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IN  
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## **NATIONAL RESEARCH PROGRAM "INFORMATION SOCIETY"**

*The society that we call today "Knowledge-based Society" has other codes as "Post-industrial Society", "Information Society", "Post-modern Society".*

*Information society is a society with qualitatively new structure, organization and social relations based on global access to and use of information and communication nets and services without national, geographical or other limitations in exchange of information, scientific, cultural and other achievements.*

*This society has to make the life of its citizens better, to present new opportunities and ways for labour, realization and leisure. The aims of the program are realized through:*

- *Support of scientific research in the spheres exerting essential influence on the development of the society and economy of the country and turning them into competitive society and economy based on knowledge.*
- *Stimulation of researchers' work in the net, particularly in the context of European integration, as well as improvement of their qualification.*
- *Acceleration of information society technologies development and support of market-orientated activities aiming at introduction of new products and services on the basis of modern information and communication technologies.*
- *Assistance in adaptation of the systems of education and professional training to the requirements and opportunities of information society.*

*National research program "Information Society" is realized through financial support of integrated projects in the following priority directions:*

- *Development of basic scientific research in the field of: new computing models, including information networks and systems making use of big distributed computations and development of easily conveyable and well-protected platforms; new methods and algorithms assisting applications of tools for computer simulation, visualization and animation.*
- *Creation of innovative applications directed to linguistic technologies applicable in administrative and public institutions; efficient utilization of geographical information systems and systems for tracing and identification; software products for protecting rights upon digital content and control upon the buyer's right to use the licensed digital content; systems for protecting the users from illegal and harmful content of information, filtering and evaluating systems*
- *Accelerated development of information society and information technologies by means of activities increasing competitiveness of the ICT sector and development of e-government.*



# NACID

National Centre for Information and Documentation

## MAIN OBJECTIVES

NACID is a governmental institution affiliated to the Ministry of Education and Science. NACID collects, processes, maintains and disseminates reference and analytical information to support the national policy in the field of education, science and innovation as well as to support Bulgarian research bodies, individual researchers and SMEs

## PRIMARY FIELDS OF ACTIVITIES

- Processing and disseminating bibliographic, reference data and analytical information.
- Maintaining specialized databases of scientific production and research resources in Bulgaria.
- Providing information about national, European and trans-European research programs.
- Providing information to support the process of harmonization of the Bulgarian education and research legislation with European Union ones.
- Performing the role of institutional contact point of the Sixth Framework Program in Bulgaria.

## INFORMATION PRODUCTS AND SERVICES

- ❑ NACID offers a large range of information products, including:
  - Subject profiles;
  - Reviews;
  - Bibliographic references.
- ❑ NACID offers a great variety of information services through its own databases as well as information brokerage to external databases. Online access to two information blocks of *locally maintained own databases* in English:

### "Bulgarian Science" Databases

- "SIRENA", R&D reports and dissertations - more than 80 000 records
- "Scientific and Technical Publications in Bulgaria", more than 2 500 records
- "Who is Who in Bulgarian Science" - more than 5 500 records
- "Papers", Number of records: 128

### " Science and Industry" Databases

- "Partnership for Innovation and Development". Information about the national research units.
- "Knowledge for Innovations and Development" Information about Bulgarian R&D activities.

The information brokerage services are available upon request, providing access to over 1200 databases from major international commercial host centers, thus providing the research community with a wealth of S&T information.

- ❑ *Central Research and Technical Library services*
  - Library collections - more than 4 million items/reference books, monographs, serials, dissertations, CD ROM, DVD etc;
  - Online access to the library catalogues since 1980;
  - Searching in electronic catalogues and databases;
  - Lending of library materials;
  - Electronic Document Delivery;
  - Interlibrary loan;
  - More than 9000 users per year.

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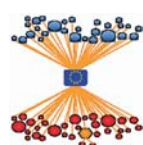
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## NATIONAL SCIENTIFIC PROGRAMMES WITH EUROPEAN DIMENSIONS

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### KNOWLEDGE TECHNOLOGIES FOR CREATION OF DIGITAL PRESENTATION AND SIGNIFICANT REPOSITORIES OF FOLKLORE HERITAGE<sup>1</sup>

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The aim of the presented project is to build an archive with digital objects (a collection selected from the fund of the Institute for Folklore of the Bulgarian Academy of Science), which corresponds to the European and world requirements for such activities, and is consistent with the specificity of the presented artifacts. The complex structure and the multi-layer characters of the folklore objects require innovational information approach. The rich-in-content WEB-presenting of the Bulgarian folklore knowledge defines the usage of modern methods and technologies for digital archive developing, which will be used not only for preservation and access to the information, but as a tool for scientific research analysis development. The main tasks are: by Knowledge-based technologies and Semantic Web approach Digital libraries and Information artery to be created in order the modern presentation in virtual form valuable phenomena of Bulgarian folklore heritage. The realization of the project gives opportunity for wide social applications of the multimedia collections, for the purposes of Interactive distance learning/self-learning, research activities in the field of Bulgarian traditional culture and for the cultural and ethno-tourism in Bulgaria.

#### 1. 1. Analysis of the researches

Under Sixth Framework Programme of the European Community for Research and Technological Development (FP6), research to digital cultural heritage is part of the priority 'Applied IST research addressing major social and economic challenges' in the specific programme 'Integrating and strengthening the European Research Area'. The main objectives are "improving accessibility of Europe's cultural and scientific resources by developing: advanced digital library services, providing high-bandwidth access to distributed and highly interactive repositories of European culture, history and science; re-creating and visualizing cultural and scientific objects and sites for enhancing user experience in cultural

tourism; advanced tools, platforms and services in support of highly automated digitalisation processes, digital restoration and preservation of film and video material..."

In the current project the analytic researches, the use of appropriate methods, tools and environments for digital presentation and preservation of the valuable phenomena of the Bulgarian folklore are orientated towards their exhibition in the global information space with opportunities for wide social applications for interactive learning, scientific researches and cultural tourism. This allows integration of the idea of traditional Bulgarian culture and folklore into the European cultural space, fully preserving its identity and variety.

<sup>1</sup> The work was supported partially by the Bulgarian National Science Fund under Grant IO-03/2006.

The project research basis is the fund of authentic folklore materials, which belongs to the National Centre for Preservation of the Bulgarian Folklore (NCPBF) of the Institute for folklore - Bulgarian Academy of Science (BAS) and other sources. The available system for technical servicing does not offer auspicious and quality preservation of the folklore documents, which are valuable cultural heritage. That is why the project is a very important and much needed step towards modernization of the folklore archive fund. Its aims are modern documentation, processing, systematisation and access.

The e-Learning is one of the initiatives of the European Commission. Thanks to the efforts of a great number of scientific teams all over the world there are different elaborated software platforms and virtual environments for learning. They become more and more popular. In our country the researches and the received results are connected mostly with the higher education.

The questions connected with the new technologies for continuous learning, life-long learning as well as their use in not traditional areas, are not enough developed. Practically there are no developments, which offer e-Learning in the subject field of the folklore heritage, for both formal and informal forms of teaching. There are no developed tools and virtual environments for folklore object presentation or for creation of social-orientated applications in education, scientific researches and cultural tourism.

It is necessary modern methods, tools and techniques based on knowledge for organization and creation of digital resources of different types of archive funds to be investigated and appropriate methods and tools for protection and security of the multimedia data to be provided.

This work is also based on the results of some international projects and archives [18-23].

## 2. Previous research work of the team

The project research team has experience from participation in national and international projects as well as from publication activity. See [1-4, 6-7, 9-17]

The developments are based on investigations of the folklore archive fund in NCPBF of

the Institute for Folklore – BAS and other sources. The archives contain different types of documents, stored in different memory devices. A classical catalogue of archive folklore materials, which is based on classification scheme, is functioning there. The folklore archive is a very complex and open system, in which the elements and the forms are in different relations, dynamic progress and in the last few years a great new fund of different types of memory devices has been gathered [mat2001] [mat2006b].

The team investigations are connected with research and development of applications according to a great number of European projects in the field of technologies based on knowledge. They present an experience in relation to the formulation and rationalization of basic concepts, categories, methods and technologies connected with creation of digital archive, digital libraries and semantic annotation of multimedia objects, Semantic Web and data protection.

The team experience in the field of e-Learning is connected mainly with participating and formulating of results in different projects, financed by the World Bank, Ministry of Transport and Communications, Ministry of Education and Science. These are the projects: "Simulating the learning by the use of e-Learning", Virtual Department of Computing "John Atanasov", Virtual Faculty of Information and Communication Technologies, Bulgarian Virtual University.

In the framework of these projects and as a result of the investigations materials related to the structures of virtual environments for learning, requirements to Web-based courses, methods for development of course materials, requirements to software platforms for e-Learning, e-Learning for adults [tto2004], etc., are published.

## 3. Goals, hypotheses and approach

The project goal is investigation of modern methods, tools and technologies for development and implementation of digital archive "Bulgarian Folklore Heritage", with semantic annotated information and tools for intellectual property protection, as a necessary basis for digital library creation and its transformation into an information portal with virtual expositions of important artefacts from the Bulgarian folklore



(Virtual gallery/museum/).

With this the digitalisation of the collection and fund treasure of IF of BAS and its future virtual presentation in the European and world cultural space will begin.

The creation of a digital folklore archive will guarantee protection of the folklore materials, which are in danger from damage and destroying, as well as safety and permanence of the information and the access to it by wide scientific and cultural spheres.

Basic investigation tasks in this direction: research and development of methods and technologies for digitalisation of the archive materials and auspicious preserving of multimedia documents in a digital archive; methods and tools connected with the semantics and metadata of the contents; methods and tools for security of the multimedia data in the archive with virtual expositions, as well as for their optimisation and processing.

The project will examine and apply the most appropriate technologies, based on knowledge for creation of digital resources and tools and methods for virtual presentation of important artefacts as well as with the conditions and necessities of IF of BAS, as the corresponding methods and tools for multimedia data protection for security and optimisation will be developed.

The project plans are to systematize and make a catalogue of authentic folklore materials with an aim to create an archive of digital objects, a chosen collection of published or unpublished folklore objects (text, audio, video, photo); see fig.3. The basic unit is digital object. Special features of the presented artefacts as well as processes of digitalisation of different types of artefacts will be taken into consideration.

Protection and security of the multimedia data in the archive with virtual expositions will be guaranteed by applying some popular and new methods and techniques, as methods using codes, correcting errors, functional dependences, stenography methods for preservation of the data with water-mark over some standard formats of the text documents, images, audio and video. Some methods and tools for optimisation of preservation, processing and usage of the multimedia objects in the archive will be investigated

and developed.

The chosen methodology and research techniques are based on the usage of knowledge-based information technologies (digital library technologies, Semantic Web approach, technologies for virtualisation of multimedia collections and objects) for digitalisation, access provisioning and preservation of cultural and historical heritage.

Valuable phenomena of the Bulgarian folklore collection and fund heritage will be presented in suitable virtual form (information portal) using the tools of Knowledge-based technologies - Digital libraries and Semantic Web. This presentation of the multimedia collections will be orientated to significant social applications for the purposes of Interactive distance learning/self-learning, research activities in the field of Bulgarian traditional culture and for the cultural and ethno-tourism in Bulgaria.

As a basis we take the hypothesis that when Bulgarian folklore heritage is digitalized and presented virtually, there is a need of contemporary information technologies, which allow complex multimedia presentation and description, as well as broad and flexible access method. We believe that the Digital libraries and Semantic Web technologies meet these requirements. The approach for building the module is formed as a result of the research experience of the team and its know-how in multimedia applications, gained in numerous European Information Society projects. It includes analytical research, choice and usage of suitable methods, tools and environments for digital representation and preservation of significant cultural and historical artefacts and their exposure into the global information space. This approach allows integration of the idea of traditional Bulgarian culture and folklore into the European cultural space, while completely preserving its identity and diversity.

The goal of the research in the framework of the forth module is to structure and present Bulgarian folklore heritage in social-orientated applications in the spheres of education, scientific researches and cultural tourism, using web-based technologies. For the use of this goal the following problems will be solved: investigation and development of methods for structuring the folk-

lore heritage as a course material; examination and formulation of general and specific requirements to the preparation and presentation of the folklore material according to the concrete social sphere; development of methods and scenarios for informal teaching of people from different target groups; development of methods for creation of applications for the needs of scientific researches and cultural tourism; analysis and assessment of the offered techniques and approaches.

**4. Methodology, research techniques, data processing, analysis**

The specific structure of the folklore heritage /irregular, strongly branched and with necessity of manual operating for its filling with content/ defines the usage of different methods and technologies and will be used not only for preserving and access to the information, but also as a tool for scientific analysis.

The folkloristic analytic development of the content of the digital archive “Bulgarian Folklore Heritage” is based on examination of the state of the folklore funds and collections of the NCPBF of the Institute for folklore - BAS with the aim the representative models as well as the necessity of preservation of the archive units that are in great danger to be defined.

Semantic and structural analysis of the available fund allows the types of collections, which contain different objects and opportunities for their virtual presenting, to be collected and processed. The results received from the analysis are determination of the basic parameters connected with the digitalisation, for preparation for the next steps: defining indicators of the multimedia content, expansion of the standards for coding of the content, specific ontology for indicators, etc.

Complementary sources of information are used; they include: catalogues, descriptions, electronic magazine. Completeness of information is provided by searching and involving bibliography for different scientific and popular exploration and materials (books, symposiums, articles).

There are used methods and techniques for:

- Digitalisation, standards, requirements and semantic technologies;
- Security and confidentiality of the multimedia data;
- Methods, using functional dependences, correcting errors (see fig. 2), [bog2005], [kat2002];
- Steganography methods for data protection with watermark over some standard formats of text, images, audio and video (see fig. 3), [cox1997], [tod2004];
- Methods using codes, correcting errors;
- Methods for data analysis [bar2000], [geo2005], [bog2006];
- Technologies of the digital libraries;
- Semantic Web approach;
- Technologies for visualization of multimedia collections and objects.

The use of Digital libraries as a Knowledge technology is possibly a more suitable tool for multimedia description and virtual presentation of cultural historical artefacts and in particular for the means of Bulgarian folklore heritage [pav2005b] [pan2005].

An informal definition of a digital library is a managed collection of information, with associated services, where the information is stored in digital formats and accessible over a network. Digital libraries contain diverse collections of hypertext-organized information for use by many different users. Digital libraries can provide materials in specific formats such as text, sound, video, animation, as well as video clips with subtitles for the people with disabilities or for the needs of a specific training [pav2005a] [pav2005b] [pen2005].

The complex characteristics of the multimedia objects just presented, along with the provisioning of broad and flexible access to them implies the development and integration of suitable methods and systems for semantics organization of the information. For that purpose, methods and resources of another technology based on knowledge will be used – the Semantic Web approach.

Despite its enormous growth during the last decade, the global net remains generally a media for accessing resources of information by people. The Semantic Web approach extends this usage by introducing semantically annotated

data. In its core are the ontologies, which allow for semantical presenting of the data in a machine-readable manner.

Practical realization of ontologies is achieved by using different computer languages and language infrastructures – XML, XML Schema, RDF, RDF Schema, OIL+DAML, OWL, etc. These languages have very much in common, but OWL is considered to be a better technology for ontologies. OWL can be used for building different types of ontologies.

The analytic researches, selection and use of appropriate methods, tools and environments for digital presentation and preservation of important cultural and historical artefacts are orientated towards their exhibition in the global information space by creation of information portal of the important phenomena of the Bulgarian folklore collection and fund heritage and with opportunities for wide social applications of the multimedia collections for the needs of the interactive distance learning, scientific researches in the field of Bulgarian traditional culture and for the development of ethno-tourism. This approach allows integration of the idea of the traditional Bulgarian culture and folklore into the European cultural space, fully preserving its identity and variety.

### 5. Research activities

The duration of the project is three years; it includes 3 stages with the following main research activities:

#### First stage

- Investigation of modern technologies for organization and digitalisation of the folklore archives:

- Research and analytical development of the content of the digital archive “ Bulgarian folklore heritage”;

- Deep examination of the state of the funds and collections in NCPBF of IF with the aim to define some representative models, as well as to determine the necessity of preservation of the archive units that are mostly in damage;

- Annotation of the objects of the digital archive;

- Selection and Processing of different types of collections according to the opportunities for

their virtual presentation;

- Definition of the requirements to the process of digitalisation and standards, according to the heterogeneous structure of the archive;

- Development of semantic-orientated presentation and metadata of the artefacts from the selected collections and their subject areas;

- Extension of the standards for coding of the content as well as summing up;

- Presentation of the semantic structure and special features of the chosen subject areas;

- Analysis and selection of the tools and language for creation of ontology for the chosen subject areas;

- Constructing a basic ontology, which corresponds to the discussed subject areas and their characteristics;

- Semantic marking of the objects from the investigated subject areas by the created ontology;

- Experiments with semantically marked objects from the subject area;

- Investigation of the architecture and the functional special features of modern digital libraries with multimedia content;

- Analysis and selection of tools and standards for creation of digital libraries with multimedia content and their repositories;

- Analysis and selection of methods and tools for presentation of metadata, semantic organization of the data and semantic data marking, according to the defined ontology in the digital libraries;

- Analysis of the needs of using the folklore heritage in the social sphere;

- Definition of the target groups from the field of education;

- Defining the target groups from the field of science and scientific researches;

- Determination of the target groups from the sphere of cultural tourism;

- Investigation of special features of the target groups as users of the information content;

- Interviewing the target groups for determination of the needs and requirements to socially-orientated applications.

