Scientific activity in Technical University of Georgia

Department of science

Scientific activity in Technical University of Georgia

Technical University of Georgia traditionally is not only the leading engineering higher school but also a powerful scientific center the authority of which is unshakably high for contemporary world scientific groups.

At scientific centers and laboratories of GTU for many decades were and are performed scientific-research works in such important fields as: information technologies and automatic systems, metallurgy and chemical technologies, biotechnology, machine building, aeronautics and astronautics, civil engineering and architect, communications, power engineering, transport, mining and geology, etc.

Scientific and Scientific educational centers of the GTU

Scientific-engineering-educational center of heat engineering. Supervisor – Prof. A Beroshvili;

Scientific sensory center. Supervisor – M Tabutsidze;

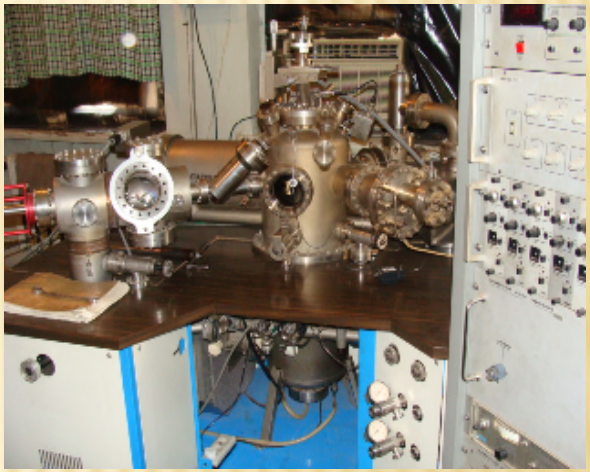
- Republican center of structural researches. Supervisor – Prof. E. Kutelia;
- Scientific center of diamonds and composite materials. Supervisor – Prof. N.Loladze;
- Scientific center of virtual computer technologies. Supervisor – Prof. D.Kereselidze;
- Scientific-research center of technical diagnostics of civil engineering faculty. Supervisor – Prof. R.Imedadze;
- Institute of special construction systems and engineering support. Supervisor – N.Tsignadze;
- Nuclear engineering center. Supervisor – Prof. L.Shermazanashvili;
- Center of fiber reinforced composite materials. Supervisor – Prof. D.Nozadze;

Scientific and Scientific educational centers of the GTU

- Republican center of hemology, diagnostics and processing of mineral substances. Supervisor – Prof. N.Poporadze;
- Engineering service center of transport and machine building faculty. Supervisor – Prof. G.Goletiani;
- Research center of medical polymers and bio-materials. Supervisor – Prof. R.Katsarava;
- Scientific educational center of Transport and machine building faculty of GTU in wood materials production and treatment . Supervisor – Prof. Z.Chitidze;
- Scientific educational laboratory of high temperature and energetic facilities. Supervisor – Prof. N.Kevkhishvili;
- Scientific-research institute of bio-energetic technologies. Supervisor – Prof. S.Dadunashvili.
- Scientific-educational center of construction site, road building and handling machinery. Supervisor – prof. M.Shilakadze.

Republican center of structural researches

The major scientific activity of the center was and is concerned to fundamental researches of structural-phase conversion of condensed environment, to creation of new scientific methods of research and new technologies (including nano-technologies) scientific grounds for production of new constructional and fundamental purpose materials and items needed for contemporary technique



Republican center of structural researches

On contemporary stage the center performs the following scientific and applied works:

1. Creation of nano-crystalline scintillation materials, powders and solid samples;

2. Nano-crystalline hard alloys and billets: water current cutting nozzle, high pressure water intake facility shaft, cutting tools, wear-resistant members of machines and devices, plates of bullet-proof vests.

3. Technology development of nano-crystalline composite materials production.

Republican center of structural researches

The Republican Center works in taight connection with following well known foreign companies and organizations:

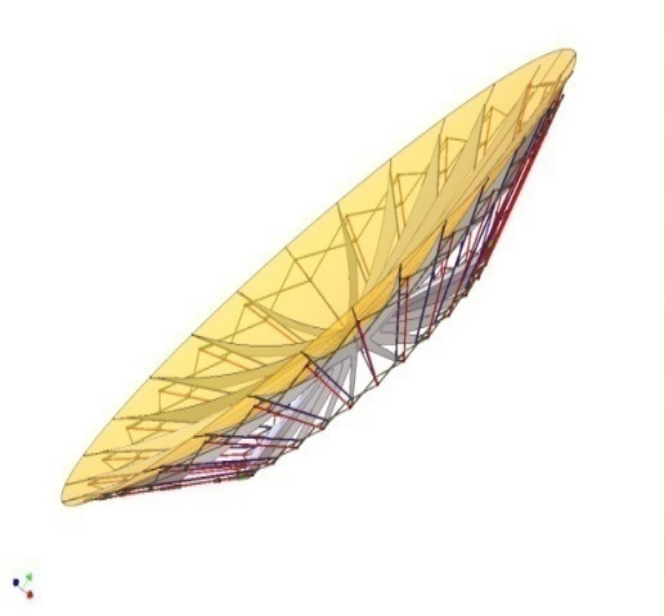
- Siemens Medical Solutions Molecular Imaging, Knoxville, TN, USA;
- ALEM ASSOCIATES, Boston ,MA, USA;
- Crystal Photonics Inc, Sanford, Florida, USA;
- Saint-Gobain Crystals, Newbury, OH, USA;
- Federal Institute for Materials Research and Testing (BAM), Berlin, Germany;
- Scintillation Materials Research Cener, Knoxville, TN, USA;
- Komatsu Ltd, Kanagawa, Japan;
- Nisan Motor Co. Ltd, Kanagawa, Japan.

Institute of constructions, special systems and engineering provision

Research area of the institute concerns to design and realization of orbital and earth engineering complexes and means of cosmic systems.

One of the remarkable work done by the institute is creation of original scheme of unfolding space reflector with new type of actuators.

Besides, design and build up of pilot samples of reusable rapidly assembled steel bridges in extreme situations are successfully performed.



New scheme of Unfolding space reflector

The constructions developed at the institute are based on using the theory of transformable engineering systems.

Institute of constructions, special systems and engineering provision

Reusable rapidly constructed steel bridge

Unfolding single-span reusable bridge (L = 48 m)

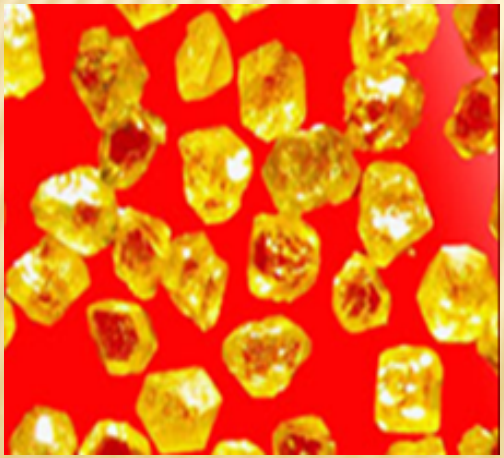
International contacts

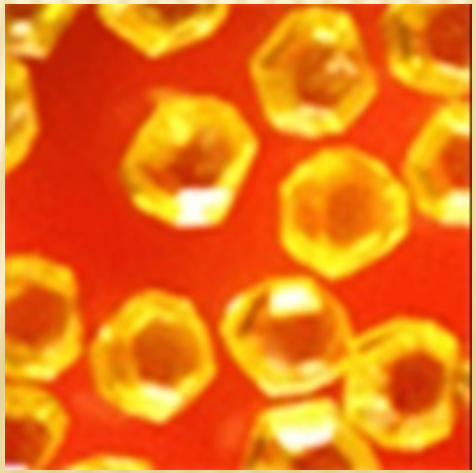
- Technical University of Munich.
- Italian company “Alenia spatio”.
- German company “Daimler bentz aerospace”
- Department of antennas of European cosmic agency – “ESTEC”.

