How the results of informatics department of NAS of Ukraine in ICT can be useful for cooperation with EU

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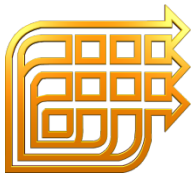


Informatics department in FP7

SCUBE-ICT

Glushkov Institute of Cybernetics

POPDAT – Problem-oriented Processing and Database Creation for Ionosphere Exploration

Space Research Institute

AFFECTS – Advanced Forecast for Ensuring Communications Through Space

Space Research Institute

EduMEMS – Developing Multidomain MEMS Models for Educational Purposes

Educational Scientific Center “Institute of Problems of System Analyses”

Risk Factors of Work-related Diseases and Prevention

International Scientific Educational Center of Information Technologies and Systems

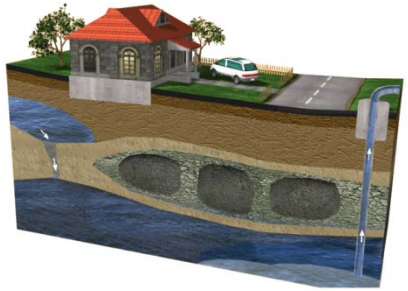
Scientists of the informatics department of NAS of Ukraine possess modern information processing technologies that solve complex practical problems in many vital areas of modern society.

This includes:

- **Ecology problems,**
- **Optimal decisions in different application domains**
- **Forecasting and economic management,**
- **Reliable software for complex applications**
- **Agriculture**
- **Bioinformatics**
- **Medical diagnostics**

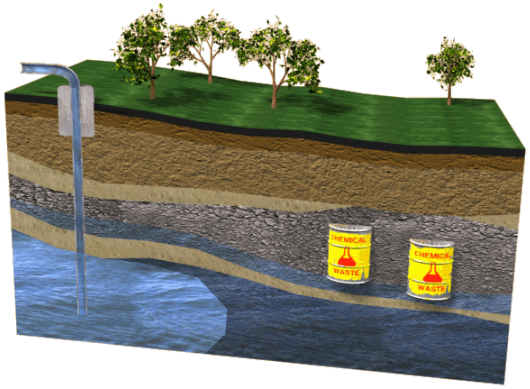
Technology of efficient mathematical modeling of phenomena occurring in spatial environments

System “НАДРА” (subsoil)

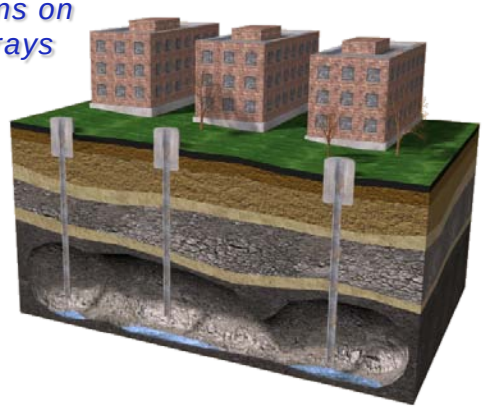


Influence of mining activities on the state of soil media

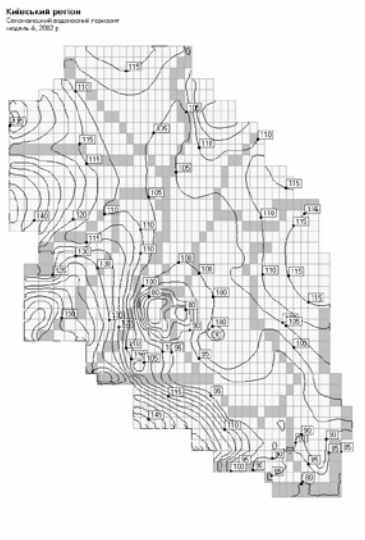
Influence of constructions on the state of ground arrays