#### Second stage

- Digitalization of the selected models;

- Analysis of the objects in order to define the metadata of the artefacts from the selected collections and their subject areas;
- Investigation of modern technologies and methods for protection of intellectual property and author's rights under the digital content with application in the developed digital expositions;
- Investigation of methods and tools for protection and confidentiality of the multimedia data in archive with virtual expositions;
- Organization of work seminars for discussion and demonstration of the developed software;
- Development of software tools for functional realization of digital libraries with multimedia collections of objects from the discussed subject area;
- Experimentation with the functional opportunities and services of the created digital libraries with multimedia content from the digital archive "Bulgarian folklore heritage" and recommendations for their perfection in order to be integrated into the information portal;
- Creation of an information portal with important phenomena of the Bulgarian folklore collection and fund heritage with opportunities for wide social applications for the needs of the interactive distance learning, scientific researches and ethno-tourism;
- Testing and support of the content of the created information portal and services presented there for development of applications in education, scientific researches and cultural tourism;
- Analysis of the folklore content from the view point of its usage in the informal learning;
- Structuring of the folklore components into virtual expositions;
- Analysis and classification of the objects for cultural tourism;
- Structuring of the course material: course units, lectures, modules;
- Investigation of the problems for synchronization of multimedia flows for concrete applications;
- Analysis and formulation of the requirements for creation of virtual expositions.

Third stage

- Creation of methods and tools for protec-

tion and confidentiality of the multimedia data in the archive with virtual expositions;

- Expansion of the digital archive and enhancement of the quality of the content presenting as well as its effective usage for the needs of scientific research and social applications. Achieving higher compactness and complexity of the information content of the Bulgarian folklore heritage archive fund;
- Testing and support of the archive;
- Examination of methods for compressing and archiving of the multimedia objects in the archives;
- Development of scenarios for informal learning and virtual expositions on the basis of the created Information portal;
- Analysis of the requirements and formulation of the special features towards the development of Web-based social-orientated applications in the fields of education, scientific researches; cultural tourism;
- Analysis of the existing software technologies for Web-based applications and requirements for a platform;
- Analysis and assessment of the created applications;
- Organization of work seminars for discussion and demonstration of the developed software.

## 6. Expected results of the research

The development is of national importance and there is a great necessity of its realization. As a result it will be realized on a new stage of digitalisation process of the collection and fund treasure of the Institute for Folklore of BAS as well as preservation and presentation in digital form of the artefacts that are in danger of damage and disappearance. Methods and tools for protection and security of the multimedia data in the archive with virtual exposition and other sources will be developed.

The digital archive and the developed software methods and tools for preservation and optimisation of its objects are a base for development of digital libraries with a complex heterogeneous multimedia content and virtual galleries with expositions of important artefacts of the Bulgarian folklore.

It can be used in other Bulgarian collections and galleries with application in Bulgarian cultural and historical heritage and will be a basis for future virtual presenting in the European and world cultural space.

Expected results:

- Classification and specification of the multimedia objects;
- Defining requirements and standards, connected with digitalisation of the folklore objects;
- Generating and structuring of virtual archive's multimedia content;
- Creation of coding parameters, according to the semantically orientated presentation of the artefacts – a basis for defining indicators of the multimedia content;
- Dictionaries: frequency, chronological, etc.
- Algorithms for data protection, which apply codes, correcting errors;
- Methods using error-correcting functional dependencies in the data;
- Steganography methods for data protection;
- Semantically orientated presentations of selected subject areas of Bulgarian folklore heritage with the approach and tools of the technology of the semantic Web with opportunities for later expansion;
- Multimedia presentation, meta data and semantic annotation of the objects from the digital archive "Bulgarian folklore heritage";
- Development of appropriate architectures and realization of digital libraries, which contain multimedia digital objects, annotated according to the created ontology;
- Development of an information portal, which will present important phenomena of the Bulgarian folklore collection and fund heritage and offer wide social applications of the multimedia collections for the aims of the interactive distance learning, scientific researches in the fields of Bulgarian traditional culture and ethno-tourism;
- Created scenarios for e-expositions and informal learning;
- Loaded online socially-orientated applications of the Information portal with virtual expositions "Bulgarian Folklore heritage" in the

fields of education, scientific researches and cultural tourism;

- Participation with scientific reports in national and international conferences, seminars and symposiums;
- Scientific publications in national and international magazines;
- Work seminars for discussion and demonstration of the developments;
- Development of a dissertation work and acquiring a scientific degree by the members of the research team.

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<http://www.sabor-koprivshtica.mct.government.bg>

20. Program Unesco -

<http://www.treasures.eubcc.bg/>

21. The Site for American Folklore -

<http://www.americanfolklore.net/>

22. Traditional and folksong archive -

<http://frogmanmusic.com/tradsongs/country.htm>

23. WebFolk.BG -

<http://musicart.imbm.bas.bg/en/about.htm>



Fig. 1 Photo-object from archival fund with folklore materials of the Folklore Institute of BAS.

	songlink:011	songlink:012	songlink:013	songlink:041	textlink:011	textlink:012	textlink:021	textlink:051
User0001	1	7	6	2	0	3	3	1
User0002	2	4	5	3	1	3	3	1
User0003	1	5	6	1	7	3	1	2
User0004	2	4	5	3	6	3	3	1
User0005	2	4	5	2	5	3	0	1
User0006	2	4	5	2	2	4	3	1
User0007	2	4	5	3	3	3	3	1
User0008	2	4	5	2	4	3	3	1
User0009	1	7	1	4	0	6	2	1
User0010	1	7	1	4	1	6	2	1
User0011	2	6	1	5	2	6	2	1
User0012	1	7	0	4	3	7	2	1
User0013	1	7	1	4	4	6	3	1
User0014	1	7	2	5	5	6	2	1
User0015	2	7	1	4	6	6	2	2
User0016	1	7	1	4	7	6	2	1
User0017	1	7	6	2	0	3	3	1
User0018	2	4	5	3	1	3	3	1
User0019	1	5	6	1	7	3	1	2
User0020	2	4	5	3	6	3	3	1
User0021	2	4	5	2	5	3	0	1
User0022	2	4	5	2	2	4	3	1

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Execution time: 00:00:01

Fig. 2. A realization of the algorithm for finding the error-correcting functional dependencies and some results. It is applied to the data obtained from a WEB based client/server system that contains an archival fund with folklore materials of the Folklore Institute of BAS.

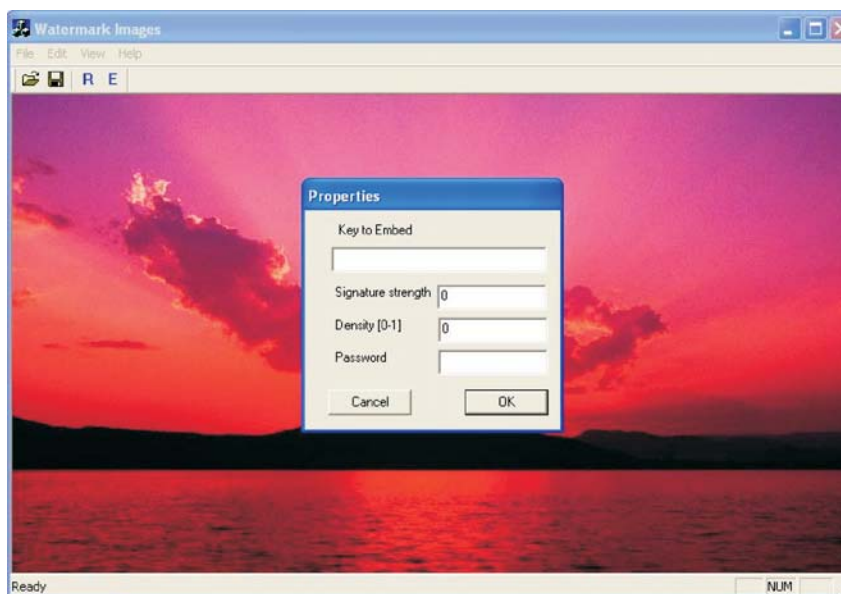


Fig. 3. A realization of the algorithm for data protection with watermark.

## THE *PROMIRA* PROJECT INFORMATION SYSTEM: IMPROVED SEISMIC MONITORING – IMPROVED DECISION MAKING RELATED TO THE LONG-TERM SAFE EXPLOITATION OF THE SALT DEPOSIT IN THE REGION

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### ABSTRACT

This article provides brief information on the *PROMIRA* monitoring project funded by the National Science Fund of the Ministry of Education and Science in Bulgaria as part of the competition Information Society, which has been just started in NE Bulgaria, Provadia region.

Within the framework of the project on the basis of real-time seismic (weak and strong ground motion) and geodetic monitoring an information system will be developed. Some general considerations on the importance of real-time seismic and geodetic monitoring, its role in the decision making as risk and uncertainties reduction, risk management and early warning system, are discussed. An overview of the information system that will be developed in *PROMIRA* is performed.

### INTRODUCTION

Sustainable development of the society depends not only on a reasonable policy of economic growth but also on improved management of natural and man-made risks. The earthquake hazard is the natural hazard that impacts Bulgaria in the strongest way and may severely affect the economic growth of the country or of a particular region. Therefore the assessment and mitigation of the earthquake hazard are of primary importance for the risk mitigation and management activities in Bulgaria.

Worldwide the problem of induced seismicity is very difficult for management and handling, i.e. earthquakes caused by mining, exploration and extraction of mineral resources. These activities can increase possibilities for generating of earthquakes and create negative public opinion, particularly in the region in the vicinity of mines or exploration areas. People and property in these regions are affected mostly by the damages of the induced earthquakes. General tendencies observed in these regions are increase of the property insurance rate, avoiding of investments in construction and even depopulation. The situation in the regions prone both to induced and tectonic seismic activity is even more complicated. Some investigations point that in conditions of compressional tectonics the extraction of fluids (oil and gas) from the Earth's crust can trigger big tectonic earthquakes. Therefore it is very important to have accurate and timely information from independent sources about the seismicity and tectonic processes in the region prone to tectonic and induced seismicity both for the broad public and industry as well as for the regional and Civil Defence authorities.

The Mirovo salt deposit near the town of Provadia is the only terrestrial salt deposit in Bulgaria. The exploitation of the salt dome started in 1956 using leaching method that is extracting of saline brine, using telescopic borehole system to the surface. There are 43 underground cham-



bers with diameter varying in-between 100-140m and height in the range 50-200m. The roof of the chambers is controlled by floating oil layer.

The Provadia region is located in seismically quiet part of the country – since the beginning of the last century no strong or moderate seismicity have been reported till 1980, there are also no historical evidences of strong earthquakes. Since 1980 several moderate earthquakes with magnitude 4.0 to 4.5 were generated in this region and caused damages to the neighboring villages. Therefore in order to monitor the seismicity, subsidence and strong ground motion in the region a local seismological network, geodetic network and strong ground motion network were designed in 1993 and deployed some years later.

The *PROMIRA* project aims to develop an information system based on modern communication services that enables real-time monitoring of the seismicity, geodetic data and adding of technological parameters of exploitation of the resources related to the physical properties of the Earth's crust. The real-time acquisition and processing of data, their near real time analysis and publishing in Internet will be based on WEB technologies for digital content. Adding the technological information will enable development of self-learning system for prevention of induced stronger seismic events and mitigation of the earthquakes damage. Spreading this knowledge acquired in the *PROMIRA* to public and industry will be realized using user-friendly interface.

This task requires integrated efforts of scientists from different branches of Geosciences, and can be solved only in good cooperation of science and industry.

The development of these information technologies aims to support the public and industry in the Provadia region and implement the knowledge gained during the project will support the secure and sustainable development of Provadia region. Improving of seismic and geodetic monitoring and adequate reliable modelling of the salt deposit behaviour during a particular earthquake are the main objectives of the *PROMIRA* Project.

The real-time seismic and geodetic monitoring holds the key to understanding of both

the seismic hazard and the response of the built environment, so that proper preparations can be made for the future. Each earthquake provides a unique opportunity to learn. Improved monitoring of future earthquakes will lead to a more complete understanding of geophysical processes, more effective hazard mitigation strategies, and improved emergency response and recovery.

### **EXISTING MONITORING SYSTEMS**

Seismic monitoring encompasses the routine recording, analysis, and archiving of wave forms for a region. Near real-time information which aims to provide source location and magnitude information minutes to hours after an earthquake is especially valuable as a tool for emergency managers. Such information can be used to improve rapid estimates of the location and extent of damage. Later updates can provide more detailed information about the mainshock and any aftershocks, including improved location information and details such as the extent and directional attributes of the faulting.

Since 1981 two local observing systems have been built in the region of the salt deposit - geodetic and strong ground motion networks, later in 1994 local seismological network Pravdia encompassing a larger tectonic region started operation.

#### *Seismic Monitoring Systems*

Real-time seismological monitoring in Bulgaria is performed by Geophysical Institute of BAS (GPhI) - National Operative Telemetric System for Seismological Information (NOTSSI). The main task of NOTSSI is to provide reliable detection and precise location of earthquakes that may cause damage or may be felt on the territory of Bulgaria. From 1980 to 2005 this was an analogue system with one component short period seismometers and real-time transmission of signal from 14 permanent stations in the country and two local networks Provadia (4 stations) and Kozloduj (3 stations).

In December 2005 within the framework of the project "Modernization of NOTSSI" funded by the Permanent Commission for Prevention of the Population from Natural Disasters, Technological Accidents and Catastrophes

(PCPNDTAC) the upgrading of seismological monitoring system in Bulgaria was done. Now all 14 stations of the National Seismological Network (NSN) are equipped 3 component sensors (11 broad-band and 3 short period). The real-time data acquisition at the NOTSSI field stations is performed by ten 3-channel and one 6-channel RefTek 130-01, two Quanterra 330 and one Quanterra 380 data acquisition systems (DAS) (Solakov et al, 2006). Real-time data transmission from field stations to the National Seismological Data Centre (NSDC) located in Sofia is accomplished via VPN provided by Bulgarian Telecommunication Company. Real-time data acquisition is performed using REFTEK's full duplex error-correction protocol RTPD. The data from the Quanterra recorders are fed into RTPD in real time via SeisComp/SeedLink protocol. This design provides very reliable digital data transmission. Fig. 1 presents the configuration of the data acquisition, processing and analyses networks at the National Seismological Data Center.

Two clustered SUN servers with swappable software module, which re-directs the real-time

data flow in case of either server failure, perform the real-time acquisition and data processing hardware redundancy at the National Seismological Data Centre. Network control and monitoring are performed by RTCC and RTPMonitor user interfaces which are running on two SUN Blade 1500 Workstations. Both RTCC and RTPMonitor serve up html pages that can be displayed in any standard web browser allowing the end-user to monitor the network status and control the acquisition parameters at any time and anywhere from any computer connected to the Internet.