Scientific center of diamonds and composite materials

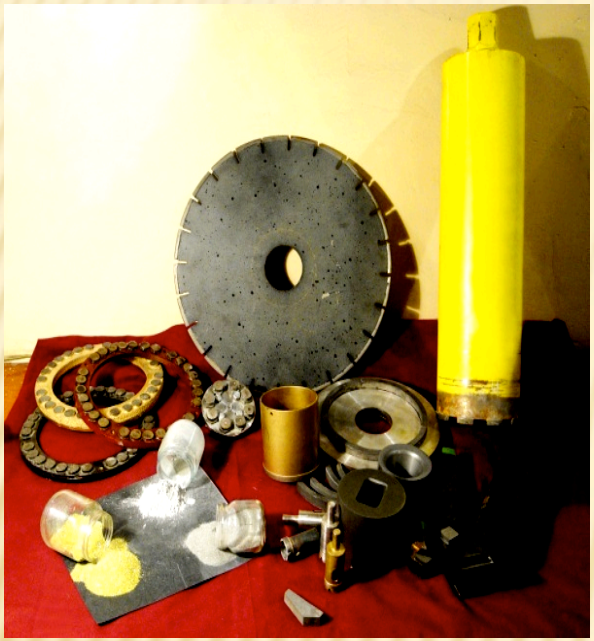
Actual scientific-research works:

On the basis of diamond shaping theory is elaborating the new innovation technologies for obtaining of diamond crystals with previously planed desired dimension and properties.





Scientific center of diamonds an composite materials



On the basis of innovative technologies the scientific works are carried out for production of highly effective diamond composition and other super-hard materials used for treatment of metal and non-metal materials.

Direction of electro mechanics of the department of mining technologies

Development of high efficiency plasmatron

Water vapor plasmatron for treatment of high resource and technical economic efficiency materials is created used for machine repair and building materials cutting and coating.

Problem of durability and efficiency is solved by creation of long-cathode plasmatron.

Service life of such plasmatron exceeds 10 times the service life of plasmatrons produced by foreign companies.

Republican center of hemology and mineral matters research, diagnostics and processing

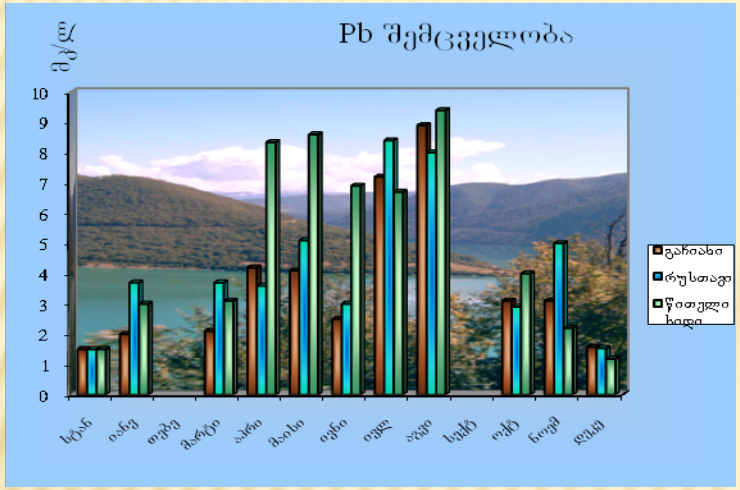
The center is carrying out the following research works

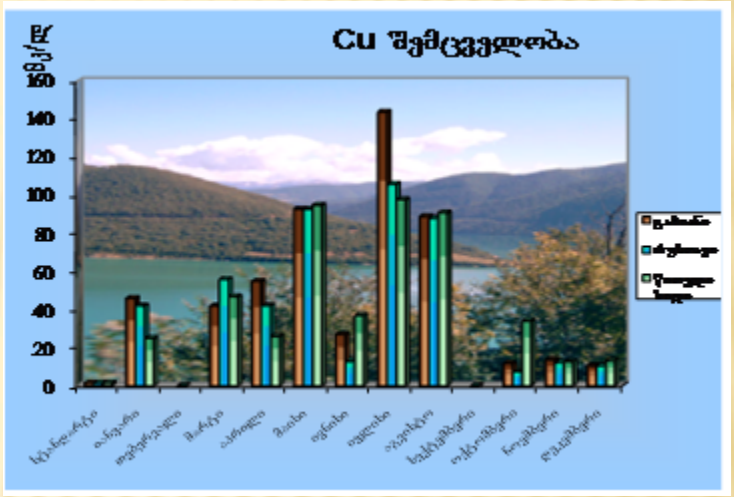
- Research metal-ceramic composition materials;
- Estimation of ground and water pollution area of territories of powerful enterprises of the republic and iso-areal mapping;
- Determination of various geo-dynamic modes of metamorphism and heat and mass transfer modeling (on example of the Caucasus).
- Research of luminescent properties of synthetic and natural crystals.
- Chemical and technological research of gold and silver artifacts discovered by archeological excavations and estimation of their raw material conjectural origin.
- Mineral-chemical study of jewelry and hand-crafting stones and litho logic-chemical study of non-metal ware and estimation of raw material origin.

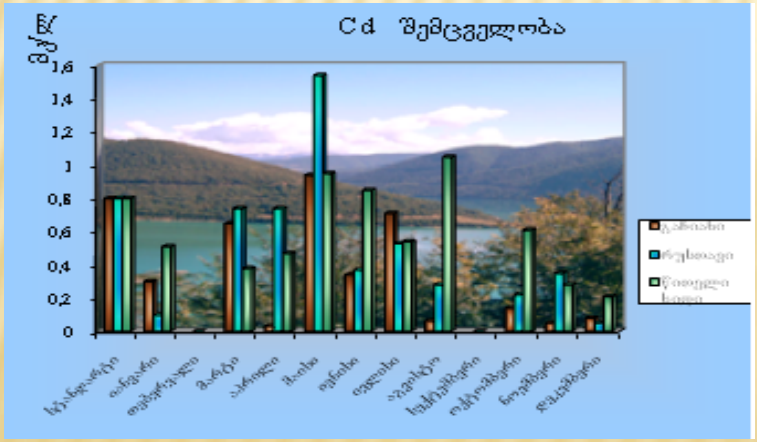
Republican center of hemology and mineral matters research, diagnostics and processing

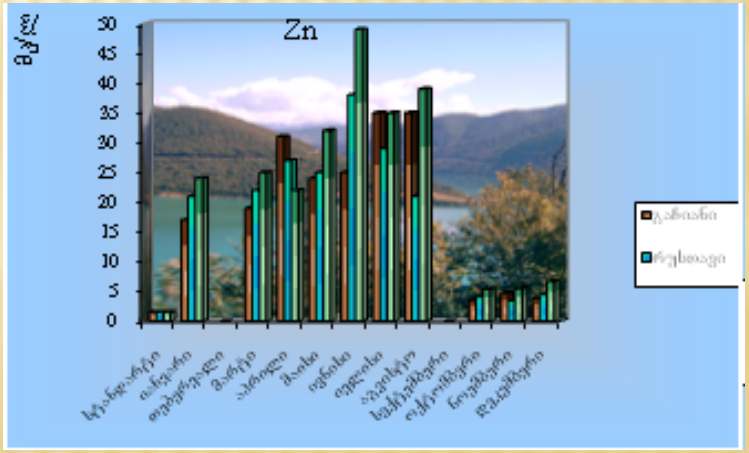
Research results

Analysis of metal pollution level of the Mtkvari river









Republican center of hemology and mineral matters research, diagnostics and processing

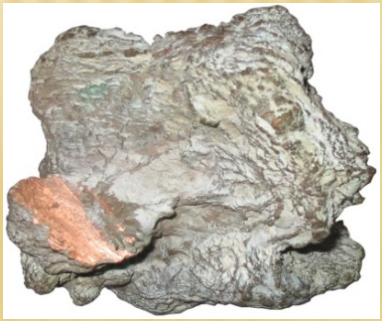
Research results

Complex analysis and inventory the Goderdzi fossil forest with the aim of conferring the status of protected territory nature monument



Chemical composition analysis of artifects - silver and gold coins discovered as a result of archaeological excavaions. It has been stated that chemical composition of the “Kolkhuri tetri” differ on the sutface and in depth. Chemical composition and hardness of no “Kolkhuri tetri” coin corresponds to that of silver. Its core is made of copper.