Burial of toxic wastes, and groundwater contamination

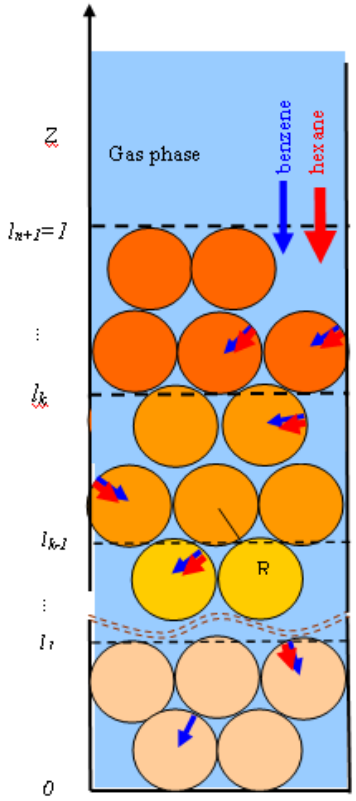


The disappearance of drinking water from aquifers



Computing isolines of piezometric water head in the Cinemania aquifer for the rivers of Ukraine (more exact than before geometry of small rivers)
Important data for monitoring pollution of groundwater

Identification of parameters in nano-porous environments.
Application domains are: biomaterials, pharmacology, sensor devices.
The results were used by French scientists



The use of supercomputers allows to perform computations on large amounts of data (city, region, country)

Is based on high-performance, grid, and cloud computing

Closely connected with “ICT for health topic”

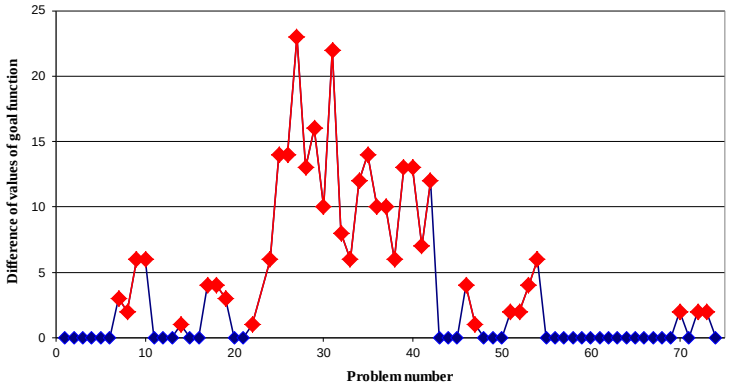
Technology of efficient solving of optimization problems:

- discrete optimization
- stochastic optimization
- nonlinear problems
- nonconvex problems

Technology is based on theoretical results that can be considered as belonging to FET

Technology of discrete optimization

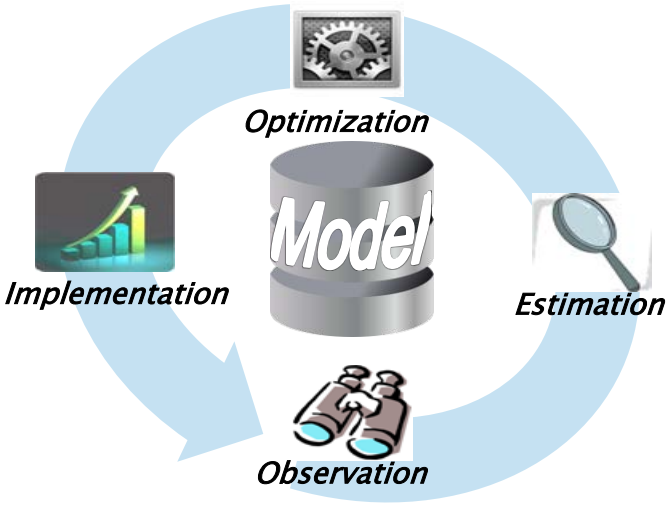
New global equilibrium search algorithm (GES) is the best one among all known discrete optimization algorithms of this kind. For 37 test problems obtained new records

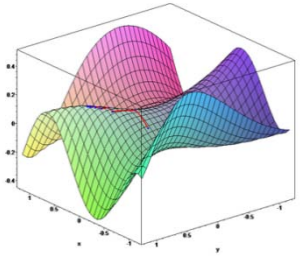


GES is faster then:

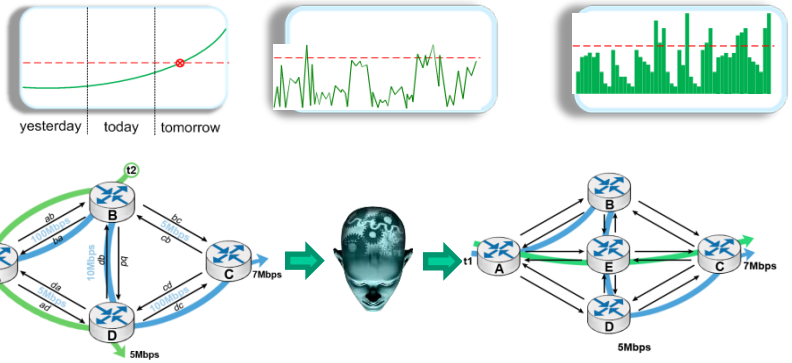
- **SS in 78 times;**
- **CirCut in 29 times;**
- **VNSPR in 10632 times.**