*Upgrading of the local seismological network in Provadia*

Provadia seismological station is established in 1990 as a part of NSN and now is equipped with broad-band sensor KS2000 (Solakov et al. 2006) with frequency range 120 sec – 50 Hz, gain 2000 and 3-channel Reftek 130-01. However one very well equipped station is not sufficient to enhance significantly the accuracy of the locations of the local low-magnitude seismicity. Therefore it was necessary to

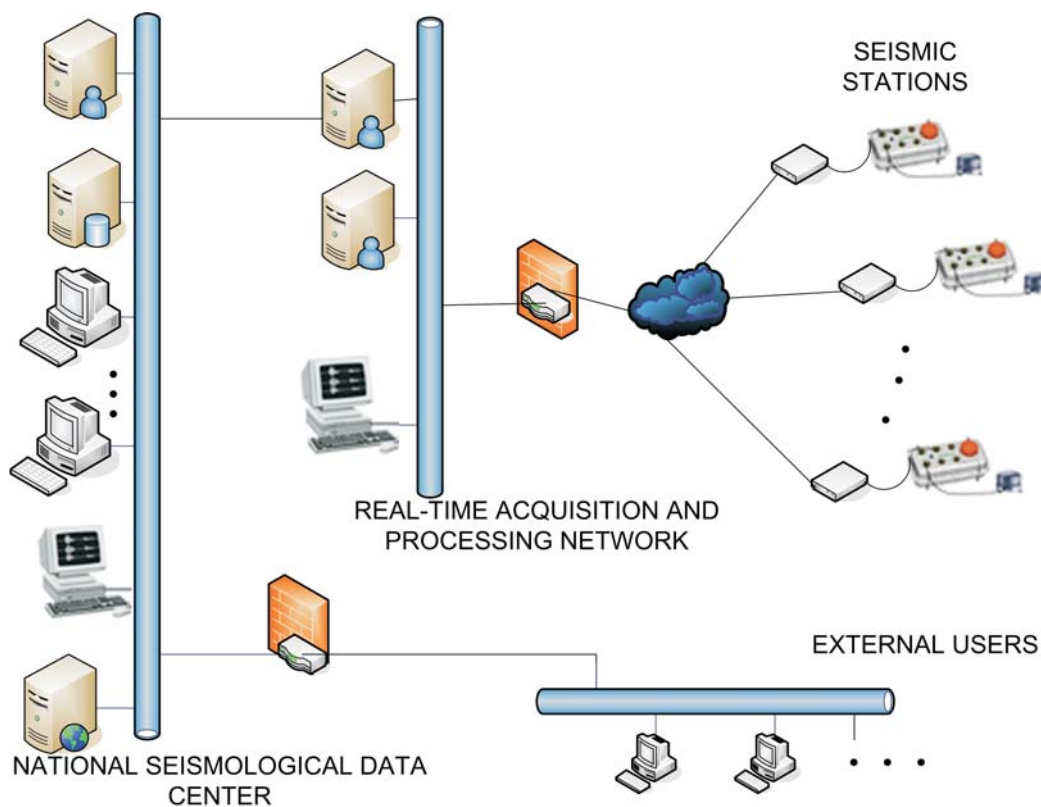


Fig.1. Real-time acquisition, processing and archiving network design at the National Seismological Data Center.

upgrade the LSN in Provadia consisting of 4 stations, located at distances from 5 to 35 km from Provadia.

To improve the monitoring in Provadia region we joined resources of several projects funded by the National Science Fund at the Ministry of Education and Science - "Environmental Monitoring Implement for Risk Assessment of Natural and Man-made Hazard (EMIRA)", "Stand-Alone Portable Digital Seismic Stations for Long-Term Field Deployment", current PROMIRA project and by PCPNDTAC - project "Modernization of NOTSSI" and made the upgrading of the stations of the LSN Provadia. To increase considerably monitoring possibilities of the LSN 3-channel DAS RefTek 130-01, 3-component seismometers were deployed and digital data transfer was established.

The main issue to solve was the transmission of the data from the local stations to Provadia station that is an entry point of the VPN of the National Seismological Network and existing communication resources (64Kbps) permit developing of a computer subnet. We studied the available solutions for radio transfer of digital signals and chose one that operates on the non-licensed frequency range of 2.4 GHz. The seismometers to be deployed should well record the expected high frequencies of the local seismic events; this range is well covered by the cost effective geophones, often used worldwide for temporary deployments in field studies of seismicity.

The deployment of the radio network, DASes, and 3-component geophones was done in September 2006. The current radio network topology is point-to-multipoint and permits all necessary changes regarding data transfer rates, channel selection, radio spectra monitoring to be done remotely from the data center in Sofia. Currently the data acquired at stations of the LSN Provadia are collected in the collecting station Provadia and are transferred via VPN to NSDC. Several low-magnitude local events were

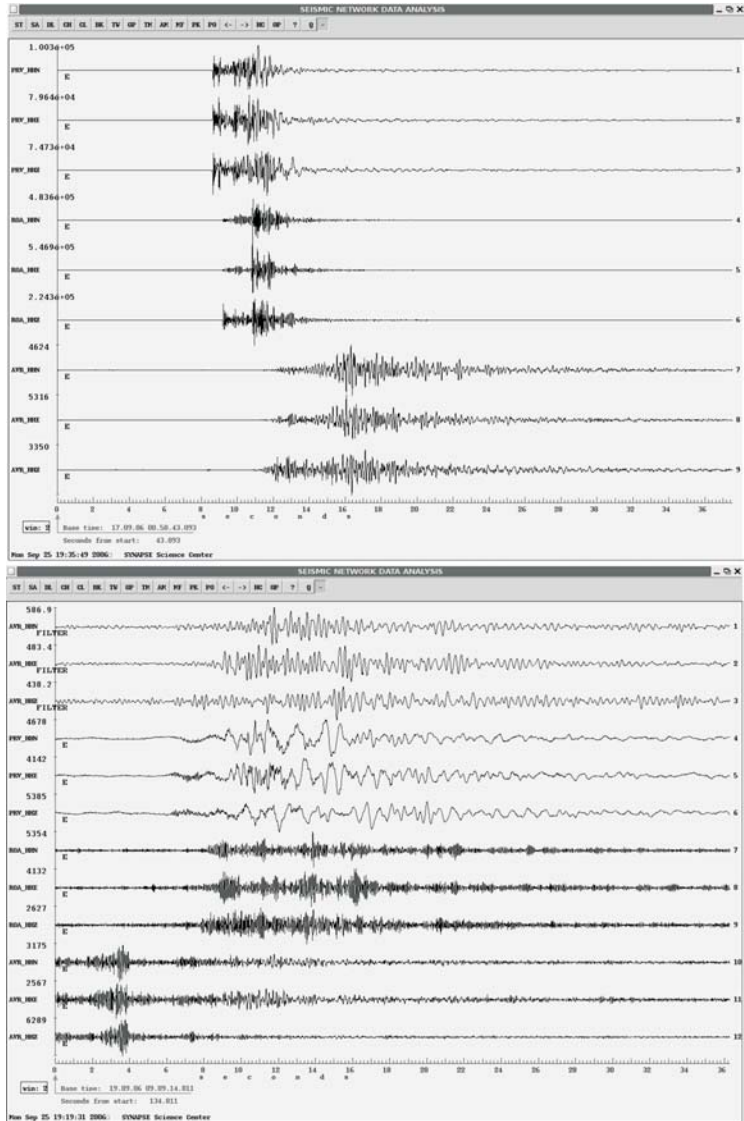


Fig. 2. Records of a local earthquake (17.09.2006, GMT 00:50) and blast in Devnia region (19.09.2006 GMT 09:09). Note different pattern of the waveforms, typical energy release in surface wave for near-surface multiple explosion.

recorded at stations of LSN and Provadia since 15.09.2006 when all stations started operation (fig. 2). These records prove the advantages of the newly deployed system; show the possibilities to discriminate blasts from local earthquakes, to perform modern methods for analyses of three-component records. The accumulation of the data will enable by the analyses of the waveforms to discriminate the typical earthquakes related to the technological processes in the salt dome and those of tectonic origin.

*Strong-ground motion network in Provadia region.*

Since 1981 CLSMEE operates a strong

ground motion network with five SMA-1 instruments (analogue registration stations equipped by accelerometers SMA-1) with maximum ranges 0.5g and 1g, sensitivity  $\pm 0,0050g$  and damping of about 60%. Later, in 1993, it was extended by a digital RefTek instrument - the RefTek station was installed and calibrated by the GTU IngenieurBuro Knoll specialists. About 81 events within epicentral distance up to 27 km occurred in the last 20 years [1, 2, 3]. More than 200 strong ground motion components registered by the SMA-1 instruments were processed. All the records have been "saturated" with high frequency vibrations. According to the response spectra for the accelerations and 5 % damping the maximum periods have been in the range 0.085-0.2 sec for the vertical and 0.1-0.57 sec for the horizontal components. Another feature of these events is their short duration (0.12-2.97 sec), most of these earthquakes act as impact excitations. The peak ground accelerations are quite large - in some records they overcome 0.5g. An epicentral map of the registered seismic events around the salt deposit is shown in fig.2a. The dynamic effect of single events obtained from the response spectra with 5% damping varies from 1.2 to 6.0 for the horizontal components and reaches up to 7.0 for the vertical components. The ratio between the peak accelerations, vertical and horizontal, is 0.17-2.26, which shows the predominant influence of the vertical component and confirms the local origin of the earthquakes. The duration of the intense part of the accelerograms is about 3 sec. Such short duration means that these events act as single short-time impulse load on the chamber-pillar system. The peak vertical accelerations have been often higher than the horizontal (50 % of the registrations), therefore there is a possibility for pillar failure due to vertical cracks occurrence. All the available records can be efficiently used for the vulnerability analysis of the structures in the region of Provadia, for pillar design and reestimations of their bearing capacity and for eventual forecast of the behaviour of the rail road crossing the region. Some other characteristics of the seismicity the Beniof graph, recurrence rates for the site for different time periods and some relation between the released

seismic energy and the extracted salt quantities, considered period - up to 1995 are shown in figures 2b and 2c respectively [1, 2].

#### *Geodetic Monitoring Systems*

Since 1992, CLG has pioneered the application of the Global Positioning System (GPS) for monitoring of crustal deformations in Bulgaria. The Laboratory undertakes theoretical and applied research in the establishment and maintenance of the national geodetic network. All the researchers participating in this project are actively involved in the development of a national database for geodetic information.

The monitoring of the Earth's crust deformations and the motion of tectonic structures on a regional and local scale is established mainly by geodetic methods. The application of modern geodetic technologies as the GPS allows determination of the crustal deformations with very high accuracy and precision - of the order of few mm per year.

The assessment of the recent crust movements is obtained from periodic geodetic measurements. They describe the total effect from rapid and slow horizontal and vertical movements. This requires determination of the coordinates of the network points with millimeter accuracy. The achievement of such accuracy is possible only by the application of modern satellite geodetic technologies as the GPS. The GPS receivers are easy for transportation and maintenance, the observations do not depend on meteorological conditions and direct visibility between the points of the network is not necessary. The data from the performed permanent measurements may be transferred to a control station, where they may be processed almost in near-real time. The obtained evaluations of the recent deformations of the crust will be the basis of the geodynamic and risk processes analysis in the region of the salt deposit.

The Mirovo salt deposit is situated in a region, which is characterized by small block structures, separated by a significant number of faults with different hierarchical and spatial parameters. It is considered that this complex mosaic had been formed as a result of impulse rising of salt mass towards the respective central horst

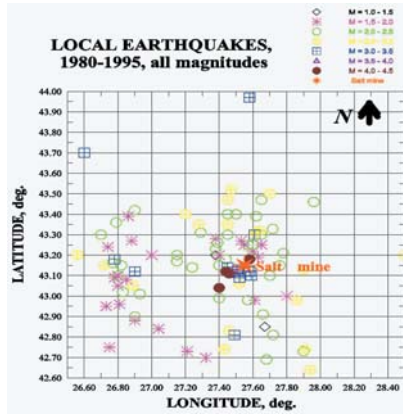


Fig. 3a. Epicentral map of the earthquakes registered by the local strong ground motion network, 1983-1995, magnitudes  $M \leq 4.5$

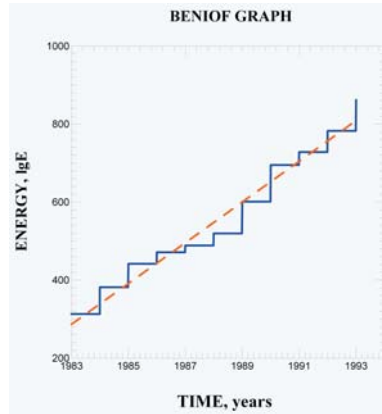


Fig. 3b. Beniof graph of the released seismic energy at the site for the period 1982-1995

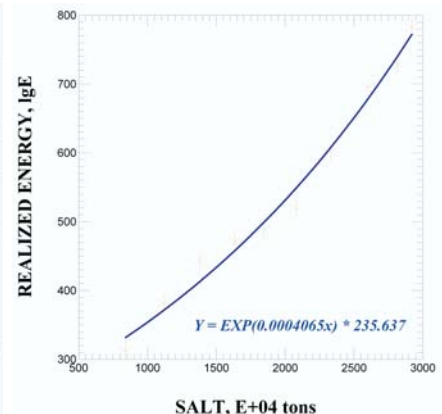


Fig. 3c. Dependence between the released seismic energy and the extracted salt quantities, considered period - up to 1995.

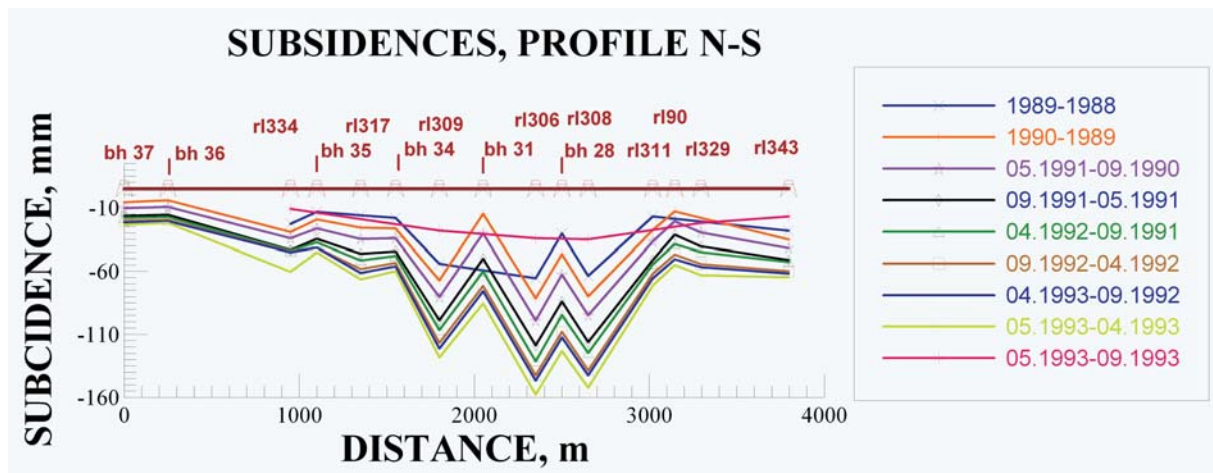


Fig. 4. Surface subsidences along a profile oriented NS, registered by the local geodetical network, 1989-1994.

structures. The recent geodynamic setting is determined by the activity of the faults from the so-called Provalia bundle, along which the last impulse of the salt body incorporation had been also accomplished. The tectonic equilibrium in the region has been disturbed due to the continuous exploitation of the salt body and numerous seismic events have been recorded.

During the period 1981-1991 extensive geodetic measurements have been carried out to monitor the vertical movements. They show that there are movements along some faults in the salt deposit region. The central part of the deposit goes down and the velocity decreases going far from the center. This means that the movements along the faults limiting the deposit continue. The geodetic observations have been processed on large and close net. A constant

subsidence with average velocity 3 - 4.5 cm per year and horizontal block movements have been observed in this region for the recent few years. The largest subsidence is observed in the central part where the top of the salt body is located. The second area of large subsidence seems to correlate with an area of intense mining activities, figure 3. On the X-axes the number of the caverns is shown. On the Y-axes the largest subsidence observed in the period 1988-1993 is shown [1, 2].

#### USES OF REAL-TIME SEISMIC AND GEODETIC MONITORING

The transition path from data outputs produced by seismic monitoring instruments to information for decision-makers (e.g. emergency managers, earthquake engineers) requires analy-

sis steps that differ depending on the type of seismic monitoring data and the area of decision. The different pathways are summarized in Figure 1 [3]. Seismic monitoring networks provide the basis for hazard analysis and quantification, and the density of network coverage and instrument type determine how much will be learned from each damaging earthquake. Recent earthquakes have shown that the existing seismic monitoring networks in the region were too sparse to provide essential information required to understand what happened during these earthquakes—the location and nature of ground motion—and in particular what can be done to improve future exploration and reduce vulnerability of the chamber pillar system, which has been formed in the salt diapir. The challenge of the tasks in PROMIRA project provides a solution that meets requirements both of the general public and industry.

*Uses of seismic monitoring for industry.*

Another important aspect of seismic monitoring is the study of microearthquakes, i.e. earthquakes with magnitudes below 1.0 that are often used to study petroleum and geothermal reservoirs and the region surrounding mining. They provide important information about the processes undergoing in the surrounding regions around the reservoirs, i.e. fracturing distribution and hydromechanical processes during the operation (Fehler et. al, 2001). Some of this information may be acquired by well logs, but they provide only direct information only about conditions near the well. Microseismic monitoring techniques can be a primary method for obtaining detailed information about the reservoirs and fracture system at distances of 1km from the reservoir. Acquiring information on microearthquakes will enable solving of the following tasks: detailed localization of microearthquakes, determination of the velocity structure around the reservoir, following of the fracturing process and fluid penetration. Developing of an enough dense network for microearthquake monitoring within the exploration field in Provadia may solve important problems related to safe exploitation of the borehole system – fracturing processes in the salt dome,

penetration of fluids, reservoir monitoring. Promira project may foster such monitoring, but the declared interest of the industry in it is decisive. Microearthquake monitoring is probably the most cost-effective way of observation of reservoirs. A field deployment of several DASes and geophones that will enable microearthquake monitoring to be made during the next year of the project and perspectives for using of microearthquakes in monitoring in control of the technological processes in saline brine extracting will be evaluated.