Educational-Scientific Laboratory of High-Temperature Thermal Power Engineering Devices

Dust-collecting filter

By order of JC road building company "Tbilisi" the laboratory has developed a new construction dust-catching filter and installed at the Avchala asphalt-concrete plant. It is used for filtering of inert materials heating furnace exhaust. Filtration coefficient is 0.995.

Scientific-educational laboratory of high temperature thermo-energy plants

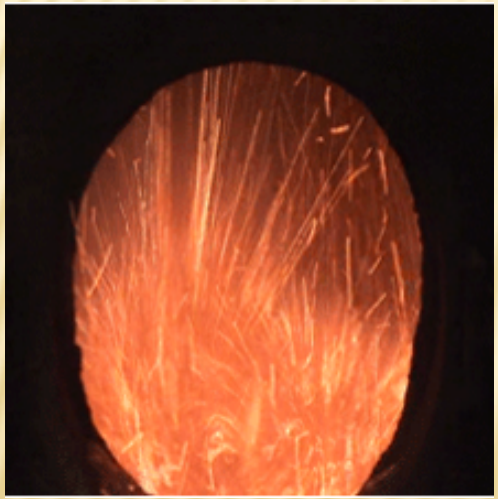
Development of the technology of receiving heat insulating and insulating constructive building materials with high temperature heat treatment

Building materials with 3-4 times less thermal conductivity and 2-2.5 times lighter compared to the materials used at present have been created. Nowadays, continuous cycle technology of building blocks production is being developed. The wall constructed of such blocks twice decreases heat losses compared to the same thickness brick walls.

SCIENTIFIC-EDUCATIONAL LABORATORY OF HIGH TEMPERATURE THERMO-ENERGY PLANTS

Elaboration of heat-power device working on low quality fine fractional local coal.

At the laboratory new technology of burning of low quality coal in boiled layers has been elaborated, which implies burning of solid fuel by usage of vibro-boiling process without preliminary treatment of fuel. The technology allows to use all kinds of low quality solid fuel with ecological demands taking in account.



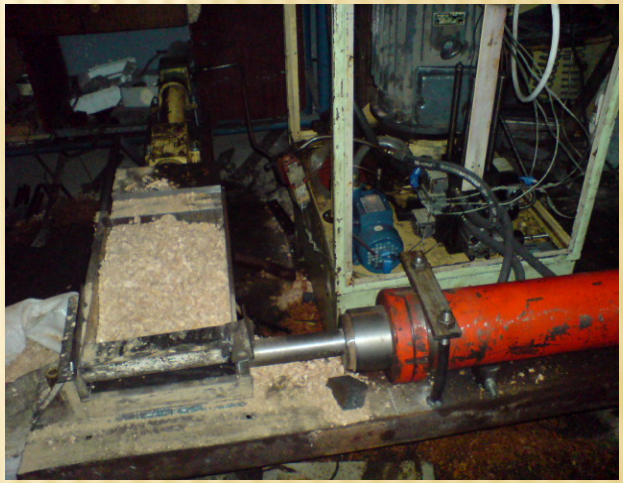
Vibro-boiling process

The burner for industrial means with 10 megawatt output power.

ENGINEERING SERVICE CENTER OF TRANSPORT AND MACHINE BUILDING FACULTY

Production of ecologically clean bio fuel

The palletised briquettes of bio-fuel

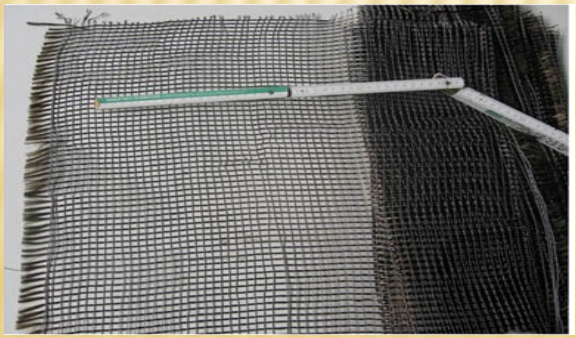


The actuating unit of the high pressure device for production of bio-fuel briquettes.

The technological line for production of bio fuel as briquettes from different reminders of timber and agro-food industries has been created at the centre

Center of fiber reinforced composite materials

By using of corrosion-resistant fiber-glass and locally manufactured basalt fiber as concrete reinforcement element an original technology is worked out, which is used for production of elements of building constructions, ornamental elements of exterior facade and interior of buildings, parts of drainage and sewerage system.



Scientific-engineering-education center of heat engineering

A new scheme of piston-cylinder group with minimum friction losses is developed. A number of high factor thermal machines are created on the basis of this scheme.

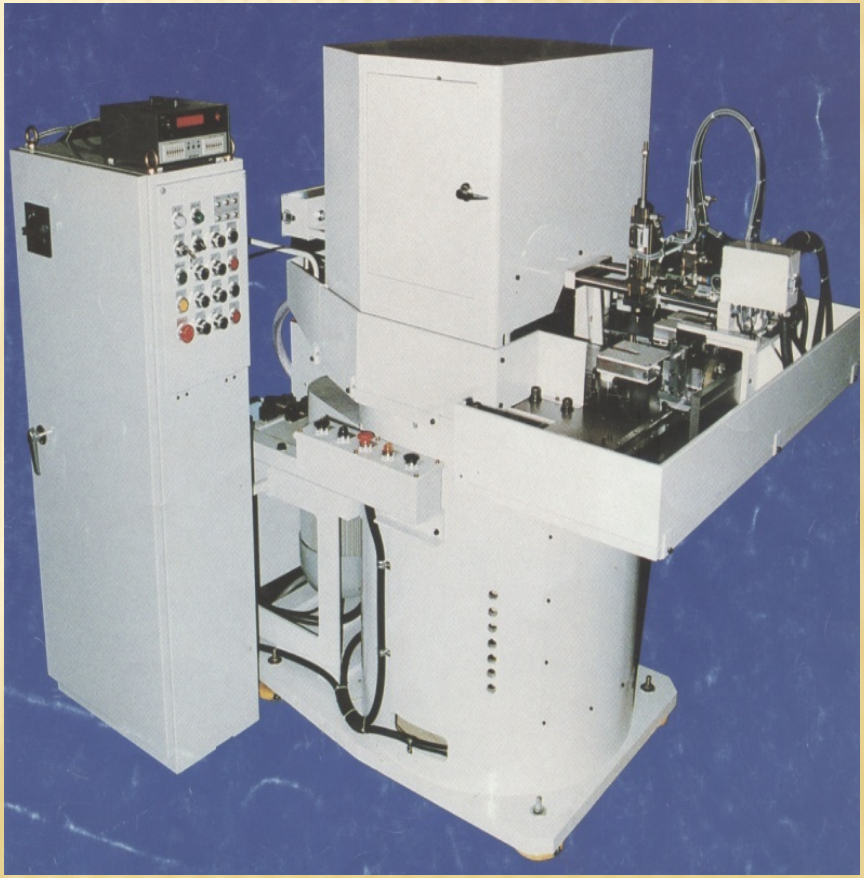
Liquid oxygen compact pump

High pressure natural gas pump

Transport and machine building faculty

Technology of fine treatment of super hard and brittle hard treated nonmetallic materials

