of studies related to them, like for example, sample survey. For Albanian officials schooled and employed for decades during the previous regime, it is difficult to accept entirely unfamiliar concepts and ways of doing things, particularly since doing so may imply that skills inherited from the past are no longer as valid or relevant as they used to be.

Our paper focuses on challenges raised in designing and implementing studies in which the method used, was sampling survey. Such a study was for example, the evaluation of the impact of a property registration project in Albania. With another colleague from USA, we were responsible for designing all aspects of the study, including conceptualization, questionnaire preparation, sampling and finally data analysis and report preparation.

Some of the issues that arose and which vill be discussed in our presentation are:

a. Conveying the need to address other audiences. In addition to the local officials with whom there is immediate contact, the approach and the research agenda of expatriate experts are influenced by the academic background and the demand and the expectations of clients or audiences for the research besides local ones, i.e. international donors. In a sense, the members of the research team with international experience must communicate expectations such as those of donors to people for which the entire matter of policy and evaluationresearch and the game of foreign assistance, is something new and unfamiliar.

b. Conveying the difference between analytical studies versus descriptive studies and what this difference implies. For most of people we worked (and who were authorized to approve or disapprove the study methodology) the idea of doing an analytical study was new. Their experience had been with studies designed to quantitatively describe the study object. The idea of having a study oriented to testing hypothesis was new and not easily understood. Many time this leeds to endless discussions and differences of opinion in two keyareas questionnaire design and sampling methodology.

c. Sampling design: Of course there are many solutions stratifying, clustering,combination of multistage clustering and stratification, etc. But in the situation in which things are in Albania concerning sampling survey (the real knowledge is insufficient to develop rigorous solutions), the choice in general is what in practice is called design of convenience; this is more reasonable.You have to combine many forms of sampling design, to get the information you need, to have results with variation as small as possible and the same for the bias. But, of course you have to respect the principles, which in designing surveys really are. On the stage in which things are in Albania actually, the success of a study depends not so much from design possibilities, estimators and variance calculation. Some other aspects of the survey process, which are essential, are important cognitive studies, pretest of questionnaires, postenumerative studies, etc.

d. Data collection and processing. Data are collected by peoples who has more and more experience, in general, except some specialist of the field, the students are used for. Data are collected by questionnaires. The data thus collected are stored onto raw level database that is the primary input to produce the reports.

e. Quality assurance: data problems associated with sampling surveys fall into two broad categories. First, errors derived from the sampling procedure that depend on the sampling design and the estimation procedure. Second, errors derived from the measurement process itself collecting data, computer process etc. These nonsampling errors are mainly of a random nature and therefore can not be predicted nor completely eliminated. Quality control methods are the only way to minimize them to level that does not harm the final estimates a considerable amount of editing procedure is necessary to spot and to correct those cases.

f. Data delivery and analysis: Data are delivered to users in the form of descriptive reports containing estimates of some observed variables. This output comes mainly in the form of computer tables and charts printed on paper. Problems: On the future, significant changes in the way data is delivered and used will have to occur. Paper tables and charts will no

longer be commodes; an increasing need for electronic delivery including faster and more intelligent software to retrieve and manipulate the data will be pressing. Also, descriptive analysis telling what happenedi must be replaced by statistical modeling aimed to explain why it happened

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## The State of Turkish IndustryAndThe Feasibility of Cooperation between Universities and Industry

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University of Istanbul and Eti ElektroteknikTurkey has a large industrial basis enjoying a relatively large domestic market and competing successfully in the international arena. The development phases over a period of some seven decades have as follows: Nineteen thirties - State run industries with central planning and little regard for costs and profits, which trained the entrepreneurs and administrators of the future decades.

Nineteen forties - A period characterized by recession.

Nineteen fifties, sixties, and seventies - Increasing private investment, protective barriers, and import substitution. Though costs were high and quality was low, growth was rapid and diversification quite broad.

Nineteen eighties and nineties - A period of perfect competition both domestic and from abroad.