*Monitoring the deformations of the Earth's crust using geodetic methods.*

The construction of a local permanent (or quasi-permanent) GPS network will provide continuous monitoring of the recent crustal motion, which in turn will create the necessary background for understanding the mechanism and forces driving these motions. The basic idea of the GPS monitoring of the salt deposit is to establish a permanent network for monitoring the crustal deformations in near-real time and in particular – the assess risk during the exploitation of the Mirovo salt deposit using the GPS technology. This includes following main activities:

- establishment of the recent deformations of the crust in the region of the deposit using the Global Positioning System (GPS);
- design and construction of a local GPS network of 3-4 points. The location of the points in the network will be determined after geomorphological and geostructural analysis;
- ensuring and carrying out of permanent (or quasi-permanent) GPS measurements of the local geodetic network;
- analysis of the GPS observations and determination of the Earth's crust deformations in near-real time;
- obtaining the active stresses in the region on the basis of the velocities of the recent movements;
- combined analysis of the geological, seismotectonic and geodetic data and assessment of the potential seismic hazard in the region. Processing of the GPS measurements carried out for the points will be made using appropriate specialized software available in CLG-BAS.

Construction of a local research network for long-term monitoring of recent deformations of the crust in the region of the Mirovo salt deposit and continuous geodetic monitoring will provide:

- Assessment of recent deformations from the permanent (quasi-permanent) GPS measurements in near-real time;
- Obtaining the active stresses in the region from the established movements. Establishing a correlation between contemporary movements, seismic events and tectonic structures;
- Complex analysis of geodetic, geological and seismotectonic information for the territory of the salt deposit.

The expected results will represent a contribution to the assessment of the degree of seismic risk in the studied region and will possess expressed ecological and social effect. It will enable developing of a concept of complex seismic-mechanical analysis of critical deformations, stresses and processes.

Full access of the project members, industry and local authorities and general public to the data acquired, to the results of assessment of seismic hazard and risk mitigation from earthquakes will be general rule in our work. An access to the technological data set will be provided to the project participants and industry members. This is the first project that aims at integration of real-time seismological, geodetic and technological data in Bulgaria. Strengthening the cohesion between science and industry will provide estimates for safer exploitation of mineral deposits.

Working in collaboration with the broader earthquake engineering community, it is expected to use advanced equipment and simulation capabilities to test and validate complex and comprehensive analytical and computer numerical models. The success of multi-institutional efforts depends on the data recorded by high-quality networks. Strong motion recordings in the free field (away from structures) provide realistic input for engineering simulations and studies of

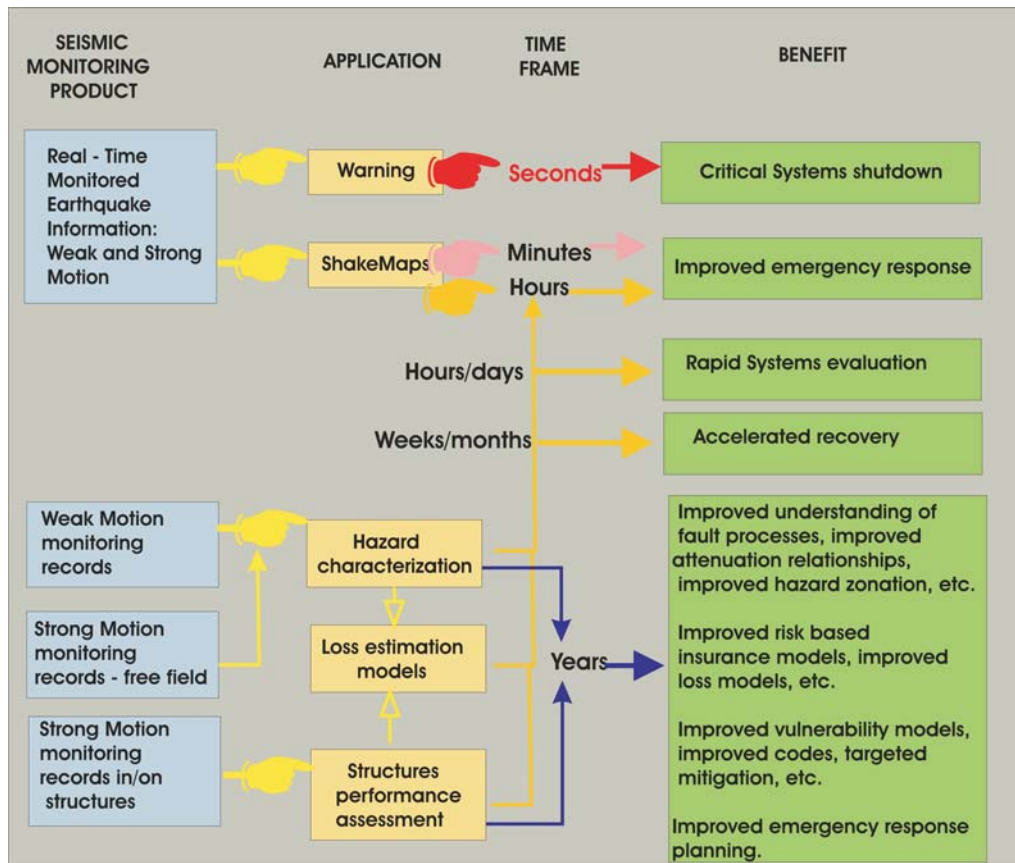


Fig. 5. A general flowchart summarizing the information path from seismic monitoring data outputs, through a range of applications, to ultimately provide the broad range of benefits.

structural response of the salt diaper, the built environment, infrastructures and other facilities. Strong motion recordings made inside buildings in the region and in different critical infrastructure provide information about structural response and damage. These data can be compared with the design parameters to evaluate possible damage states immediately after an earthquake and prioritize inspection and repair activities. In the longer term, these data are essential for developing new generations of earthquake-resistant technological or building systems.

**THE ROLE OF THE SEISMIC MONITORING IN DECISION-MAKING**

There are three key components of decision-making that use seismic monitoring: (1) *Risk assessment* - the role of monitoring in reducing risk and uncertainty; (2) *Risk perception and choice* - how individuals, groups, and organizations process information from seismic monitoring data and how this information influences their choices and (3) *Risk management* - the role of seismic monitoring as a contributor to strategies for dealing with earthquake hazards. An assessment of the contribution of seismic monitoring to disaster mitigation and management must be based on the integration of these three components.

*Risk Assessment: The Role of Monitoring in Defining Risk and Reducing Uncertainties*

Quantitative estimates of seismic risk are important for judging whether earthquakes represent a substantial threat at any location; they enable objective weighting of earthquake risk relative to other natural hazards and other priorities for making design and retrofit decisions (NRC, 1996). Earthquake risk assessment encompasses the range of studies required to estimate the likelihood and potential consequences of a specific set of earthquakes of different magnitudes and intensities. The essential role of seismic information is to reduce the uncertainty in risk assessment over time and thereby to increase its usefulness for emergency preparedness, loss avoidance regulation, private risk financing and insurance, and/or earthquake prediction. As improved monitoring provides increasing

amounts of information, more complete understanding of geophysical processes, more realistic models, and better-informed risk assessments will become possible. The *PROMIRA* Project will produce and provide improved information and thus it will be possible to design better safety and regulatory programs, to generate improved ShakeMaps after earthquake events, and to improve earthquake prediction capabilities.

Within the range of geological and geophysical investigations conducted under the long-term monitoring programs on the Salt Deposit, seismic monitoring has always played a key role in the definition of the earthquake hazard - the foundation on which earthquake risk assessments are based. Seismic networks provide both parametric (e.g., earthquake origin times, locations, and magnitudes) and waveform or seismogram data. These data are used as the basis both for public safety decisions and for scientific and engineering research. One component of the *PROMIRA* Project work is the development of "earthquake design ground motion libraries", where strong motion records from a number of different earthquakes processed in a consistent manner will be made available to earthquake engineers and researchers in a web-accessible format for a variety of magnitude, distance, and fault types. The collection of high-quality data at close distances is critical for validating and verifying the earthquake engineering models that are used in the vulnerability estimates of any environment. An additional component in the risk assessment process is the development of an understanding of the chamber-pillar performance or capacity. Measurements of the system response during actual earthquakes will provide empirical information on seismic performance and can also provide information for evaluating the efficacy of current mitigation engineering practices. Immediately after a significant earthquake there is a need to assess the extent and severity of damage and identify where emergency actions are needed. With the availability of ShakeMap, responders can pinpoint the areas of the strongest shaking and focus their emergency response efforts quickly. Projects designed to reduce losses from natural or other disasters, such as improved seismic monitoring, are ex-



pected to provide benefits in the form of costs avoided. This requires that for any particular area the probability distribution of possible earthquake disasters and the consequent expected financial losses must be calculated, requiring a series of difficult estimates based on geologic and earthquake engineering projections. Each projected earthquake disaster event can be expected to cause damage and associated losses, business interruption losses, and infrastructure service losses. These three interact in complex ways, making separate identification of each one very difficult.

*Decision – Makers /End-Users and Their Actions*

The decision-makers who will utilize the results of the *PROMIRA* Project seismic monitoring in developing risk management strategies include builders and engineers, property owners, insurers and reinsurers, lenders, public sector agencies, and lifeline organizations, with the potential impacts of these risk management decisions affecting the lives of people and the national economy.

The *PROMIRA* Project seismic monitoring data provide potentially derivable benefits that may be observed over multiple time frames. *First*, there are the immediate benefits after an earthquake (e.g., an informative ShakeMap can be used by emergency responders). This increment in more accurate information assists officials to deploy limited resources more rapidly and strategically to areas that have been identified as experiencing the greatest shaking. As a result, communities will experience more rapid and consequently less expensive restoration of services, resulting in reduced business interruption and cost savings. *Second*, there are near- and long-term benefits from seismic monitoring information, related to the interval of time that allows society to react to the information in a strategic manner beyond the immediacy of an emergency response. The incremental benefits in this time frame principally reflect additional loss avoidance activities, beginning with property damage and running the course of all loss categories. Such loss avoidance would result either from information gained from a single event or from the accumulation of monitoring information over

time. This accumulated knowledge can potentially result in an improved approach to the design and construction of infrastructure, implementation of appropriate mitigation of existing structures, and/or revision of building polices and regulations. The *third* category of benefits is the accretion of knowledge. Accumulation of information from improved seismic monitoring potentially leads to a more complete understanding of the spatial and temporal physical processes associated with faulting and other sources of seismic activity.

**CONCLUSION**

Our understanding of the nature of earthquake hazards-distribution, frequency, and severity of damaging ground shaking-is based on past damaging earthquakes as well as on those small earthquakes that occur throughout the region every year. Improved seismic monitoring networks will provide the basis for better characterization of this seismicity, so that the ground motion prediction models that underpin the aseismic codes and earthquake engineering design-the basis for safeguarding life and property-can more accurately reflect the complex nature of the hazard. In addition, any potential for the future prediction of damaging earthquakes will rely in part on seismic monitoring data.

The monitoring of the Mirovo salt deposit and the Provadia region is of high scientific and economic interest. The *PROMIRA* information system and the accumulated seismic and technological data will allow the scientific and engineering community to study the problems of the seismic hazard assessment and prevention in the region more effectively. By means of such observations it would be possible to correlate the generation mechanism of seismic events with the local and regional tectonics as well as with technological activities within the mine. The results of the studies carried out up to now show the possibility to calculate the stress and deformation behaviour of very complex spatial cavern systems using appropriate numerical models. Seismic investigations as well as geodetic measurements at the surface can be used to calibrate the numerical models and to verify the obtained results. Relying on the numerical modelling it is

possible to obtain information about: (a) global deformation with respect to the geological conditions, tectonic stress state, seismic loading and mining processes; (b) radius of the mining induced deformation and stress redistribution regarding the development of induced seismic events; (c) the stability behaviour of a single cavern, considering creeping of rock salt and seismic loading; (d) the stability behaviour of groups of caverns with special respect to the pillars located between the caverns as well as geometrical system parameters (diameter, distance of cavern axes, height, distance between depth levels, etc.) and additional technological pressure. Therefore regular control of the stress-strain state by the means of numerical modelling can help to follow the optimal scheme of salt extraction - from which group of bore-holes, what quantity and with what velocity to perform the salt extraction in order to keep the whole system in a safe condition.

The broad range of potential benefits of the improved seismic monitoring can be summarized in three categories- benefits that flow from information that is available immediately following a single earthquake or swarm of earthquakes (e.g., levels of ground shaking, potential for coastal inundation by a tsunami, or warnings about an imminent volcanic eruption); intermediate- to long-term benefits that occur as society responds to the information provided by monitoring data; and knowledge benefits that will accrue as a result of an improved fundamental understanding of earthquake processes and the distribution of earthquake risk.

The proposed *PROMIRA* information system could supply some policy instruments (e.g., economic incentives, insurance, building codes) and regulations that can be used to reduce future earthquake damage and loss of lives while providing financial relief after a disaster. The capability to reliably predict the pattern of ground motion amplification in the monitored region, and thus identify locations that are especially vulnerable as well as ones that are not, has the potential to reduce earthquake losses significantly and guide rational region development.

### Acknowledgements

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## BULGARIAN ADDED VALUE TO ERA

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### BULGARIAN INFORMATION SOCIETY CENTER OF EXCELLENCE FOR EDUCATION, SCIENCE, AND TECHNOLOGY IN 21 CENTURY (BIS-21)

**Professor Ivan Dimov, DSc;** Institute for Parallel Processing, Bulgarian Academy of Sciences, Acad. G. Bonchev 25A, 1113 Sofia, E-mail: *ivdimov@bas.bg*  
and

**ACET,** The University of Reading, Whiteknights, PO Box 217, Reading, RG6 6AH, UK,  
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#### Introduction

Information Technology (IT) is a broad subject concerned with the use of technology in managing and processing information. In particular, IT deals with the use of electronic computers and computer software to convert, store, protect, process, transmit, and retrieve information. For that reason, computer professionals are often called IT specialists, and the division of a company or university that deals with software technology is often called the IT department. Computer science, or computing science, is the study of the theoretical foundations of information and computation and their implementation and application in computer systems. Computer science has many sub-fields; some emphasize the computation of specific results (such as computer graphics), while others (such as computational complexity theory) relate to properties of computational problems.

The EU idea of establishing Centres of Excellence in the newly Associated States was very original and extremely fruitful for Bulgarian scientists. Thanks to our Centres of Excellence the position of Bulgarian science in EU has changed dramatically – it is now more appreciated and its status is much higher. In a very hard competition with many leading institutions the Institute

for Parallel Processing of the Bulgarian Academy of Sciences (IPP-BAS) succeeded to be granted as a Centre of Excellence. In the field of Mathematics, Informatics and Engineering there are six more institutions: one in Poland, one in Czech Republic, two in Hungary, one in Rumania, and one in Cyprus (see Figure 1).

Within the existing program for exchanging scientists among member countries, the Centre of Excellence at IPP-BAS has developed a real network of individual contracts among scientists, thus promoting the training of young scientists and the exchange of doctoral students, which in turn activates the human research potential.

#### 1. Main Objectives of the Project BIS-21

One of the most important objectives of the project was further development of an excellent research and training institution (IPP-BAS), which kept leading expertise in **information technologies**.

Bulgarian Information Society Centre of Excellence for Education, Science and Technology **BIS-21** prolonged the existing IPP's tradition of fruitful collaboration as follows:

- In **Information Technologies (IT)** for *large-scale computing and environment protec-*



Fig. 1. CENTRES OF EXCELLENCE IN MATHEMATICS – INFORMATICS - ENGINEERING (MAIN-EN)

tion: co-operation and twinning with our partners: University of Reading (Reading, UK), National Environmental Research Institute (Roskilde, Denmark), Catholic University of Nijmegen (The Netherlands), *Institute of Geonics CAS* (Ostrava, Czech Republic and the University of Bristol (UK). The main objective is to **exchange knowledge and expertise** in the field of development of large-scale computing systems for solving real-life problems in emergency forecast of damaging air pollution levels. BIS-21 allows for joint **training of PhD** students through exchange of visits and organisation of seminars and conferences on *Large-Scale Computing Tools*.