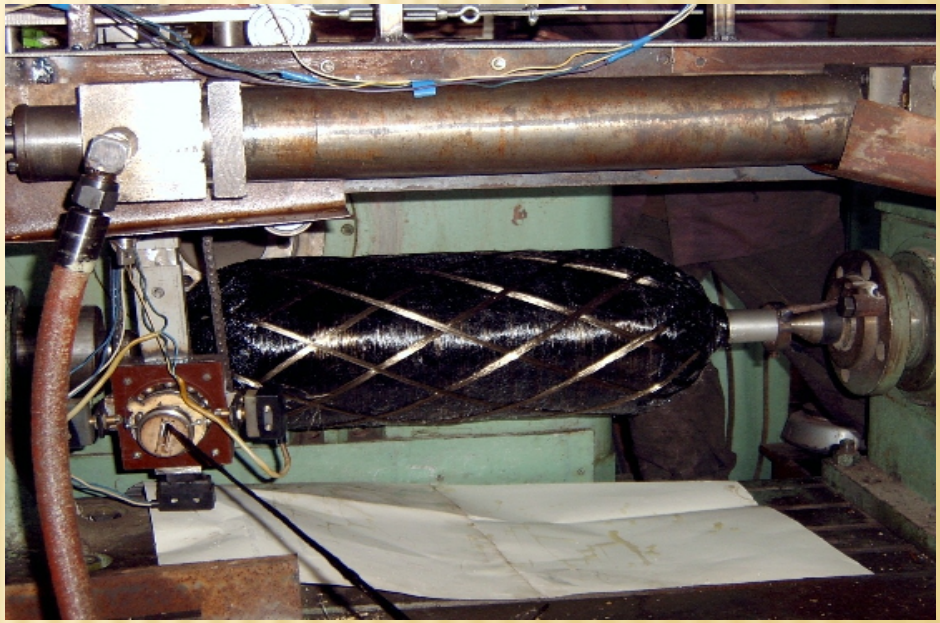
At the department of machine building technology, the technology of fine treatment of super-hard and brittle hard-treated nonmetallic materials have been developed, the patent of which in the second part of the eighties was sold to Germany and Japan. On the basis of this technology at contemporary stage is being developed in cooperation with the James Morris Liverpool Technological University.



Fine grinding machine

Transport and machine building faculty

At the same department the technology of high pressure natural gas cylinders production using fiber polymer composites is developed.



High pressure natural gas containers produced on the basis of fiber polymer composites

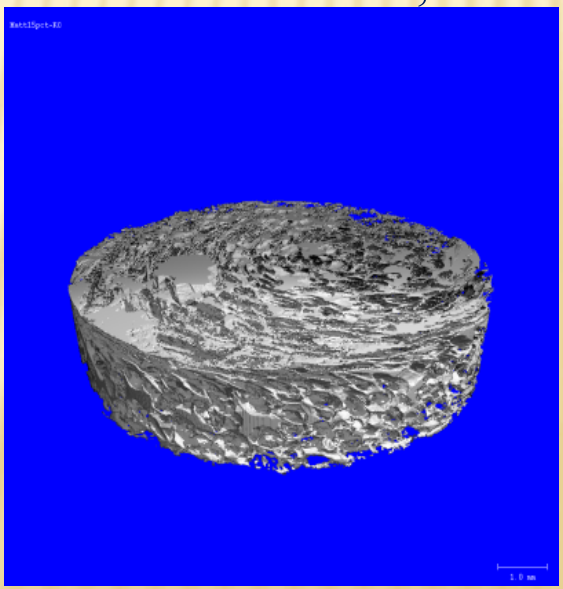
Education-scientific center of wood material production and processing

The investigations performed at the center are connected with production of wood material producing and processing facilities, instruments, machine-tools and high quality experimental furniture and creation of pilot samples. The center also works on development and production of wood materials processing instruments prepared of hard-alloyed metal and steel covered with titanium nitride.

Research Center for medical polymers and biomaterials

In the centre wound dressing (artificial skin) “PhagoBioDerm” has been elaborated. It is composed on the basis of original biodegradable polymer and contains a complex of bacteriophages and other bactericides, as well as pain killer and enzymes. “PhagoBioDerm” shows a high bactericidal and anti-inflammatory activity.

Another achievement of the center is production of medical bactericidal glue GF-6 (spray). Represents a solution of original biodegradable polymer in ethanol. Contains silver sulfadiazine and other powerful bactericides. Very effective for both in-patient and out-patient treatments of burns, infected wounds, etc.



Faculty of chemical technologies and metallurgy

Direction of composite materials and articles technology

Technology of synthesis of paints, pigments and artistic enamels is developed on the basis of using strong structure acceptor minerals.

Faculty of chemical technology and metallurgy

Direction of organic substances technology

On the basis of natural resources of Georgia provides receiving of new medical highly effective preparations and ethereal oil pilot samples. At the moment the ethereal oils research and introduction in medicine technologies, as well as, in perfumery are performed. Here has to be mark out production of new cosmetic products using natural resources of Georgia – curing plants, mud, bentonite clay-sand mineral etc.

Assortment of products: hair and body shampoos; face lotions; face unguents and masks; tooth pastes, etc.

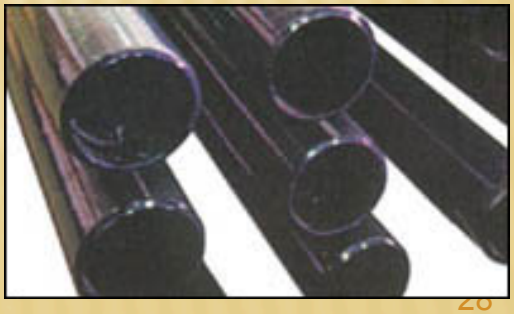
Faculty of chemical technologies and mettalurgy

Direction of physical and colloidal chemistry

The work is carried out in the line of steel pipes antirust protection for receiving competitive (according to ISO standards) high technology anti-corrosion direct-on enamel which do not contain toxic fluorine, expensive nickel and lithium.

The expected results: operation life increase of oil pipelines; ecological safety of the region; competitiveness of pipes and cost value decrease; improvement of oil pipelines hydrodynamic characteristics and high quality and purity of pumped product.

The work is in implementation stage at “Poltavamash” (Ukraine).



Faculty of chemical technologies and metallurgy

Scientific center of biologically active agents research

The centre works on scientific problems aimed on creation and implementation of biologically active agents of anti-diabetic, dietary, anti-corpulent preparations and medical-prophylactic foodstuffs prepared on the basis of local raw material. By 2009 the center has worked out anti-diabetic bread “Pikanturi”, “Elitaruli” and bread with mustard baked at firm “Orioni”.

Scientific research institute of bio-energetic technologies

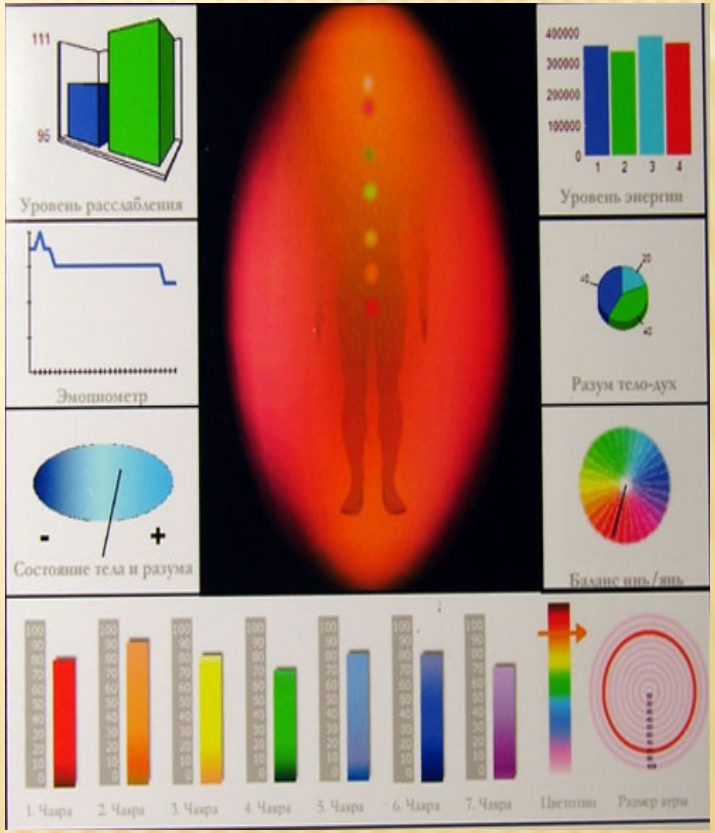
Major directions of institute activity

•1. The research of energy conversion mechanisms in the process of biological systems vital activity

•2. Research of energy transformations at bio-sphere functioning for determination of transformation parameters and optimum progress of these transformations.