Technology of stochastic optimization





Stochastic systems with local interaction



Global changes, new risks and new methods for their evaluation

Societal challenges

Information technology of safety management for environmental, epidemiological and social systems under abrupt changes of modes of functioning

Prediction of macroeconomic indicators

- *Open variant*
- *Assumptions*
- *Analysis of results*
- *Close*
- *Perform calculations*

Software design technologies

Based on insertion modeling of multiagent distributed interactive systems

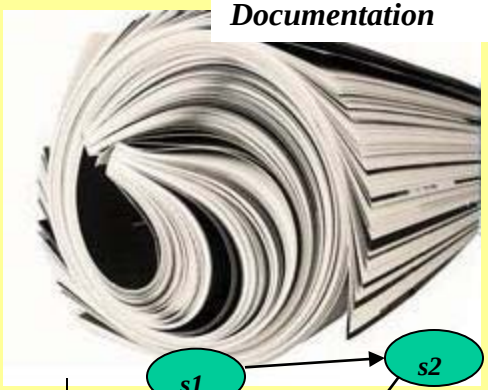
Three levels of super reliability of software and hardware systems:

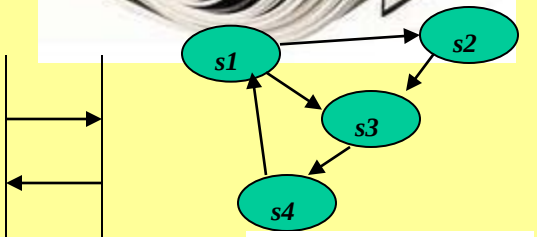
- **Formal verification of requirements**
- **Symbolic simulation of design models**
- **Deductive testing of software and hardware systems**

Technology has been implemented in the system VRS developed for Motorola and used by UniqueSoft company

Design technology from requirements to reliable product

Textual Documentation





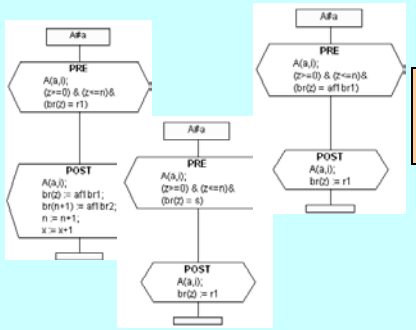
State machines

Charts

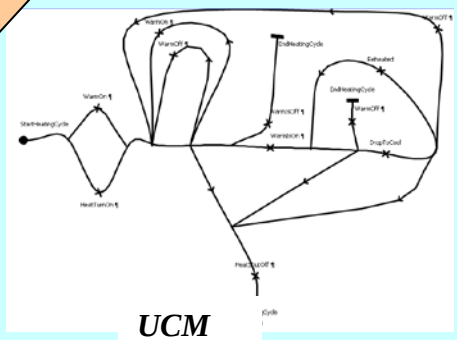
Data1	Data2	Data3
12	14	X
13	15	Y

Tables

FORMALIZATION



Basic Protocols



UCM

VERIFICATION

Verification Verdict

Trace Generation

Test Suite (Traces)

Design (Code) Generation

Generated Code

Computational technologies in agriculture

Portable device for rapid diagnosis of the states of plants “Floratest”

Rapid assessment of plant life after drought, frost, clutch, including pesticides;
Rapid determination of optimal doses of chemical fertilizers and biological additives, which Allows to optimize the amount of fertilizers and additives and reduce nitrate content in vegetables;
Rapid Determination of contamination of water, soil and air by pesticides, heavy metals and industrial emissions;
Saving energy and water by artificial irrigation;
of pesticides;