- In *Human Language Technology (HLT)*: cooperation and twinning with 3 partners: University of Sheffield (UK), University of Hamburg (Germany), and University of Tuebingen (Germany). The main objective is **sharing knowledge** in order to **transfer technologies** for processing of English/German to Slavonic

languages, thus providing excellence in HLT for Slavonic languages as well as technologies for development of knowledge-based tools for natural language processing. BIS-21 supports joint training of **PhD students** and qualification of **post-docs** through exchange of visits and sharing expertise.

- In *Technologies for management of information processing, communications and networks*: cooperation and twinning with
  - 4 partners: NTUA, Greece, the University of Groningen, The Netherlands, and, CEO Mundial Avenue S.A., Brussels, Belgium, and the City University, London, UK with the main objective to **exchange knowledge and expertise** in the field of high performance RISC processors based on VLSI PGA;
  - 3 partners: Rheinisch-Westfaelische Technische Hochschule (RWTH) Aachen, Germany, Helsinki University of Technology, Finland, and the Academy of Economic

Studies, Romania in order to **exchange expertise** in communication and network services as well as **exchange of information** about the activities in other IST **Centres of Excellence**.

The successful cooperation with partners from the University of Reading, Department of Computer Science, UK, the National Environmental Research Institute, Roskilde, Denmark, the University of Nijmegen, The Netherlands, The Institute of Geonics, SAC, Ostrava, Czech Republic, IRISA, Rennes, France and Hamburg University, Germany, has to be especially emphasized. The transfer of newest achievements in the field of error analysis, Monte Carlo methods and large-scale computing to real life applications in engi-

neering and technology is one of the most important project's features.

## 2. Achievements

During the **period of the project 53 long-stay visits** and **30 short visits** of EU scientists were realized.

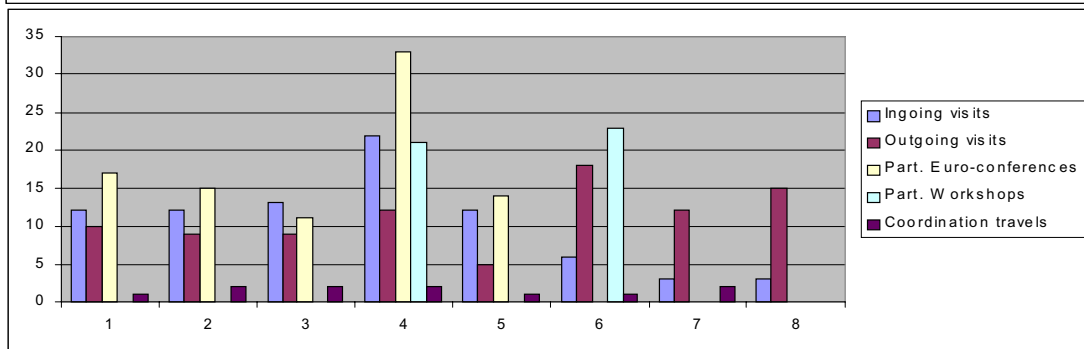
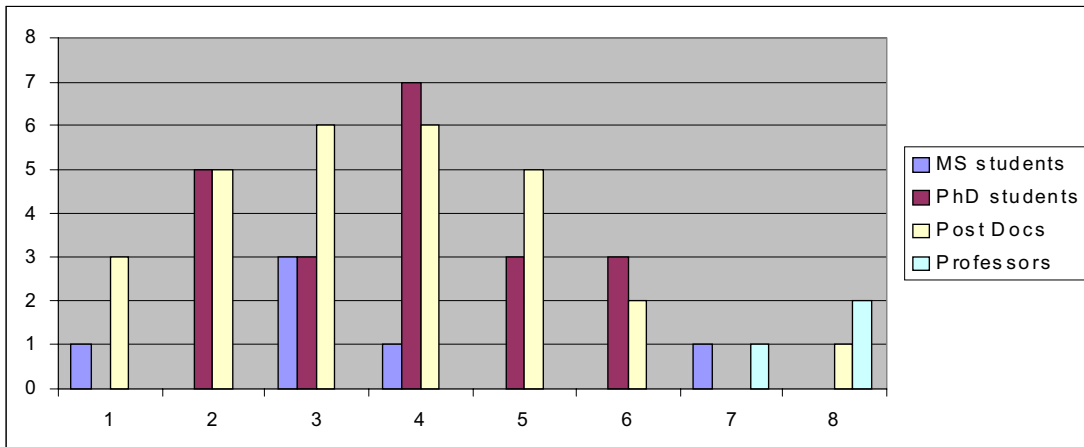
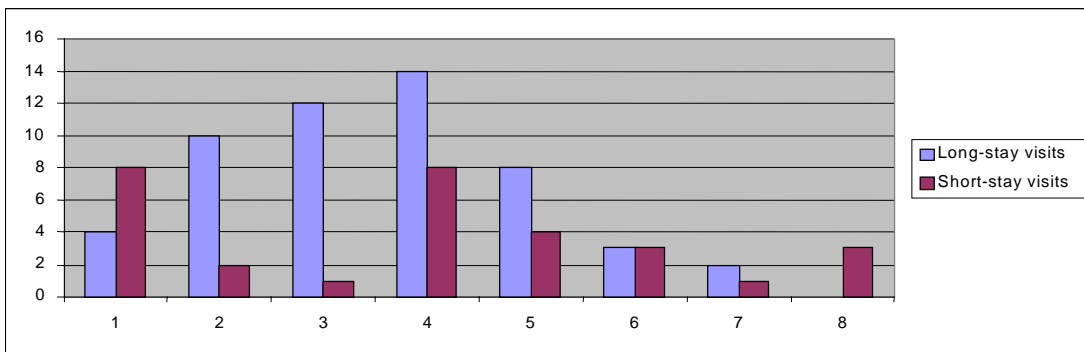
For the period from **1 January 2001** we had:

- **83** ingoing visits;
- **90** outgoing visits.

During the **period of the project** we completed:

- **90** participations of Euro-conferences;
- **44** participations of workshops;
- **11** coordination travels.

The long-stay visits of EU scientists and



students were distributed as follows:

- **6** visits of MS EU-students;
- **21** visits of PhD EU-students;
- **28** post-docs visits of EU-scientists;
- **3** visits of professors.

The distributions of different visits during the eight periods of the project are presented on pictures given below.

One can see that the distribution of our activities is more or less optimal and corresponds to the activities connected with the deliverables of the project.

During the **period** in a strong collaboration with our partners we obtained **innovative results** published in a number of journal papers and papers in proceedings of international conferences.

Running long-term experiments with real data takes a lot of time even on up-to-date parallel supercomputers. That is a rather challenging task for the powerful GRID infrastructure, which is already available in the framework of the ongoing projects EGEE and SEE-GRID. In connection with this goal it was very important to develop portable codes and test them on as

much as possible supercomputers of various type and brand. For achieving best portability we were using only standard parallelization tools (MPI for distributed-memory parallelism and OpenMP for shared-memory parallelism). The results obtained in our Centre are published in **Springer Lecture Notes** in Computer Science, Vol. 3401.

One generic approach to improving the convergence of MCMs has been the use of highly uniform, quasirandom numbers (QRNs) in place of the usual pseudo random numbers (PRNs). Quasi-Monte Carlo algorithms are based on the number theory and are carried out by deterministic low discrepancy point sets. Two quasi-Monte Carlo algorithms for boundary value problems, based on the use of good lattice points in the sense of Korobov, are proposed and analyzed. The study deals with finding optimal coefficients for good lattice points in weighted Sobolev and Korobov spaces. Two approaches are used to obtain such coefficients: "component-by-component" and obtaining the coefficients depending on single parameter by Korobov's construction. Numerical tests are per-

formed for a model similar to some real-life problems in environmental mathematics. The results show that the convergence of the proposed algorithms is practically the same, but they have some advantage in comparison with Monte Carlo algorithm in high dimensions.

**The Flexible Modeling System developed at IPP-BAS is a basic tool for solving problems in the computer science, real-life problems of the modern society (ecological – information for decision makers about the ozone pollution obtained using our Macintosh G4 cluster is presented).**

The period is April–September, 1997.  
 Maximum value in the domain: 74  
 Minimal value in the domain: 0

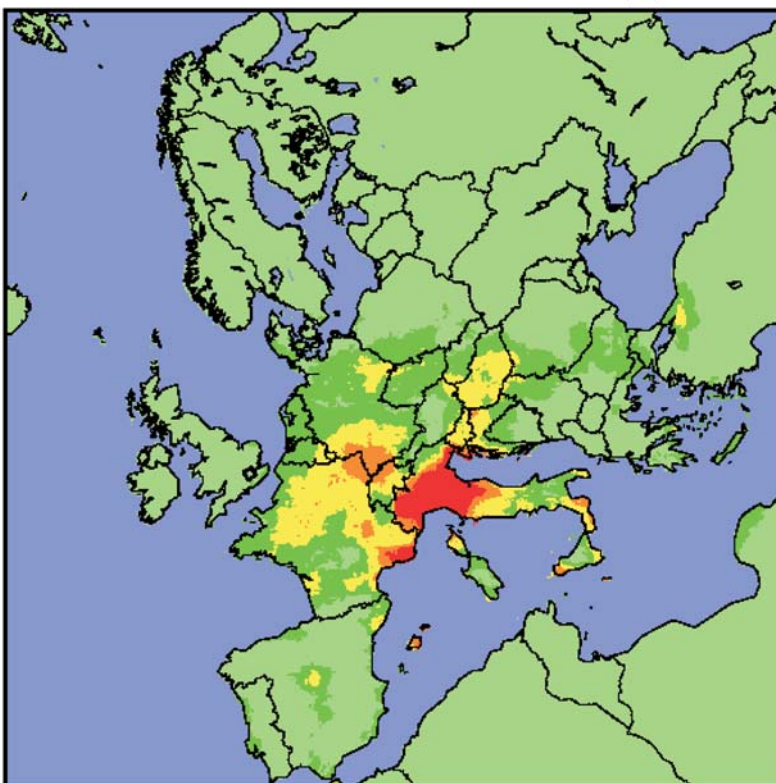
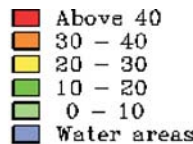


Fig. 2. BIS-21 provides Information Technologies for Emergency Situations Forecast.

## EXPOSURE TO HIGH OZONE CONCENTRATIONS

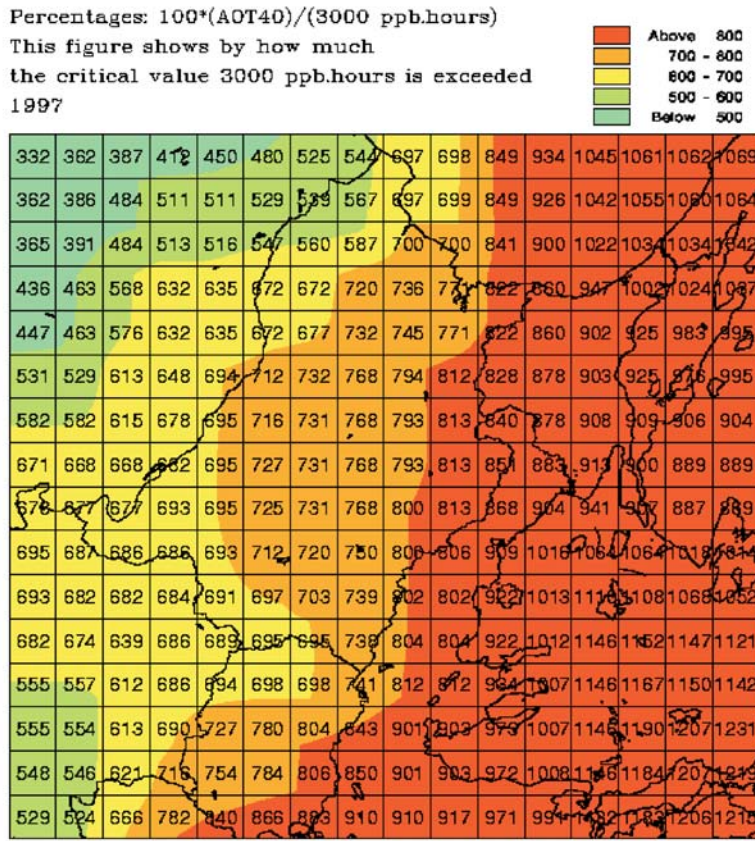


Fig. 3. Ozone pollution in Bulgaria and the surrounding area

The following tasks in the field of scientific computing were under investigations during the reported period:

Optimal Algebraic Multilevel Iteration (AMLI) methods for pure elasticity problems approximated by non-conforming FEM systems.

Parallel solution methods for rotated bilinear FEM elliptic systems.

Discussions of models, numerical discretization and solution approaches to be used for preparation of mutual collaborative research projects related to computer modelling, multi-scale phenomena and coupled problems.

The second major aspect of the planned work is related to the field of high-level education.

BIS-21 project helped us to prepare several proposals (or parts of them) in the framework of the 6<sup>th</sup> FP. Two of them:

- **EC Project # 002356 "South-Eastern European GRid-enabled Infrastructure Development (SEE-GRID)"** (Project Coordinator: J. A. Sanchez- Papaspiliu, GRNET, Greece, Contractor for IPP - BAS: I. Dimov), Call identifier: FP6-

2002-Infrastructures-2, Contract type: Specific Support Action (VI Framework Programme of EU), <http://www.see-grid.org/>

- **EC Project # 508833 "Enabling Grids for E-science in Europe (EGEE)"** (Project Coordinator: F. Gagliardi, CERN; Contractor for IPP - BAS: I. Dimov), (VI Framework Programme of EU), <http://public.eu-egee.org> can be considered as a result of our active collaboration within BIS-21 project.

**The further cooperation** continues via the INCO project 016639 BIS-21++ (Bulgarian IST Centre of Competence in 21 Century), a Specific Support Action that is already running, achieving significant results. BIS-21++ focuses on research training of young scientists (including PhD students) and further qualification of post-docs. The cooperation is based on the available BIS-21 results. The Bulgarian trainees will have joint supervision between one Bulgarian and one foreign senior researcher.

### 3. Challenges for the Future

The networks and links created during the

BIS-21 project have chance to continue in further development of our collaboration with most leading institutions in EU and USA. The BIS-21 project activities have a strong contribution to the international recognition of the RTD achievements of IPP BAS. This in particular results in the sustainable increase of scientific publications in some of the best international journals and series. Building up of networking and twinning activities is an inherently integrated part of BIS-21. The obtained results motivated by the realized long stay visits to IPP BAS are one of the best contributions to the real strengthening of the European Research Area in such fields as ***information technologies for environmental protection, human language technologies, and technologies for management of information processing, communications and networking***. The BIS-21 workshops, and a number of traditional scientific conferences organized by IPP BAS, became forums for promotion of new ideas and active exchange of research and technological results. The increased capacity of the research groups of IPP BAS results in their active and successive involvement in FP5 and FP6 proposals. As an example, IPP BAS is one of the initiators and a co-founder of the recently established Bulgarian GRID Consortium, facing the new priorities of FP6. One important accent in our current activities as a research partner of Bulgarian industry and SMEs is ***substantially to shorten the innovation cycle***.

Nevertheless, we trust that the European joint research should be organized by more systematic way, if we want to compete with US scientific and technological programmes where large budgets are available without annoying administrative obstacles. That is why we support the idea which appeared during the Yearly meeting of Centres of Excellence in Cyprus to support few virtual excellent Joint Research Centres— in fact networks of closely collaborated excellent research units — in themes which are vital for Europe and are not covered by existing research priorities. Our strong point is that the European Centre of Excellence should play an important role in further development of successful academic scientific collaboration in Europe.

As a very successful Centre of Excellence IPP-BAS was granted by BIS-21++ Project “**Bulgarian IST Centre of Competence in 21 Century**”. The project started in 2005 and is still running. The general objective of BIS-21++ is to further strengthen the human potential and to reinforce the excellence in education, science, and technology of the currently most established Bulgarian IST Centres. BIS-21++ is relevant to the objectives of the Call to “improve the research capacities of highest quality and promising centres”. To meet the Call objective for “reinforcing the scientific potential”, BIS-21++ emphasizes on training of young scientists.