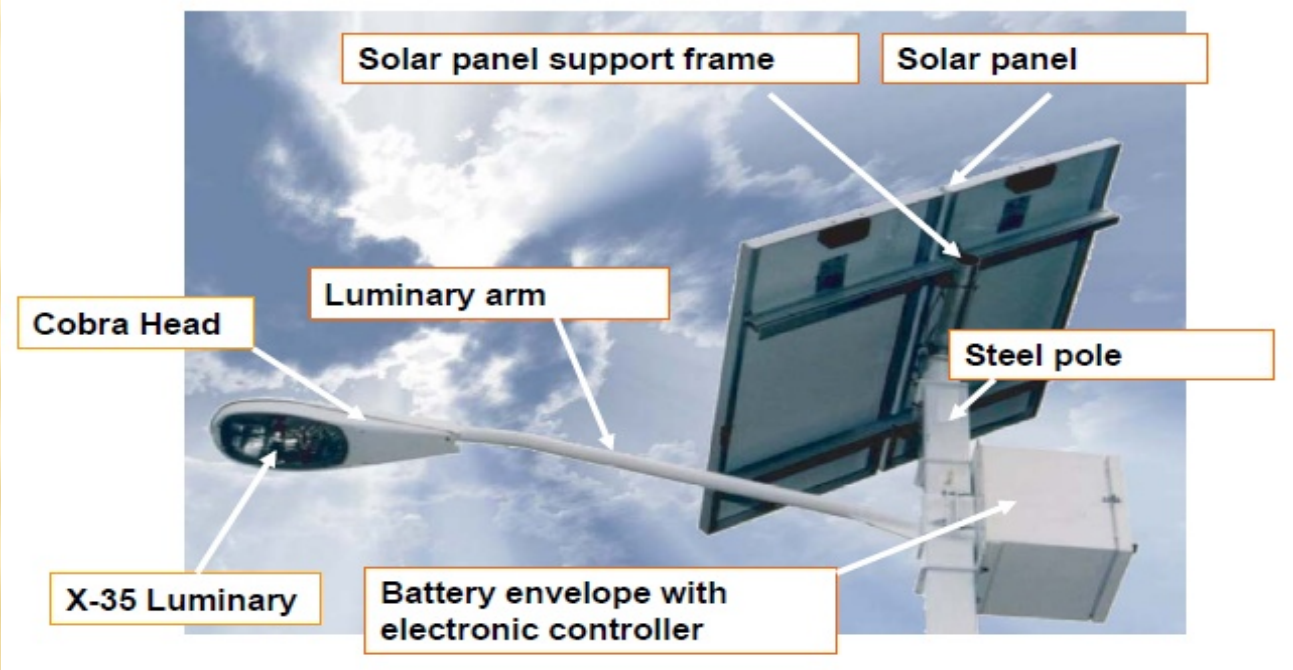
•3. Using appropriate technologies and relevant facilities the methodology is developed for increase of population health level and living standards.

The works currently carried out at the institute are financed on the basis of TEMPUS grant contract under the title “Development of bio-medical engineering in Georgia”



Faculty of power engineering and communications

To the order of US Agency of International Development (USAID) and with participation of Georgian power engineering specialists (2009) the project for estimation of technical-economic possibilities of solar energy utilization for Gori-Igoeti highway lightning has been drawn up

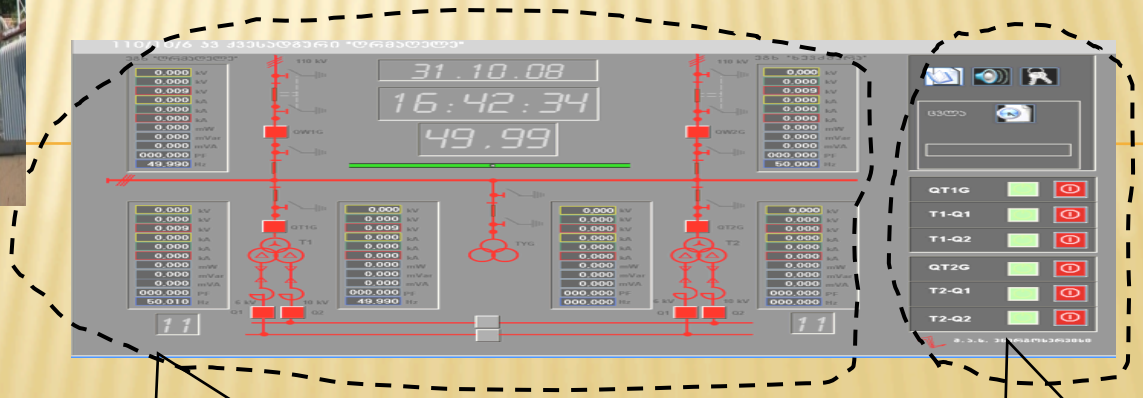


Typical construction of solar panel lighting system

Faculty of informatics and control systems

System of control of electric parameters of high voltage substations

The system provides measurement, visualization and monitoring of output electric parameters of high voltage substations, passing feeder computer control of switches, and disconnections.