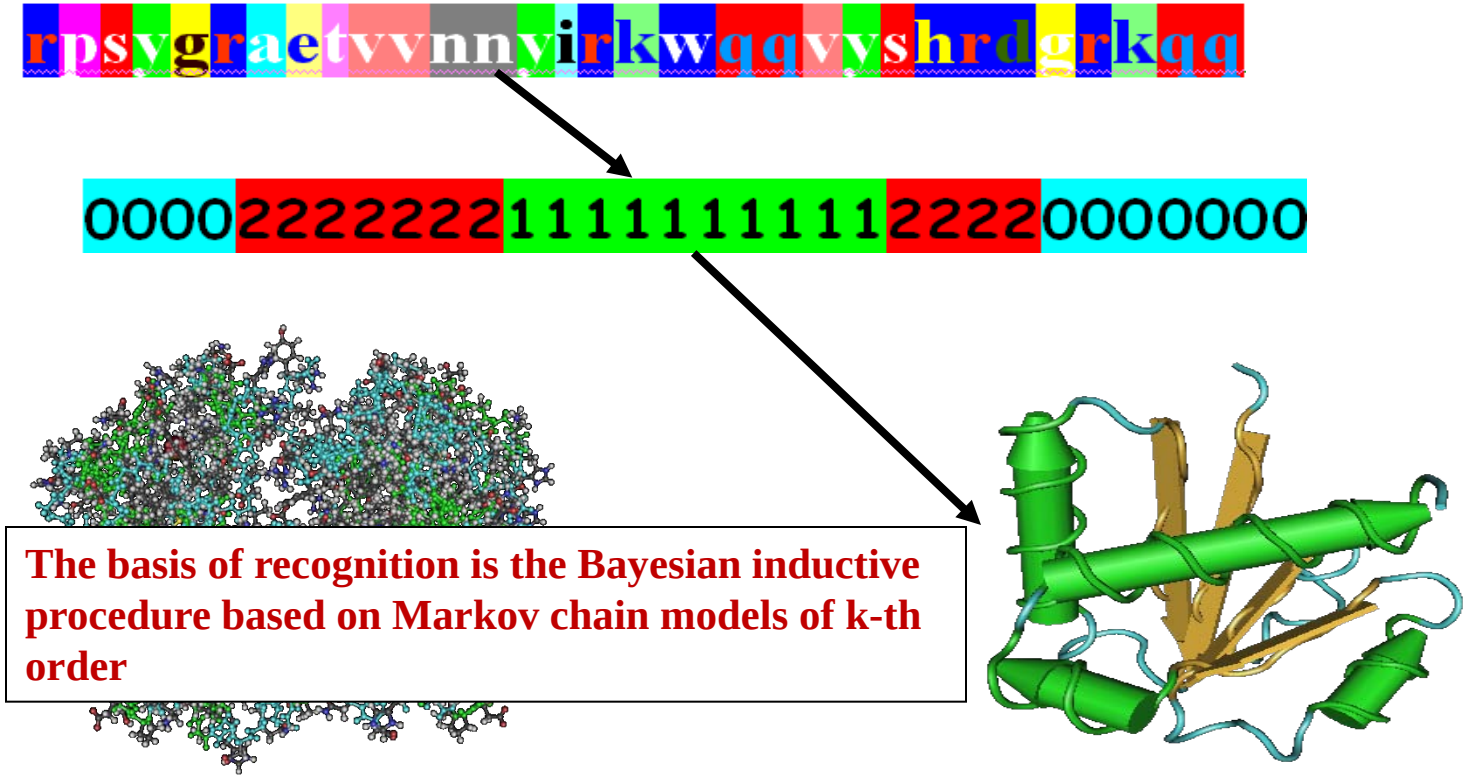
Creating precision agriculture technology in the manufacture of high-quality wines and wine in conjunction with biosensors, developed at the Institute of Molecular Biology and Genetics NAS of Ukraine (since Rapid assessment of grape plants and completing an express assessment of the quality of the final product - grape and wine);
in agriculture insurance unit provides a forecast results for future crops;
Automation Research in Plant Physiology

Electric quadrocopter – unmanned vehicle as a mobile data collector from a network of miniature devices of the family "Floratest"