**Strengthening the scientific potential of IPP-BAS.** A number of new young scientists will be supported by IPP-BAS using the EC support from BIS-21++. In order to ensure the context for the high-quality training of the scientists and provide the framework of their professional growth, IPP-BAS senior staff members will organise and supervise 8 RTD tasks in key IST areas:

- *New Computational Grid Technologies for Emergency Forecast,*
- *Computationally Intensive Problems: Monte Carlo Simulations with Grid Applications,*
- *Robust Scientific Computing Algorithms and Software Tools,*
- *Improved Computer Systems Recovery and Intelligent Stores,*
- *Plausible and Paradoxical Reasoning in Sensor Data Processing,*
- *Multilinguality in Advanced Information Search,*
- *Formal Structures in Large-Scale Search and Semantic-Based Applications,*
- *Computer Networks and Grid Infrastructures.*

#### **Acknowledgements**

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## MADE IN BULGARIA WITH EUROPEAN SUPPORT

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### A SHELL FOR DESIGN, DEVELOPMENT AND SUPPORT OF VIRTUAL LEARNING ENVIRONMENTS

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Applied Research and Communications Fund (ARC Fund)

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The shell is a contemporary platform of design, development and support of virtual learning environments. It contains **five subsystems**:

**Information subsystem:**

- Supports virtual learning in different educational programs and learning courses;
  - Uses learning information resources (lectures and assignments) in different formats - doc, pdf, txt, html, mp3, wav, midi, mpeg, mpg, avi, gif, exe;
  - Finds out learning resources in an integrated database (DB) and a virtual library of High Schools through keywords;
  - Gives general information about the university (diplomas, personnel, students, etc.), supporting means and services for the users;
  - Enables printing of the learning course (or of a part of it) on paper, downloading of the learning course as hypertext document (including on a CD-ROM disc) with possibilities for separate reviewing;
  - Provides portability to/from other platforms through bringing out the structure and data of the integrated DB in XML format;

**Author subsystem:**

- Proposes to authors opportunities for interactive creation (using integrated DB) and distance publishing of learning materials, tests and learning courses;
- Visual means for creation of non-linear learning courses with check points and opportunities for dynamic change of learning according to students' results are proposed to authors and teachers for the first time in Bulgarian practice;

- Support variants of learning materials in one subject domain with different characteristics (learning concepts, structure, level of difficulty, time required for learning, etc.);

- Automatically generates new learning courses (and selects the accompanying learning materials), tests and learning strategies through DB queries with pointing of global and local restrictions (incoming level of students, logical links among learning units, estimation of the progress of each student, etc.), related with result, level, time, price, etc.

**Test subsystem:**

- Supports rich variety of main types test questions and assignments assuming answers with imposed restrictions (multiple choice, alternative answer, multiple answer, ordering, correspondence, filling in fields with multiple choice), without restrictions (filling in fields in the template of the answer, free answer);
  - Allows creation of new (compound) types of assignments on the basis of the main ones;
  - Automatically generates (according to the set conditions) tests as combination of questions and assignments from different types (including adaptive and time types);
    - Carries out distance examination by automatically checking and assessing the tests, and if it is necessary - establishes feedback with the teacher.

**Communication subsystem:**

- Proposes information and means for supporting different types of relationship among users;

• Asynchronic (e-mail, forum, calendar, reminder, shared files, personal Web pages, SMS centre, traditional post, fax);

• Synchronic (chat, audio conference, video conference, WAP applications, telephone conversation, face-to-face meeting).

**Administrative subsystem:**

• Supports different kinds of settings - adding new subject domains, concepts, learning resources, etc.;

• Serves the users, supports the DB with information about the subjects and objects of PeU 2.0 and gives variety of reports and statistics;

• Registers users with different access rights;

• Provides administrative attendance of education - forming of learning groups, assigning of teachers, etc.

**Innovative Aspects:** The system is comparable to the best European samples - it not just satisfies almost all of the 108 criteria for assessment and comparison of the virtual learning environments, but it also possesses a number of unique functional characteristics:

• Modelling the course for learning the given subject domain as oriented graph with nodes containing grouped learning materials,

linked with relations from type predecessor – successor;

• Grouping materials into learning course nodes with logical relations from type “and”, “or” and “case” (in the last case check points are created, in which the assessment of the learners progress is generated automatically and the feedback with the respective teacher is realized) and the learning is automatically orientated according to the student’s progress;

• Description of learning materials through lists of concepts, levels and used resources;

• Creation and edition of the learning courses - on the basis of logical grouping of the learning materials (created by different authors), setting the check points and relationships in the learning course;

• Automatic generation of dynamic learning courses and adaptation to particular learners;

• Carrying out learning with resource restrictions - Supporting of an integrated DB including the subjects of learning, subject domains, learning materials, learning courses, educational plans.

**Main Advantages:** This platform gives the opportunity to experiment a new method of learning, to develop and learn the courses dynamically for particular users.

## TEXT-TO-SPEECH SYSTEM TRANSFORMING AN INPUT TEXT INTO COMPUTERISED SOUND OUTPUT

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A Bulgarian university offers a Text-to-Speech system transforming an input text into computerised sound output. The text passes through segmentation, normalization, analysis & annotation, and phonetic transcription. For this purpose the necessary lexical resources and software tools were created, including a Bulgarian computer dictionary with 1 174 607 word forms (used from a morphological analyzer); cascading grammars; 60 segmentation rules; 207 rules for phonetic transcription; expanding dictionary

with abbreviations; sound database presenting 500 Bulgarian allophones and 15 000 Bulgarian syllables; original minimized rules for dividing words into syllables.

Two years ago a project BalkaNet started with main task - creating of lexical resources for Bulgarian language. A Bulgarian university’s Text-to-Speech system is a part of this project and two lecturers, 2 students and 1 PhD student participated in it. Real application of the system is an integrated module for “listening” to educational materials.

**Potential application:**

- Computerised sound output of Bulgarian language in dialogues with different software applications
- Automatic show out of sound reports and messages from databases and Internet portals;
- Converting to sound telecommunication services;
- Electronic education of Bulgarian language (especially for foreign students);
- Creating of multilingual dictionaries with sound output.

**Innovative Aspects:**

Attempts at generating sound from computer-based Bulgarian text were made more than 20 years ago, and later - in single graduation and demonstrational works. These works remain on experimental level because of the lack of solid lexical resources and software aids for computer-based processing of text in Bulgarian language.

**Main Advantages:**

This system gives the opportunity to create a Bulgarian catalogue and lots of sound variants of books, textbooks and magazines connected with every library and information service addressed to blind people.

## COMPUTER IMAGE PROCESSING SYSTEM FOR IDENTIFICATION OF MACHINES PRODUCING ILLEGAL COMPACT DISKS

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The developed image processing computer system that identifies machines producing illegal CDs consists of one standard microscope, colour CCD TV camera (512x512), personal computer, scanner and printer. The optical tract of the microscope was modified, in order to allow magnifications above 1000x. Two coordinate tables were specially designed. The first one moves horizontally or vertically and rotates up to 3600. The second one is a vertical coordinate table, with diversion of +/- 10 degrees, and allows detailed analysis of the surface in different close-ups. The obtained real-time TV image is displayed on the half of the monitor of the PC. On the other half an image of a disk produced by a known machine is displayed. These two images are compared visually by moving one relatively to the other. In case of similarity, the operator marks corresponding areas and the images are printed and saved. If necessary, the operator can measure particular geometric parameters in the disk image.

**Innovative Aspects:** The developed technology offers a new tool for comparison of two images in an interactive mode and fully replaces the comparative microscope. New specialized soft-

ware for image processing has been developed to analyze and compare the acquired image with a sample one. The specially designed vertical coordinate table allows detailed analysis of the surface in different close-ups.

**Main Advantages:**

The image processing system is based on conventional equipment and has a significantly lower price (more than 10 times) compared to the price of a comparative microscope. The accuracy of analysis is higher due to the obtained higher magnification (more than 1000x). Images can be processed and geometric parameters can be measured. The analysis results are documented and archived.

- Creation and edition of the learning courses - on the basis of logical grouping of the learning materials (created by different authors), setting the check points and relationships in the learning course;

- Automatic generation of dynamic learning courses and adaptation to particular learners;

- Carrying out learning with resource restrictions - Supporting of an integrated DB including the subjects of learning, subject domains, learning materials, learning courses, educational plans.



## EQUAL IN EUROPEAN RESEARCH AREA

### BULGARIAN VIPs

#### The Chairman of the State Agency for Information Technology and Communications

**Assoc. Prof. PLAMEN VATCHKOV, PhD**

*Phone: +359 2 9492115, e-mail: info@daits.government.bg*



Doctor of Technical Sciences, Senior Research Associate – second degree, Member of the Scientific Board of the Institute of Technical Cybernetics and Robotics, Bulgarian Academy of Sciences, since 1985. Member of the Balkan

Academy of Science and Culture.

Mr. Plamen Vatchkov starts his higher education at Technical University in Sofia in 1967 and graduates his MSc in Industrial Electronics at Moscow Power Engineering Institute in 1973. He defends his PhD dissertation in the field of Power Convertors in 1977. Since 1986 Mr. Vatchkov is an Associate Professor.

The work experience of Mr. Plamen Vatchkov starts in 1973 at the Central Computing Institute as an engineer. From 1973 to 1977 he is an Assistant Professor at Technical University in Moscow. The specific professional experience of Mr. Vatchkov includes the following major positions:

1977: Central Computing Institute, Research engineer

1979 – 1983: Bulgarian Academy of Sciences, Institute for Technical Cybernetics and Robotics, Research engineer

1983 – 1984: Bulgarian Academy of Sciences, Institute for Technical Cybernetics and Robotics, Deputy Director

1984 – 1992: Microprocessor Systems, General Director

1992 – 1994: Bulvar Electronics Ltd., Managing Director

1994 – 1997: Multitech JSC, Executive officer

1997 – 1999: Globo, Ltd., Managing Director

1999 – 2001: Cable Bulgaria JSC, Manager

2001 – 2003: Overgas Holding JSC, Director of Information Technology

2003 - October 2005: Cabletel JSC, Deputy Director Operations

Since October 2005 up to now Mr. Plamen Vatchkov is the Chairman of the State Agency for Information Technology and Communications, Sofia.

Membership of Mr. Vatchkov in scientific councils, different authorities and communities dealing with evaluation and accreditation of activities, concerning the matter of science, education and qualification includes:

Since 2003 - a member of the Balkan Academy of Sciences;

From 1985 to 1992 – a member of the Scientific Council of the Institute for Technical Cybernetics and Robotics, part of the Bulgarian Academy of Sciences.

Mr. Vatchkov is a member of the following public and professional organizations:

- Federation of the Scientific-Technical Unions in Bulgaria.

- The Union of Scientists in Bulgaria.

During his long professional career Mr. Plamen Vatchkov has more than 40 articles, one monograph and 6 certificates in the field of electronics and computing machinery.

## The Head of the Bulgarian Centre of Excellence for Information Technology Research (BIS-21)

**Prof. IVAN DIMOV, DSc, PhD**

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Phone: +359-2-979-6641, e-mail: [ivdimov@bas.bg](mailto:ivdimov@bas.bg)



DSc, Numerical Analysis; PhD, Mathematical modelling. Professor at the University of Reading, School of Systems Engineering, ACET Centre, UK since 2005. Presi-

dent of Scientific Council of IPP-Bulgarian Academy of Sciences since 2004. Head of the Bulgarian Information Society Centre of Excellence for Education, Science and Technology in 21 Century (BIS-21), Bulgaria since 2000. He is Professor in Mathematical Modelling, Bulgarian Academy of Sciences (BAS) since 1996.

Mr. Ivan Dimov defends his PhD dissertation on Mathematical modelling in May 1980, and his DSc on Numerical Analysis in October 1984 in Moscow, Russia.

### **The professional record of Mr. Ivan Dimov includes the following major stages.**

1982-1985: Assistant Researcher in Numerical Analysis at the Institute of Mathematics, BAS.

1985-1990: Associate Professor in Numerical Analysis at the Institute of Mathematics, BAS

1990-1995: Associate Professor in Parallel Algorithms, Head of the Laboratory of High-Performance Systems and Parallel Algorithms, Deputy Director of the Center for Informatics and Computer Technology, BAS.

1995-1996: Deputy Director of the Institute for Parallel Processing (successor of CICT), BAS.

Since 1996: Professor in Mathematical Modelling, BAS.

1996-2004: Director of the Institute for Parallel Processing, BAS.

Since 2000: Head of the Bulgarian Information Society Centre of Excellence for Education, Science and Technology in 21 Century (BIS-21), Bulgaria.

Since 2004: President of Scientific Council of IPP-BAS

Since 2005: Professor at the University of Reading, School of Systems Engineering, ACET Centre, UK

The main professional experiences of prof. Ivan Dimov are in the fields of:

- Monte Carlo solution of partial differential equations, a priori estimates and error analysis.

- Statistical numerical methods with super convergent probability error.

- Parallel algorithms and GRIDs.

- Mathematical modelling and scientific computation in:

- Environmental Mathematics;

- Gas discharge plasma;

- Semi-conductors physics.

Mr. Ivan Dimov has a long record as an invited and plenary lecturer and visitor at a number of leading European research institutes, universities and events in the fields of his professional experiences. He has as well a rich teaching experience in terms of undergraduate and graduate teaching university courses and supervision of MSc and PhD Thesis.

The list of the international and national scientific projects with the participation of prof. Ivan Dimov is extensive, as the most recent ones are:

- NATO Science Project EST.CLG.980505: "Impact of Climate Changes on Pollution Levels in Europe", Joint project between the National Environmental Research Institute, Roskilde, Denmark and CLPP, BAS, Sofia, Bulgaria, Eotvas Lorand University, Budapest, Hungary, University of Medicine and Pharmacy, Iasi, Romania and National Academy of Sciences of Ukraine (Project Coordinator: Z. Zlatev, Principal Investigator: I. Dimov) (2004-2006)

- EC Project # 002356 "South-Eastern European GRid-enabled eInfrastructure Development (SEE-GRID)" (2004-2006), (Project Coordinator: J.

A. Sanchez-Papaspiliu, GRNET, Greece, Contractor for IPP - BAS: I. Dimov), Call identifier: FP6-2002-Infrastructures-2, Contract type: Specific Support Action (VI Framework Programme of EU), <http://www.see-grid.org/>

- EC Project # 508833 "Enabling Grids for E-science in Europe (EGEE)" (2004-2006), (Project Coordinator: F. Gagliardi, CERN; Contractor for IPP - BAS: I. Dimov), (VI Framework Programme of EU), <http://public.eu-egee.org/>

- NATO Security Through Science Programme – Advanced Study Institute "Multisensor Data and Information Processing for Rapid and Robust Situation and Threat Assessment" (16 May 2005 – 27 May 2005, Albena Bulgaria), (Co-directors: Dr. Eric Lefobvre, Lockheed Martin, Canada, Montreal, Canada, Prof. Dr. Ivan Dimov, Bulgarian Academy of Sciences, Sofia, Bulgaria), SST. 981433, (ASI Programme), <http://www.nato.int/science/calendar/asi-2005.htm>

- National Scientific Fund Project # I-1201/02 "New stochastic algorithms for electronic transport" (2002-2005) (Co-coordinator: T. Gurov; I. Dimov – member of the team)

- National Scientific Fund Project # MM-902/15.12.1999 "Novel Monte Carlo approaches for solving problems of linear algebra, integrals, integral equations and their applications" (1999-2004) (Co-coordinator: I. Dimov)

- National Project # I-811/30.09.1998 "High-performance Monte Carlo algorithms and computer modelling of large-scale problems of pollution transport" (1998-2003) (Co-coordinator: I. Dimov)

Mr. Dimov is a member of the following professional societies: the Union of Mathematicians of Bulgaria - from 1982; the Union of Scientists - from 1984; IMACS (International Association for Mathematics and Computers in Simulation) – Member of the Technical Committee from 1999; IFSW (International Federation of Scientific Workers) - from 1986.

The Membership of Mr. Dimov in scientific committees and expert commissions includes:

- Governing Board of the Union of Scientists (1989-1996)

- Scientific Council of the Institute of Information Technologies of BAS (1993-1998, 2003-.)

- Scientific Council of the Central Laboratory for Parallel Processing of BAS (1995-2003)

- Scientific Council of the Institute for Parallel Processing of BAS – Chairman of the Council (2004-.)

- Specialized Scientific Council on Computer Science and Applied Mathematics at the High Attestation Commission at the Bulgarian Government (1998-2004)

- Specialized Scientific Council on Electronics and Computer Technology at the High Attestation Commission at the Bulgarian Government (1995-.)

- General Assembly of the Bulgarian Academy of Sciences (1994-.)

- Commission on Finance of the Bulgarian Academy of Sciences (2000-2003)

- Commission for Euro-integration (2002-.)

- Specialized Scientific Council on Computer Science and Applied Mathematics at the High Attestation Commission at the Bulgarian Government (1998-.)

- Commission for Information and Communication Services of BAS – Chairman (1997-2002)

- NATO Scientific Program (Member of the Panel: "Environmental and Earth Sciences & Technology") (2000-2003)

- "Marie Curie Actions" Programme of the VI Framework Programme of EU (2004-.)

During his prosperous professional career Mr. Ivan Dimov has published more than 105 articles, including 46 in refereed international journals, 9 in referred proceedings of international conferences and over 40 in international scientific series, as well as 7 books

## AWARDS

### "JOHN ATANASSOV" AWARD FOR ACHIEVEMENTS IN THE DEVELOPMENT OF INFORMATION SOCIETY



In 2003 within the celebration of the 100-th anniversary from the birth of John Atanassov under the patronage of the President Georgi Parvanov, the head of state consecutively met with friends and relatives of the inventor, as well as with Pete Hayes, vice president of Microsoft.