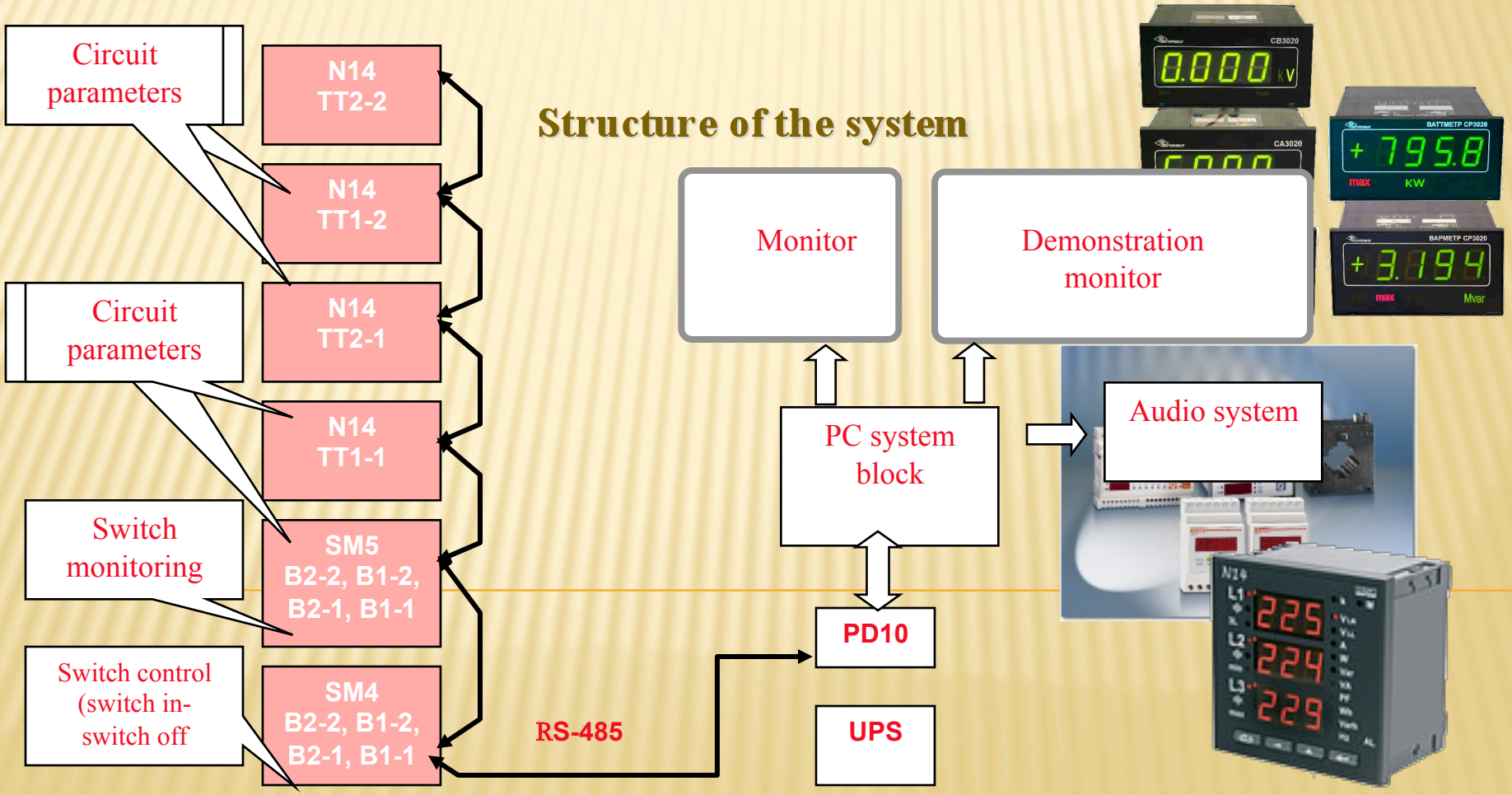
Symbolic circuit field

Control field

Faculty of informatics and control systems

Monitoring of power supply system for enterprises

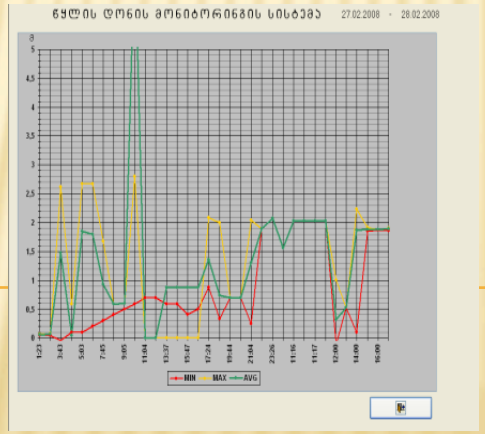
Structure of the system

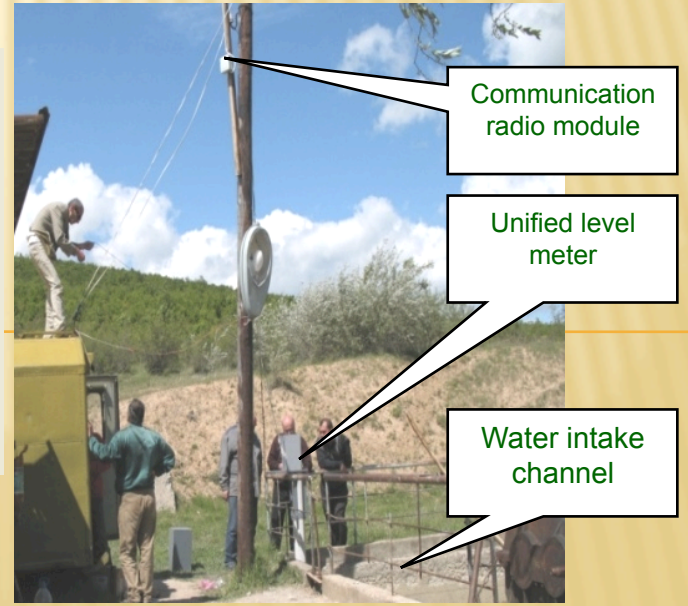


Faculty of informatics and control systems

Water level monitoring computer system

Metering subsystem is mounted on HPS head works, while computer is located on control board and simplifies operation of HPS. In 2007-2009 the system had been implemented at “Igoeti HPS”, “Alazani HPS”, “Ach HPS” and “Bzhuzhi HPS”.





Consumers: small and medium HPSs, “Tbiltskalkanali”.

Faculty of informatics and control systems

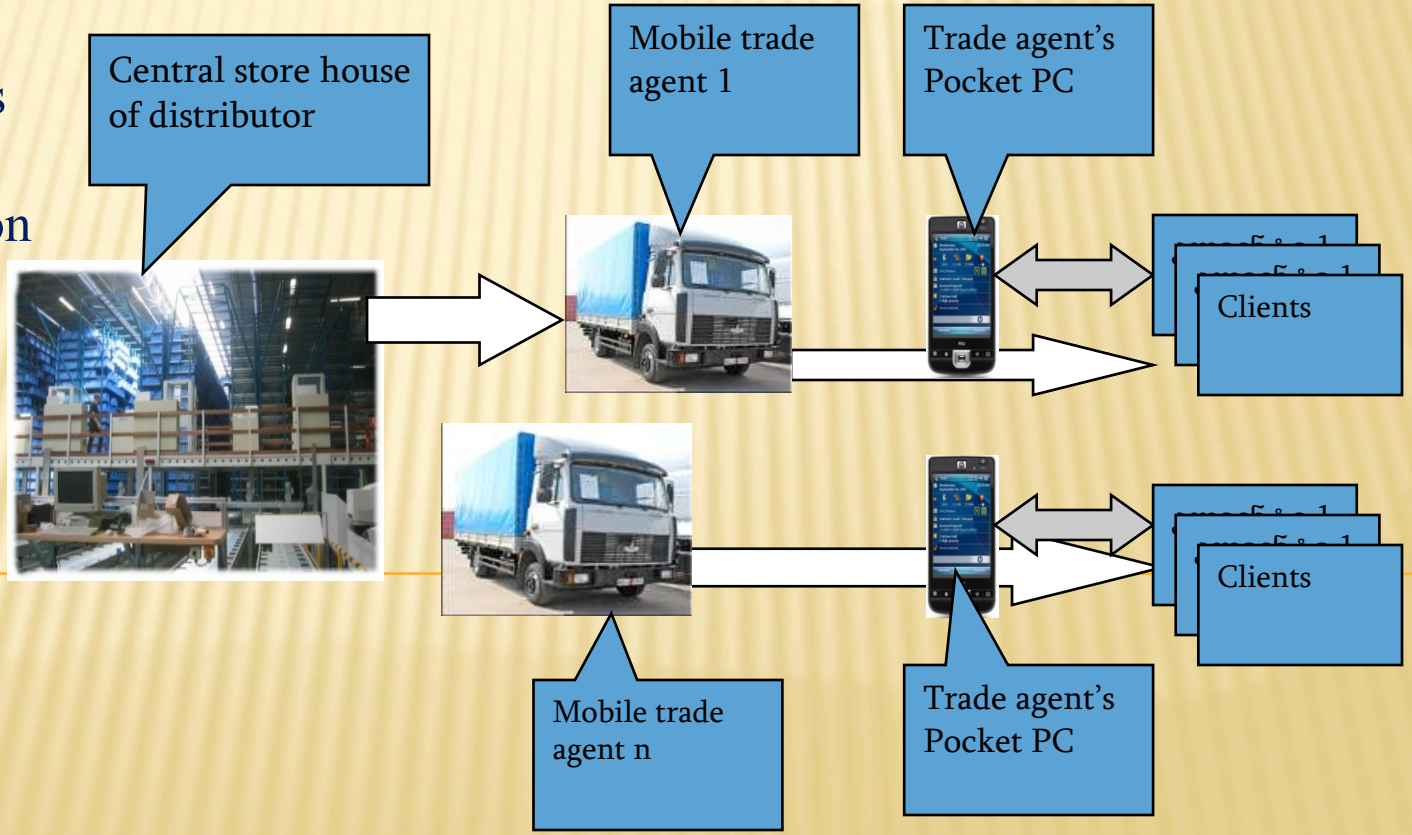
Computer-aided system of distribution

Is meant for automation of distribution companies work. Significantly increases the accuracy of accounting and decreases time of balance making.

Pocket PC interface is in Georgian language.