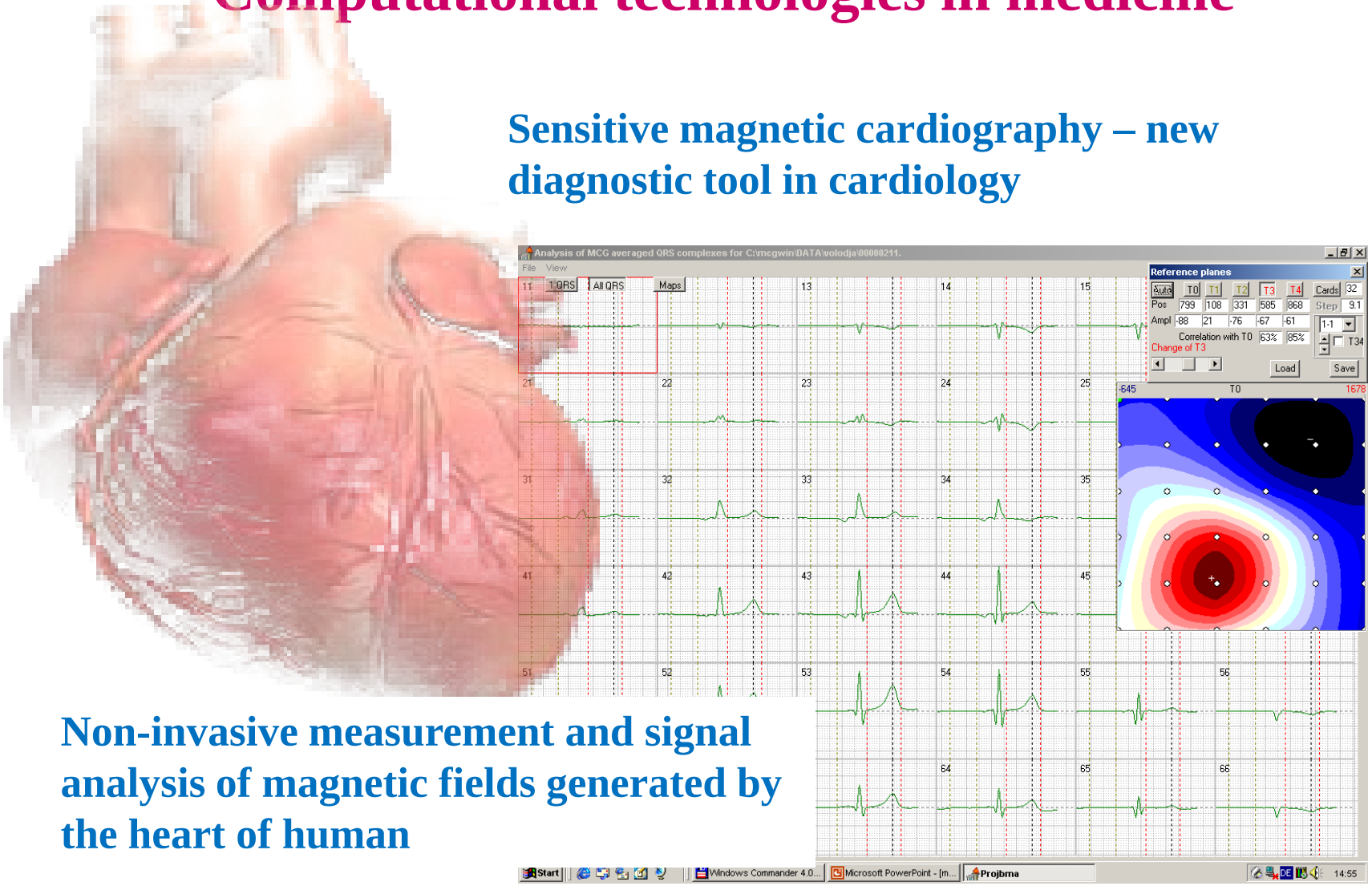
Sustainable agriculture

Computational technologies in bioinformatics

Recognition of structural components of spatial protein conformation



Computational technologies in medicine



Sensitive magnetic cardiography – new diagnostic tool in cardiology

Non-invasive measurement and signal analysis of magnetic fields generated by the heart of human

Concluing remarks

1. **Only a small part of ICT projects performed in GIC and informatics department were considered**
2. **All of them are performed as cooperative projects with institutes of NASU and industrial companies**
3. **Most of these projects have partners from EU**
4. **Projects meet the priorities of Horizon 2020 and can be used for preparing proposals to H2020**
5. **We are looking forward to cooperate with European science following priorities of H2020.**

Thank you