Pete Hayes, special messenger of Bill Gates for the celebration, handed the head of state a letter of congratulation from the President of Microsoft. Bill Gates and the biggest computer corporation in the world officially acknowledge in it John Atanassov's merits in invention of computer.

In the letter it is mentioned that in 1942 John Atanassov and a grandaund Clifford E. Berry thought out, developed and demonstrated their first digital computer working with vacuum tubes, thus laying the beginning of fundamental ideas on development of computers. The Chairman and Chief Software Architect of Microsoft notes that during the recent 60 years engineers develop their inventions on the basis of John Atanassov's original ideas in order to create

powerful computers everybody relies on in our days. In Bill Gates's opinion, computers today are a very important part of the modern society. "We are grateful to John Atanassov for being a pioneer of this technology that helped it to become a reality", the letter concludes.

In his turn the head of state declared his decision to establish an award in the name of the great inventor of Bulgarian origin John Atanassov to be bestowed for achievements in the development of information society.

Annually Bulgarian students, young scientists and lecturers are awarded "John Atanassov" award for their contributions to the development of information society, science and technologies that facilitate communications and promote general access to information and information technologies. The procedures for nomination and election of winners are developed by special commission constituted by the Council on Information Technologies to the President of the Republic that includes representatives of the Bulgarian Academy of Sciences, universities and other institutions related to these problems. Foreign citizens having considerable contribution to the development of information society can be winners of the award as well.

### The first laureate of "John Atanassov" award for the year 2003 is Preslav Ivanov Nakov from Veliko Turnovo.



In 1996 Preslav graduated from Secondary School of Mathematics and Natural Science "Vasil Drumev" in Veliko Turnovo with national diploma for achievements in the field of mathematics and natural

sciences. With equivalency exams he also graduated from the Secondary School of Foreign Languages "Prof. Dr. Assen Zlatarov". He has a MSc degree in informatics from Sofia University "St. Kliment Ohridski". He is a PhD student at the University of California at Berkeley, USA, specialty "Artificial Intelligence". He works over Bio Text research project on new methods and tools for facilitation of the process of searching and synthesizing of textual information in the field of medicine and biological sciences.

**Svetlin Nakov is the second winner of "John Atanassov" award for contribution to the development of information society**



Svetlin has a MSc Degree from the Faculty of Mathematics and Informatics at Sofia University "St. Kliment Ohridski". As a school and university student Svetlin has won various national competitions in programming and has four medals from international Olympiads in informatics. He is the author of numerous scientific and technical publications related to software development in Bulgarian and foreign journals.

He is a PhD student in informatics at Sofia University "St. Kliment Ohridski", a chairman of

the Bulgarian Association of Software Developers, research associate for Net Framework, Microsoft Research, Great Britain. He is a lecturer in modern software technologies at Sofia University "St. Kliment Ohridski". His interests comprise Java technologies, NET platform and information security. "I want to stay home and help my country", says Nakov. He rejected tempting financial offers from Microsoft and Google companies. One of his aims at present is to improve teaching of students in informatics, and for this purpose he founded National Academy for Software Development. The Academy gives students an opportunity to get specialized knowledge and acquire the necessary professional training.

**Laureate of "John Atanassov" award for the year 2005 is a businessman Valentin Nikolaev Pavlov**



Valentin Pavlov is a PhD student at the Institute for Parallel Processing of Information at the Bulgarian Academy of Sciences. He is a vice-president of one of the biggest Bulgar-

ian software companies "Rila Solutions". The young scientist's research interests are in the field of linguistic modeling and are in the basis of the company's leading projects in Bulgaria, USA and England. Valentin Pavlov has special merits for the development of information technologies in Bulgaria; his research works are already known in India and China. He is the leader of "Rila Solutions" project – Register of Public Orders of the Republic of Bulgaria.

**The winner of "John Atanassov" award for 2006 is Hristo Kostadinov, DSc**



Hristo Kostadinov was born on October 6, 1974. In 1994-1998 he studies for a bachelor's degree in mathematics at the Sofia University St. Kliment Ohridsky, Faculty of Mathematics and Informatics. In 2001 he graduates

from the Sofia University St. Kliment Ohridsky with master's degree in algebra. During 2002 – 2005 he is a doctorand in the theory of coding at the University of Electro-Communications in Tokyo. Since 2005 he is a mathematician at the Institute of Mathematics and Informatics for 1 year and after that he continues his education in Tokyo. In 2006 he becomes a research associate at the Institute of Mathematics and Informatics with the Bulgarian Academy of Sciences. He has 7 publications, some of them in prestigious Japanese journals.



## BRONZE MEDAL FROM THE INTERNATIONAL BIOLOGY OLYMPIAD

Kamena Kostova from the 11<sup>th</sup> form of the High School of Natural Sciences and Mathematics "Nikola Obreshkov" in Kazanlak was included in the national team of the country for participation in the International Biology Olympiad in

Argentina in July and won a prestigious bronze medal. The award is still more valuable when one takes into consideration the number of participants in the Olympiad – 160 from over 50 countries of the world.

## BULGARIAN STUDENT IS A WINNER AT THE INTERNATIONAL OLYMPIAD IN INFORMATICS

Rostislav Rumenov, a student from the High School of Natural Sciences and Mathematics "N. Popovich" in Shumen, was the only one who solved the most difficult problem at the XVIII International Olympiad in Informatics. Rostislav is the gold medal and special prize winner at the prestigious word competition that took place in the city of Merida in Mexico. Bul-

garian team also won silver medal – Preslav Dat Le, a student from Plovdiv High School of Mathematics "Acad. K. Popov" and bronze medal – Veselin Kulev from High School of Mathematics "Dr. Petar Beron" from Varna. The leaders of the students of our national team are Assoc. Prof. Stoyan Kapralov, DSc and Res. Assoc. Emil Kelevedzhiev.

## EXCELLENT PERFORMANCE OF BULGARIA AT THE JUBILEE X PRIMARY MATHEMATICS WORLD CONTEST FOR STUDENTS UNDER THE AGE OF 14

During the Primary Mathematics World Contest held in Hong Kong on July 15 – 21, 2006 Bulgaria was represented by 4 teams – two from Sofia and two from High Schools of Mathematics in Ruse and Varna. Traditionally one of the Sofia teams was from the Sofia High School of Mathematics "Paisii Hilendarski" /SHSM/, but this-year surprise was the mathematics team of

the 125 high school "Prof. Boyan Penev" in Sofia, which classes for the first time for participation in the contest. Bulgaria won **one gold, two silvers and three bronzes** in individual competition. The first distinction is for Daniel Dobrev from SHSM. In the team competition the HSM "Dr. Petar Beron" team from Varna placed first together with representatives of the USA with equal score.

## AWARDS OF THE INTERNATIONAL WEB ALBENA FESTIVAL 2006

The fourth edition of the WEB Awards took place in Albena resort from June 7 to June 11 in the spirit of growing interest and tolerant competition.

**Cognitive site [www.otkrivam.bg](http://www.otkrivam.bg) won the Grand Prix of the WEB Festival.** The site offers information about cultural heritage of Southeastern Europe. Through games, illustrations and adapted texts it offers information to children aged from 6 to 14, to parents and teachers.

259 sites took part in the challenging program of the festival, competing in 46 categories. Five special prizes were bestowed:

- for best text– "Za chista Bulgaria" ([www.zachistabulgaria.info](http://www.zachistabulgaria.info));
- for best home/welcome page – "Sofbuild" ([www.sofbuild.com](http://www.sofbuild.com));
- for best graphic design – "Bogdan Mebel" ([www.bogdanmebel.bg](http://www.bogdanmebel.bg));
- for best usability – "Treasure Quest" ([www.otkrivam.bg](http://www.otkrivam.bg));
- for best use of animation/video – "Capasca" ([www.capasca.com](http://www.capasca.com)).

The world-known company KPMG was the auditor of the festival and watched closely the exact performance of the voting procedure and correctness of the results.

## ARTICLES

### RECENT PUBLICATIONS OF BULGARIAN SCIENTISTS

**Title:** ICTs and Bulgarian Women's Rights Movements  
**Authors:** Haralanova, Christina  
**Source:** Development; Vol. 49, 1(2006 Mar.), 132-133  
**Document Type:** Article  
**ISSN:** 1011-6370

**Title:** KINDERET: Developing Training for Early Childhood Educators in Information and Communications Technology (ICT) in Bulgaria, England, Portugal, Spain and Sweden.  
**Authors:** Saúde, S.<sup>1</sup>, Carioca, V.<sup>1</sup>, Siraj-Blatchford, J.<sup>2</sup>, *js303@cam.ac.uk*, Sheridan, S.<sup>3</sup>, Genov, K.<sup>4</sup>, Nuez, R.<sup>5</sup>  
**Source:** International Journal of Early Years Education; Vol. 13, 3 (2005 Oct.), 265-287  
**Document Type:** Article  
**Author Affiliations:** <sup>1</sup>Escola Superior de Educaçáo de Beja, Portugal, <sup>2</sup>Faculty of Education, University of Cambridge, UK, <sup>3</sup>University of Gøteborg, Sweden, <sup>4</sup>Association RegioNet, Bulgaria, <sup>5</sup>Fondo Promotion de Empleo, Spain  
**ISSN:** 0966-9760

**Title:** Muddy Waters.  
**Authors:** Danov, Danail  
**Source:** Transitions Online; (2005 Oct.), 4-4  
**Document Type:** Article  
**ISSN:** 1214-1615

**Title:** Global Asymptotic Stability of Impulsive Delayed Cellular Neural Networks with Dynamical Thresholds.  
**Authors:** Stamova, Ivanka M.<sup>1</sup>  
**Source:** Nonlinear Studies; Vol. 13, 2 (2006), 113-122  
**Document Type:** Article  
**Author Affiliations:** <sup>1</sup>Bourgas Free University, 8000 Bourgas, Bulgaria  
**ISSN:** 1359-8678

**Title:** Multi-Step Ranking of Alternatives in a Multi-criteria and Multi-expert Decision Making Environment.  
**Authors:** Tsiporkova, Elena<sup>1</sup> *elena.tsiporkova@psb.UGent.be*, Boeva, Veselka<sup>2</sup>  
**Source:** Information Sciences; Vol. 176, 18, (2006 Sep.), 2673-2697  
**Document Type:** Article  
**Author Affiliations:** <sup>1</sup>Computational Biology Division, Department of Plant Systems Biology, Flanders Interuniversity Institute for Biotechnology/Ghent University, Technologiepark 927, 9052 Ghent, Belgium, <sup>2</sup>Department of Computer Systems, Technical University of Plovdiv, Tsanko Dyustabanov 25, 4000 Plovdiv, Bulgaria  
**ISSN:** 0020-0255

**Title:** **Scalarization Techniques or Relationship between a Social Welfare Function and a Pareto Optimality Concept.**

**Authors:** Slavov, Zdravko Dimitrov<sup>1</sup> *slavovibz@yahoo.com*

**Source:** Applied Mathematics & Computation; Vol. 172, 1, (2006 Jan.), 464-471

**Document Type:** Article

**Author Affiliations:** <sup>1</sup>Department of Mathematics, Varna Free University, Golden Sands Resort, Varna 9007, Bulgaria.

**ISSN:** 0096-3003

**Title:** **Neural Networks for Air Pollution Nowcasting**

**Authors:** Videnova, Ivanka<sup>1</sup>, Nedialkov, Dimitar<sup>1</sup>, Dimitrova, Maya<sup>1</sup>, Popova, Silvia<sup>1</sup> *popova@icsr.bas.bg*

**Source:** Applied Artificial Intelligence, Vol. 20, 6, (2006 Jul.), 493-506, 13 charts, 1 diagram, 5 graphs, 1 map

**Document Type:** Article

**Author Affiliations:** <sup>1</sup>Institute of Control and System Research, Bulgarian Academy of Sciences, Sofia, Bulgaria

**ISSN:** 0883-9514

**Title:** **BASIC—A Genetic Algorithm for Engineering Problems Solution**

**Authors:** Shopova, Elisaveta G. *eshopova@mail.bg*, Vaklieva-Bancheva, Natasha G.

**Source:** Computers & Chemical Engineering, Vol. 30, 8, (2006 Jun.), 1293-1309

**Document Type:** Article

**Author Affiliations:** Institute of Chemical Engineering, Bulgarian Academy of Sciences, "Acad. G. Bontchev" Street Bl.103, 1113 Sofia, Bulgaria

**ISSN:** 0098-1354

**Title:** **Predictive Non-iterative Coordinations in Hierarchical Systems**

**Authors:** Stoilova, K.<sup>1</sup>

**Source:** Automation & Remote Control, Vol. 67, 4 (2006 Apr.), 634-646

**Document Type:** Article

**Author Affiliations:** <sup>1</sup>Institute of Computer and Telecommunication Systems, Sofia Bulgaria

**ISSN:** 0005-1179

**Title:** **How to Use Weblogs in Libraries. (English)**

**Authors:** Stoykova, Dobrinka<sup>1</sup>, Varbanova-Dencheva, Kristina<sup>2</sup> *refer4@cl.bas.bg*

**Source:** Bibliothek Vol. 29, 3;(2005), p353-360, 1 chart

**Document Type:** Article

**Author Affiliations:** <sup>1</sup>ul. Kastenski vodopad, bl. 223, vh. A, et. 4 ap. 12,1404 Sofia, Bulgaria,

<sup>2</sup>Gagarinstreet, 6, bl. 65 A, wh. A, ap. 6, 1113 Sofia, Bulgaria

**ISSN:** 0341-418Z

**DEFENDED DISSERTATIONS ON THE SUBJECT: "INFORMATION SOCIETY"  
"SIRENA" Database- NACID**

**Author** Tuparova, Daniela Ivanova  
**Degree** PhD  
**Title** Modular Approach in the Informatics Secondary School Course  
**Affiliated Organization** South-western – West University, 66 Alexi Velichkov, 2000 Blagoevgrad  
**Abstract** The study presents some problems in teaching information and information technology /IT/ in Bulgarian secondary schools. The main aim of the research is to increase the efficiency of technology of instruction in IT and information. The thesis consists of 4 chapters and 5 appendixes. In chapter 1 a review of existing theories of modular approach and tendency in teaching IT and information in different countries are presented. The curriculum and objectives of teaching IT and information in Bulgarian secondary schools are discussed. The problems in teaching IT and information are analyzed and some suggestions are proposed. Chapter 2 considers two sides of modular approach- using modular curriculum in information and learning activity packets /LAP/ for learning applied software. The attributes of module of information and IT are described. An example modular curriculum relevant to used hardware and software is presented. A technology for design of LAP is discussed. The technology includes: construction of problem solving system, development of self-assessment tests. One point of view for web-based presentation of LAP is proposed. A psychological description of students in grade 10-11 is presented. In chapter 3 used books for learning spreadsheets in the secondary schools are analyzed A description of LAP for learning spreadsheets in MS WORKS for MS WINDOWS is done. In details problem solving system and tests specifications are proposed. A web-based LAP is described and performed on the CD-R.

**Depository Library** Central Research and Technical Library

**Author** Ivanova, Latkes Todorova  
**Degree** PhD  
**Title** Modeling and Optimization of Information Systems in Global Networks  
**Affiliated Organization** Institute of Computer and Communication Systems (BAS), Acad. G. Bonchev Str., bl. 2, 1113 Sofia  
**Abstract** The doctoral thesis analyzes the topical research problem about the global network information systems and the portfolio optimization application as information service in Internet. The thesis explores the nature, current state and fixture developments of the Internet information services. A system-algorithmic model, which formalizes the technological and development diversity with the e-services, has been defined. Forth-hierarchical information: system for optimal distribution of investments has been modelled. Two models for portfolio optimization solution via increasing the number of investment horizons and taking into account the imperfection of the initial data have been developed. Portfolio optimization solution methods for the models defined in the thesis have been developed. An efficiency assessment on the operation volume and speed has been made. The methods produce relatively little volume of calculations, which contribute to the realization of the e-service in real time. A hierarchical 4-level system-algorithmic

server, which solves the defined portfolio optimization problems, applying the methods, developed in the thesis, has been constructed. The thesis results confirm the developed methods calculation efficiency. They have been applied to a Swiss investment put on for an investment fund and realized through Internet.