In 2007-2009 was implemented at several distribution companies

Consumers: distribution companies

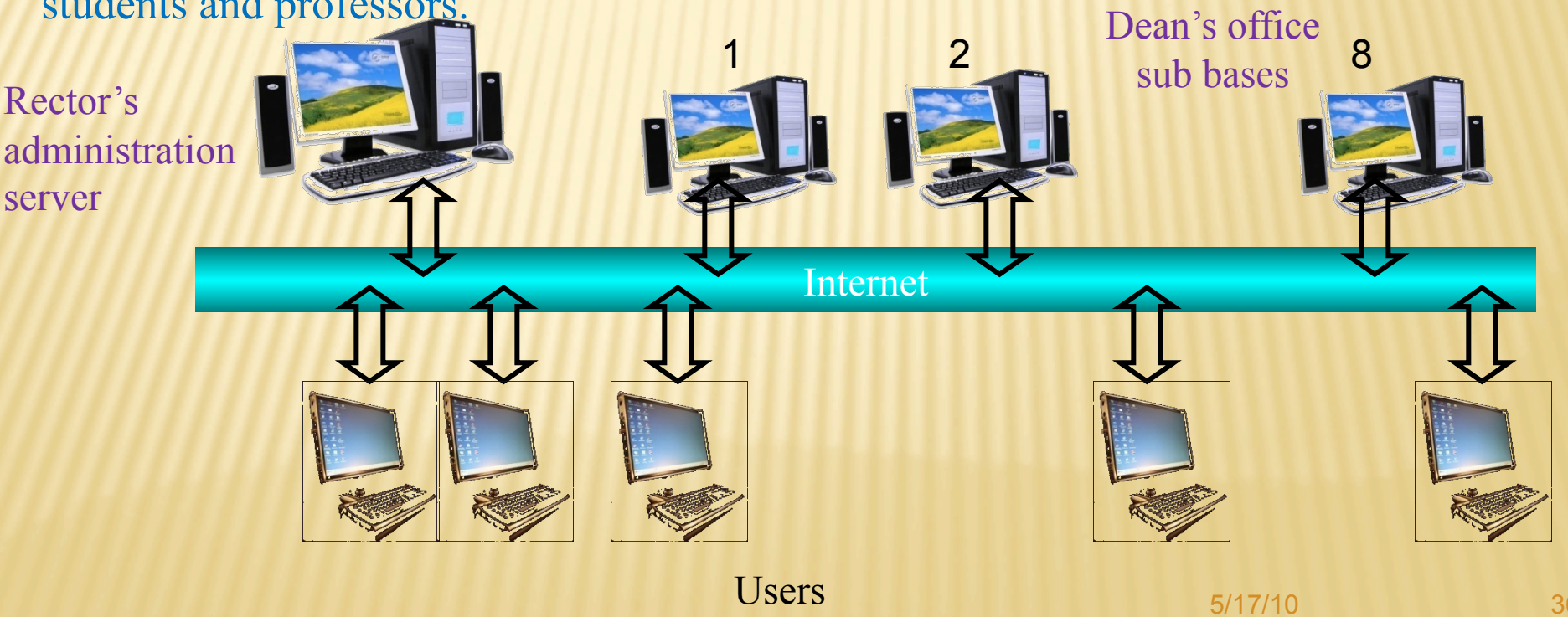


Faculty of informatics and control systems

Training process control systems at higher educational institutions

Function

Weekly evaluation of students; monitoring of educational process management by training course leading professors; provision of students evaluation transparency; students evaluation according planned schedule for information of students and professors.



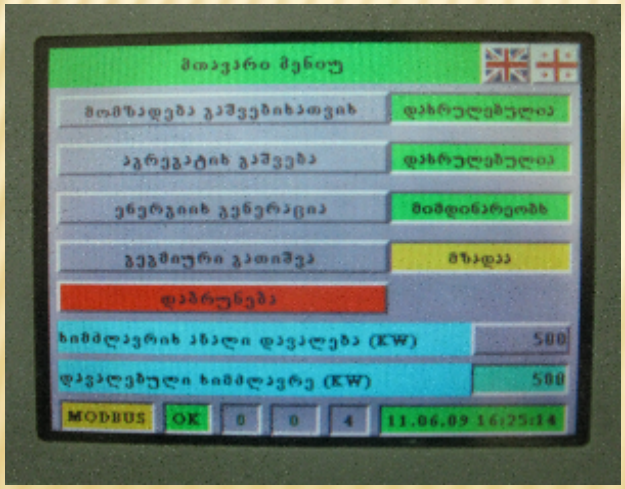
Faculty of informatics and control systems

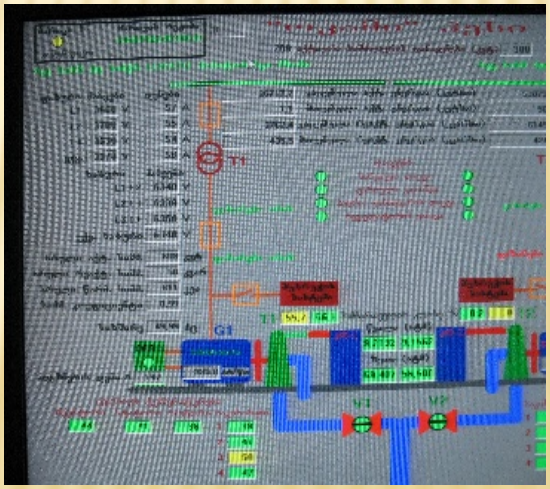
Development of ventilation control system of Chakvi-Makhinjauri tunnel

Automatic system of ventilation has been developed, tested and installed. The system continuously controls concentration of CO, CO_2, relative humidity and transparency factor (visibility factor). Environment transparency coefficient meter is developed, which does not create optical barriers for drivers and periodically is calibrated automatically.

Faculty of informatics and control systems

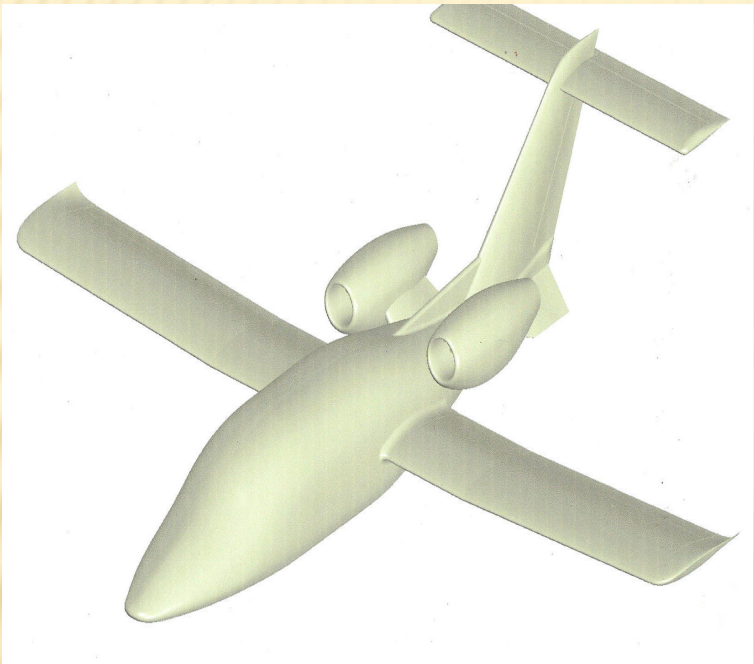
Within the program of “Renewable energy 2008” and international program “Georgia Rural Energy Project” the system of complex control and monitoring of small HPS – “Okami HPS”, “Boldoda HPS” HPS “Kekhmori HPS” have been developed. Within this program, have been designed the regulators of HPS, which provide electric power generation according to international standards

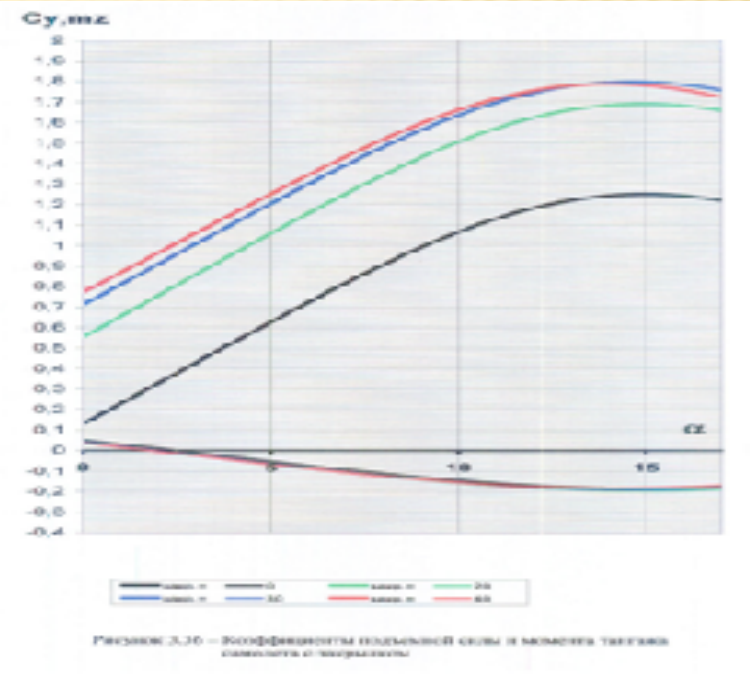




Faculty of informatics and control systems

Optimum profile of Georgian construction subsonic aircraft wing





Mathematical model and respective algorithm of calculations have been elaborated, which allowed to determine the wings profile of aircraft with maximum bearing strength and minimum resistance force coefficients.