Maturing of industry. Important strides in materials procurement and productivity. Although many industries are fully competitive by now, there is still too much dependence on imported technology and manufacturing under foreign licences.Some industries are conducting their own research and development. However, small and medium size companies in particular face difficulties in creating technology, developing new products, and increasing productivity.The government is trying to promote technological innovation and development through tax breaks and outright grants on one hand, and state research facilities on the other. Some progress has been made in this direction, but there is still a long way to go considering the size and state of the industry as a whole.Although it would seem an obvious strategy at first, there are fundamental problems impeding industrial - academic cooperation towards innovation and technology development. They can be summarized as follows. Diverging objectives for both groupsIndustry expects a relatively quick profit usually within a year or two for small and medium scale projects. It is not interested much in advancing knowledge, in publications, presentations, and other high priority items on the academic agenda. Meeting deadlines at any cost, on the other hand, is not a hallmark of academia. It takes dedication on the part of academics to master the industry's problem at hand and bring it to conclusion. A 99% complete solution is not a solution for the industry. Although academics can be

highly dedicated to their academic research topics, they often tend to trivialize and look superficially at more practical issues. Topics and goals are often changed during the course of academic research for reasons of expediency or because of unexpected discoveries, which lead to previously unforseen interesting questions. An acceptable solution for the industry does not necessarily mean a scientifically rigorous one, but a solution which leaves no loose ends to be studied later, and which has a high degree of reliability. Something that usually works but often fails is not acceptable. When a theorem cannot be proved in mathematics for a general case, the usual tendency is to try a proof for special cases. This is not matter of factly accepted in industrial circles.Lack of aggressive marketing on the part of academiaJust as companies try hard to sell their products not only by passive display and advertizing but also by market research, customer need identification, and individual prospective customer contact; active marketing efforts are needed on the part of academics to be awarded contracts from industry. Brokering efforts by some universities, although desirable, are not particularly effective as they rely to a large extent on chance encounters of parties with common interests and complementary faculties.The proposed strategy for achieving and maximizing cooperation between industry and universities should involve the following. Aim at first at government, state owned, or nonprofit organizations unless there is a proposal which is really appealing for the private sector.Study cases and prepare proposals before approaching a prospective partner. Willingness of parties to cooperate without an articulated specific goal will often result in loss of interest after the initial enthusiasm is over. A pre feasibility study is essential both to avoid future disappointments and to impress the other partner favorably.Search for outside financial support, and approach the targeted partner after having collected sufficient information and worked out strategies and ways to get around obstacles to achieving support. Watch for unsuitability of partner, proposed project etc.



## Industrial Mathematics; Researches and Future Trends

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The aim of this paper is to present a status of the art and to outline the perspectives of Industrial Mathematics in some of the principal academic centers in Romania, Bucharest, Timisoara, Cluj, Iasi.

Although this field has not been defined as such, there are many Romanian researchers whose scientific works have significant applications in industry. Quite a large number of these researches have been performed in the frame of joint research projects between Romanian universities and foreign ones. This is why the Romanian researchers - mainly those from the Computer Science departments of the Bucharest University - have welcomed the perspective of a stronger collaboration with the faculty of the Informatics department of the Aristotheles University or with the researchers from other European universities, for instance in the frame of a virtual research institute for IM in the Balkans.

# On approximate calculating ofRobustified Maximum Likelihood

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It is well known that the Maximum Likelihood Estimator (MLE) can be very sensitive to some deviations from the assumptions, in particular to unexpected outliners in the data. To overcome this problem many robust alternatives of the MLE have been developed in the last decades. For detailed introduction, see (Huber,1981, Hampel et al.,1986, Rousseeuw and Leroy, 1987).

Neykov and Neytchev (1990), following the definitions of the Least Median of Squares (LMS) and Least Trimmed Squares (LTS) estimator of Rousseeuw (1984), introduced two classes of estimators for the parameters of any unimodal distribution with regular density as an extension of the maximum likelihood principle. This modification considers the likelihood of individual observations as residuals and applies on them the basic idea of the LMS and LTS estimators.

The corresponding estimators was called Least Median Estimator (LME(k)) and Least Trimmed Estimator (LTE(k)), where k is a tuning constant which can be chosen by the user within some reasonable range of values, see Vandev and Neykov (1993).

The estimation of the location parameter is the testing point for all methods of the statistics. Among the oldest methods is the median which proved to be one of the best methods when the basic assumptions about the distribution are suspicious or a priori inadequate (C.D.Small,1990). Recently a trimmed version of this median (TLM) was proposed and studied (see A.Gordaliza, 1991, D.Vandev, 1992). It proved to have some advantages when the sample is heavily corrupted.

In the paper (D.Vandev, 1995) an algorithm and a Fortran program were proposed for approximate computing of the trimmed multivariate L1-median according Mahalonobis distances. Here we will concentrate on the computational aspects of the stochastic approximation algorithm applied to the problem of computing of both LME(k) and LTE(k). Special attention will be paid to estimating the location parameter.