**Depository Library** Central Library of Bulgarian Academy of Sciences

**Author** Petrova, Mariana Mateeva

**Degree** PhD

**Title** The Models of Education of Information /non-mathematical specialist /

**Abstract** In chapter one the methodological and methodical aspect of teaching information are studied. Special attention is placed on the relation of teaching informatics and the general and private sciences. Chapter two is dedicated to investigation of information in the educational models of the general high /secondary/ schools. The reflection of development of infraction in educational models of schools and the presence of information in the educational models of the European countries are studied. Educational strategy in information in the degrees of schools is determined. In chapter three models for education in information in non- mathematical specialties of universities are worked out. The models of education in information in the universities are analyzed and estimated. Models for participation of information in the non-mathematical specialties are developed, methods and models for forming and optimization of the educational plan of the non-mathematical specialties and methods for improvement of planning and organization of personal work are suggested.

**Depository Library** Central Research and Technical Library

**Author** Nikolov, Eugene Christov

**Degree** DSc

**Title** Investigation of the Information Security of Computer Protection System Working in Network Environment and TCP/IP Protocols

**Affiliated Organization** National Laboratory of Computer Virology", 1113 Sofia, "Acad. G. Bonchev", Str., bl. 8

**Abstract** Questions related to the projection, optimization and use of computer protection systems are the investigation topic of this dissertation. They arose from the evolution of the common computer anti virus program from a device of a single local check of certain zones of the operating memory and/or the local disks for binary presence and/or absence in a single system with complex operating and management functions and tasks, guaranteeing data, computer, communication and info security as a whole in a network environment and TCP/IP Protocols-Internet/Extranet/Intranet. The influence of the type of problems solved by the CPS on their peculiarities, contents, structure and management is researched and an evaluation scheme is attached. The results attained in this investigation are used in different projects by National Laboratory of Computer Virology /BAS/.

**Depository Library** Central Library of Bulgarian Academy of Sciences

**Author** Aleksov, Zorancho Angelov.

**Degree** PhD

**Title** The Place and the Role of Computers and Contemporary Educational Technology in the Instruction in Informatics

**Affiliated Organization** South-western – West University, 66 Alexi Velichkov, 2000 Blagoevgrad

**Abstract** A new instructional model is proposed in the dissertation. The model is named KTeTeCoSt It is compounded of five parts: Student, Knowledge, Technology, Teacher and Computer. According to the proposed instructional model, new model for lecture preparation is presented, adapted to the complete integration of computers in the educational process. An investigation among the teachers is taken in order to determine their readiness to accept the new technologies and computers in the classrooms. Some conclusions are presented about the improvement of the teachers' work. An experiment for determination of the influence of the new educational and informational technologies on the instructional outcomes has been made. It has been proved that the process of integration of the new educational technologies and the computers, as constitutive parts in the instructional process, e.g. as active components in the proposed instructional model KTeTeCoSt, leads to the increase of the educational level. Also, it has been proved that the use of computers in the classroom for teaching, learning and testing, decreases the difference in the results among the best and not-so-good students, and that doesn't mean decrease of the best students' performance.

**Depository Library** Central Research and Technical Library

**Author** Stoyanova-Petrova, Silvia Velkova.

**Degree** PhD

**Title** Internet-based Performance Support Systems with Educational Elements for Engineering Education-Internet-based Environment, Development Technology and Utilization

**Affiliated Organization** Plovdiv University "Paisij Hilendarski", 24 Tsar Asen Str., 4000 Plovdiv

**Abstract** IPSS.EE system applies method of performance support systems to the university educational process and puts task performance in the centre of learning. This means that a student is close to the requirements of the real work place. The main elements of the system are: task for performance, task-specific training, reference information, instructions how to perform simulation software and expert advice. Developed environment gives to the teachers a possibility to create IPSS-EE without knowing the theory and organization behind performance centred approach. The design, functional and interface model of the Web system is presented. Experimental design and analysis of results from the pilot test are described.

**Depository Library** Central Research and Technical Library

**Author** Sotirova, Evdokia Nikolaeva.

**Degree** PhD

**Title** Modelling of the Information Processes in a University by Generalized Nets

**Affiliated Organization** Technological University "Prof. A. Zlatarov", 1 Prof. Yakimov Str., 8010 Bourgas

**Abstract** The aim of the work is to investigate the information processes in a university by generalized net. A new global operator G21, defined over the generalized nets, is introduced and its basic properties are studied. In the result a shorter and more compact generalized net model has been obtained. Twelve generalized net models are constructed. They are related to different activities in a university - Financing, Supplying and Serving of Sections, University classes schedule, Intranet.

**Depository Library** Central Research and Technical Library

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**Author** Kirilov, Rosen Ivanov.  
**Degree** PhD  
**Title** Design and Efficiency of Bank Computer Information Systems for Credit Risk Analysis in Internet Integrated Environment  
**Affiliated Organization** University for National and World Economics, Studentski grad, 1100 Sofia  
**Abstract** The thesis analyzes methodological and information problems for design of computer information systems for credit risk analysis. The thesis defines information digestion of the problems with dynamic input and output of information system, method for valuation the efficiency of electronic markets and Computer Information Systems for Credit Risk Analysis Integrated Environment.

**Depository Library** Central Research and Technical Library

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**Author** Paunova, Stilia-Felisi Kirilova.  
**Degree** PhD  
**Title** Fields of Homogeneity in Interpersonal Internet Communication  
**Affiliated Organization** Sofia University "St. Kliment Ochriski", 15 Tsar Osvoboditel Blvd., 1504 Sofia  
**Abstract** The theme of the dissertation is connected with the global actuality of the Internet communications comes from its origin cultural change in the human being and his social segregations, and globally - in intercultural relations in the world. The subject of the dissertation is interpersonal communication of culturally different partners in Internet seen once at its own point of view, and then - in comparative perspective with the face-to-face communications, and in comparative perspective with the other media communications. The object of the research is the Internet - audience and its degrees and qualities of producing intercultural communicative conditions and abilities.

**Depository Library** Central Research and Technical Library

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**Author** Gradinarova, Boyka Jhekova.  
**Degree** PhD  
**Title** The Integrating Requirements of Methodology and Technology of Distance Learning and Educational Software  
**Affiliated Organization** Technical University - Varna, 1 Studentska Str., 9000 Varna  
**Abstract** The dissertation is investigating the problem of improving the means and methods of designing distance learning courses by integrating modern Internet technologies, with a view to offering a more flexible and qualitative education. There are created methodological and software means supporting the designing and carrying out of such courses. WWW is shown as an environment for designing and developing courses on one hand and a subsidiary platform for the learning process on the other hand. The developed methodological and technological means don't carry with regard to the subject area. also The developed methodology for evaluation of quality of the on-line learning process is presented and the results of its experimental application are analyzed. Issues of analysis of the experimental research of students' learning behavior, their attitude to the means and methods used, to the created learning environment and the discussions held, also to the quality of communication and the role of collaboration are described. The analysis of the results of the inquiry held among the students of their opinion about the quality of the course, their attitude to the distance form of education and their preferences are also presented.

**Depository Library** Central Research and Technical Library

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**Author** Popova, Maria Alexandrova.  
**Degree** PhD  
**Title** The Virtual Man - Social and Communicational Features  
**Affiliated Organization** Sofia University "St. Kliment Okhridski", 15 Tsar Osvoboditel Blvd., 1504 Sofia  
**Abstract** The Internet user is determined as a virtual man in the text. He is the main and active factor in the virtual space. The virtual man is presented with its multiple identity, anonymity, radical uncertainty and possibility to create virtual community and society. The influence of social environments is presented by economical and political relationships, creation of cultural and media products, regulation possibilities and the cyber crime prevention.  
**Depository Library** Central Research and Technical Library

**PUBLICATIONS IN BULGARIAN SCIENTIFIC PERIODICALS ON THE TOPIC  
 "INFORMATION SOCIETY"  
 "Scientific and Technical Publications in Bulgaria" Database-NACID**

**Author(s):** Kiskinov, V.  
**Title article:** New Qualities of Law in the Information Society  
**Description of source:** Contemporary Law, 2006, N 1, 7-22  
**Abstract:** The advancing information society influences the characteristics of contemporary law. The changes consider the legal science, the normative regulation and the law enforcement. Thus the information society's impact on law has three major directions. First, new objects of normative regulation appear. Second, new mechanisms for law enforcement within the virtual environment are elaborated. These effects determine the nature of law changes. Third, the legal science and its conceptual apparatus are changing. The article examines the changes in the first and second direction. The concepts "virtual legal relations" and "virtual legal facts" are introduced. Their original qualities are stated. The operation of virtual legal relations is described and the significance of virtual legal facts within the legal framework of the virtual environment is pointed out

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**Author(s):** Ognyanova, N.  
**Title article:** From Television to Information Society Services: EC Policy and Legislation  
**Description of source:** Contemporary Law, 2005, N 1, 30-50  
**Abstract:** IT development radically changes the nature of electronic media. The convergence between IT, electronic media and telecommunications raises many problems and many legislative choices. Mass media is fast disappearing. Ahead is the age of "massless media" and information society services. The new nature of television and legal aspects of changing EC policy and legislation are considered in the paper.

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**Author(s):** Shtrakov, S, G. Kalpachka, A. Stoilov  
**Title article:** Computer Tests for Check and Validation of the Students' Achievements  
**Description of source:** Elektrotechnika & Elektronika, 2005, N 3-4, 68-73  
**Abstract:** In this paper a self-created computer system "Learning tests" for checking and validation of students' achievements is presented. The program application is cre-



ated by means of visual programming developer tool "Delphi". It comprises an executable application file and data base files, made by software product "Paradox 7". The basic functional possibilities of the computer system are: creation and storage of tests in different fields of study, holding tests with different students groups, storing data base for students. In the paper different types of tasks and questions, which take place in a typical computer tests practice, the possibility to use auxiliary information for the presented questions, the way of knowledge estimation and validation of achievements, the visualization of results, etc. are discussed. Exemplary tests, connected with the teaching of the chapter "Mechanical oscillations and waves" at the 9th class, first and second level, are used to illustrate the program's possibilities. The computer system "Learning tests" can be used for check and validation of students' achievements in oilfields of study.

**Author(s):** Nikolov, R.  
**Title article:** The Role of Education, Science and Technologies on the Development of the Society  
**Description of source:** Science, 2004, N 1  
**Abstract:** This paper describes the author's vision of the role of the new technologies, education and science, based on some emerging models and lessons learnt by the Department of Information Technologies, Faculty of Mathematics and Informatics, Sofia University and its large network of Bulgarian and international partners. This vision implies that Sofia University should be not only the educational and scientific centre of the country, but also to become a national and regional innovation and high technology centre, which provides a working model of 'university-industry-government cooperation'. Sofia University, as the national leader in higher education, should play a crucial role in providing better high technology and e-skills orientated education and training, targeting the needs of the industry and society. The level of entrepreneurship and understanding of the commercial value of knowledge are considered to be the key factor for adapting a university to the requirements of Knowledge Economy. Development of the Bulgarian e-Learning industry could be considered as one of the strategic directions of the country. This industry could be considered a 'meta-industry' since it could positively influence all other industry sectors. It could become the Bulgaria's most important asset on its way to the Information Society and Knowledge Economy. However this industry, as any other for that matter, needs investments. It could be expected that such investments would radically change the «knowledge sector» of the industry, which should be built around the real knowledge producers - universities and research institutions.

**Author(s):** Schwertner, K  
**Title article:** Creating Some ORACLE DATA BASES for Telecommunication Company BTC  
**Description of source :** Elektrotechnica & Elektronika, 2005, N 3-4, 55-61  
**Abstract:** The paper presents Oracle Data bases in Telecommunication Company. Oracle is widely used in BTC for storing large amounts of data in numerous applications. One of the biggest information systems is the corporate information system for the communication net maintenance. It comprises software components for selling of services to customers and for technical support of parts of the telecommunication net. The subsystem for repair of damages provides tools for claiming

and registering of damages, for automated test of the damages and for the administration of the process of the repair. The subsystem integrates technical (string, numbers), graphical and geographical data, which describe the communication net in one united DB. The development is done using Oracle CASE tool Designer/2000 and application development environment tools Forms and Reports. The basic notions, architecture and possibilities OLAP Oracle tool Express server are explained. This product provides a multidimensional view on large amounts of consolidated data and flexible possibilities of real time collecting of statistics. The advantages of the grid processing of data and maintenance of DB with the new release of Oracle 10g are shortly discussed.

**Author(s):** Stoyanov, S, I. Ganchev, I. Popchev, M. O'Droma  
**Title article:** From CBT to E-Learning  
**Description of source:** Information Technologies and Control, III, 2005, N 4, 2-10  
**Abstract:** Two basic concepts, significant for the development of software in support of the learning process, are formally presented, distinguished and compared. The first, Computer Based Training (CBT), is used as a starting point for the development of a means for learning support. The second, eLearning, is used as a reference point for long-term research and development of education and learning using the full potential of electronic media and technology. The paper includes a demonstration of an approach for the development of information systems for education, based on clear differentiation between these two concepts.

**Author(s):** Dimitrov, I.  
**Title article:** Internet and Popularization of Science  
**Description of source:** Journal of the Bulgarian Academy of Sciences, 2006, N 2, 53-56  
**Abstract:** This article mainly represents the author's practical experience into science popularization activities via Internet. Some theoretical issues concerning the EU idea of Knowledge-based society are discussed, too. However, the focal point is on a project for an interactive knowledge network named 'Democritus'. The central problem can be expressed by means of the decisive question: "How the objective expert evaluation could be guaranteed through a rational communication system?"



## E V E N T S

### 25-28 October, 2006

3rd Workshop on Neutron Measurements,  
Evaluations and Applications

#### **NEMEA-3**

Borovets, Bulgaria

Address:

Institute for Nuclear Research and Nuclear  
Energy,  
Bulgarian Academy of Sciences  
72, Tzarigradsko Shosse, 1748 Sofia, Bulgaria  
Phone: ++3592 7144604 or  
++3592 8757086

### 2-4 November, 2006

Third International Conference

#### **"Mechanics and Machine Elements"**

Sofia, Bulgaria

Address:

Technical University of Sofia  
Department of Machine Elements and Non-  
Metal Constructions, Mechanical Engineering  
Department  
8, Kliment Ohridski Blvd., Sofia 1756, Bulgaria  
office 4425 Phone: (++359 2) 965 3219  
E-mail: [nedpetko@tu-sofia.bg](mailto:nedpetko@tu-sofia.bg)

### 7-8 November 2006

National Scientific and Technical Conference  
of Automation with International Participa-  
tion

#### **BULICAMC '06**

Earth and Man National Museum, Sofia, 4,  
Cherni Vruh Blvd.

Address:

108, Rakovsky Str., 1000 Sofia  
Scientific and Technical Union of Mining,  
Geology and Metallurgy  
Phone/Fax: +359 2 986 13 79,  
E-mail: [mdgm@fnts-bg.org](mailto:mdgm@fnts-bg.org)

### 8 - 10 November 2006

Jubilee International Scientific Conference  
**"Economic Asymmetries in United Europe"**

Svishtov, Republic of Bulgaria

Address:

D. Tsenov Academy of Economics  
2, Em. Chakarov Str., 5250 Svishtov  
Phone: ++359 631/ 66 205; 6 04 50  
E-mail: [agop@uni-svishtov.bg](mailto:agop@uni-svishtov.bg)

### 9-11 November 2006

International Science Conference '2006  
**"20th Anniversary of the Plovdiv Branch of  
Technical University - Sofia"**

Address:

Plovdiv Branch of Technical University - Sofia  
E-mail: [conference@tu-plovdiv.bg](mailto:conference@tu-plovdiv.bg)

### 9-10 November 2006

International Symposium  
**"Modern Technologies, Education and  
Professional Practices in Geodesy and  
Related Fields"**

Sofia, Bulgaria

Address:

Union of Surveyors and Land Managers  
in Bulgaria  
House of Science and Techniques,  
108, Rakovski Str.  
1000 Sofia, Bulgaria  
Fax: +359 2 987 9360,  
Phone ++359 2 987 5852  
E-mail: [geodesy\\_union@gis-sofia.bg](mailto:geodesy_union@gis-sofia.bg),  
[geodesy\\_union@fnts-bg.org](mailto:geodesy_union@fnts-bg.org)

**24–25 November 2006**

International Scientific Conference

**Unitech'06**

Gabrovo, Bulgaria

Address:

5300 Gabrovo

4, Hadji Dimitar Str.

Technical University of Gabrovo

*<http://unitech.tugab.bg>,*

E-mail: *[unitech@tugab.bg](mailto:unitech@tugab.bg)*

Phone: ++359 66 223 505

**30 November – 1 December 2006**

National Conference with International  
Participation

**GEOSCIENCES – 2006**

Address:

CLCM, BAS, Sofia 1113,

“Acad. G. Bonchev” Str., Block 107,

Phone: ++ 359 2 870 01 61 (ext. 52);

++ 359 2 979 32 45 (ext. 52)

E-mail: *[etarassova@mail.bg](mailto:etarassova@mail.bg), [www.bggs-bg.org](http://www.bggs-bg.org)*