Faculty of informatics and control systems

The problem of soft landing of aircraft had been solved. As the result had been find the moment of engine cut off, when aircraft will make smooth landing at the given place.

Mathematical model has been created and the problem has been solved for pilotless aircraft..

Scientific center of the theory and application of electromagnetic waves

The activity of center is connected with development and application of electromagnetic waves propagation in a turbulent anisotropic absorptive media.

A new theory of single and multiple scattering of monochromatic electro-magnetic waves and laser beam propagation in statistically anisotropic medium and a respective device for researches has been done.

Problem laboratory of solid body physics

The laboratory is engaged by production of thin films of rare earth elements compounds and their complex research. Thin films of 15 new compounds have been received. Their electro-physical, galvano-magnetic, luminescence, optical properties are studied, parameters of zonal structures are calculated, the areas of their practical application are determined. At present the laboratory works on production of thin films of samarium, iterbium and disprozium sulphides and antimonids.

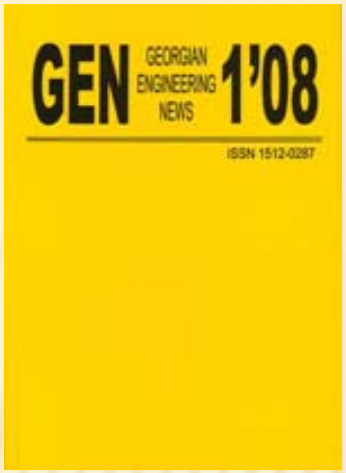
The samples of thin films of rare earth elements compounds

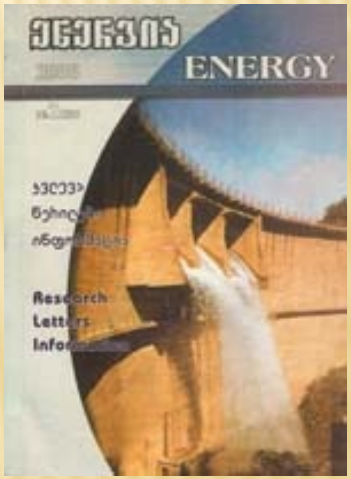
Original device for studying magnetic resistance and Hall effect.

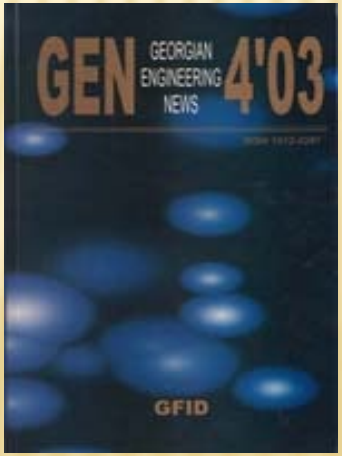
Participation in projects finances by International Scientific Foundations (during 2009,2010)

Fund	*Number of projects*	*Financing in GL*
GSNF	19	1 880 713
USTC	3	63 226
GRDF	3	317 296
Rustaveli Fund	1	37 350
2009 GTU scientific fund	3	100 000
TEMPUS	1	121 500
USAID	3	530 000
2009 GTU scientific fund	The contest is being held	826 000
The Sum		*3 876 085*

THE SCIENTIFIC MAGAZINES ISSUED AT GTU







THE ELECTRONIC SCIENTIFIC MAGAZINE OF GTU
(ESTABLISHED IN 2001)

The editorial board - Germany, France, Spain, Hungary, Latvia, Armenia and Georgia.

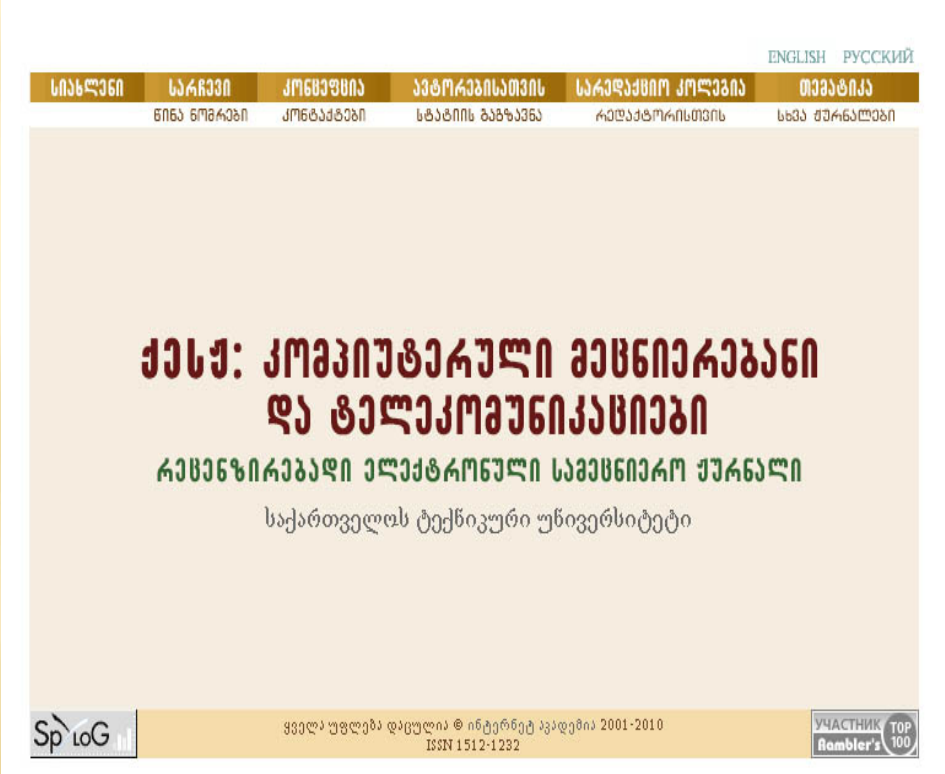
The investigators from more then 20 countries are used magazine for publishing of scientific papers. Participation of foreign authors can estimated as 73%.

On the basis of information from GOOGLE and SPYLOG in March of 2010 had been made the following inquiries:

Initial inquiries –**1522 - 64.22%**

Repeat inquiries – **848 - 35.78%**

http://gesj.internet-academy.org.ge



The Banner page of the magazine

Connections with foreign scientific and scientific-educational centers

- European Organization for Nuclear Research (Genève, Switzerland) ;
- Friedrich Schiller University of Jena (Jena, Germany);
- Graz University of Technology (Graz, Austria);
- Vilnius College of Higher Education (Vilnius, Lithuania);
- Association “ Rondine Cittadella della Pace” (Arezzo, Italy);
- Karadeniz Technical University (Trabzon, Turkey);
- Yalova Technical University (Turkey);
- The University of Nottingham, (Nottingham, United Kingdom);
- University (HSHN) (Heilbronn, Germany);
- Karlsruhe University of Applied Sciences (Karlsruhe, Germany);

Connections with foreign scientific and scientific-educational centers

- AFEKGEO MEDICAL LTD. (Israel);
- EUA – European University Association (Brussels, Belgium);
- Black Sea Universities Network (Romania, Constance);
- European University Information Systems (EUNIS) (Paris, France);
- “British Petroleum”;
- “Durapact” GMBH;
- “Boeing-Rotorcraft”;
- “INVENSYS”;
- “Schneider Electric” and “SIEMENS”;
- “Julich – Forschungszentrum”;
- “GRENA”;
- CERN;
- European Academy of Sciences and Arts – Salzburg, Austria.

Thanks for attention