

Muskhelishvili Institute of Computational Mathematics
at the Georgian Technical University

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The views of Ilia Chavchavadze, the prominent Georgian enlightener of the country, are as relevant today as before. Discussing the future, Ilia said that the country's progress is in hard work and hard work only, in education and training, in following the world progress; that the future of the country belongs to educated, gifted, hardworking and purposeful people. Ilia dreamed of a dozen engineers to provide reconstruction of the country. His thoughts were realized in full since the 20s of the last century, when a large-scale construction activities started throughout the whole country with participation of the staff of the Georgian Polytechnic Institute. Tbilisi, Kutaisi, Sokhumi, Tskhinvali, Batumi, Rustavi, Poti and other places of the country were decorated and enriched by the buildings and enterprises created by the dedicated work of Georgian builders, architects, hydraulic engineers, energy engineers, mechanics, metallurgists and others.

A blacksmith of Georgian Engineering School, Georgian Technical University, was founded on January 16, 1922 as the Polytechnic Faculty of Tbilisi State University. The first session of the faculty was chaired by the rector of the university Ivane Javakhishvili. Professor Alexander Didebulidze was elected as a Dean. On the same day, Andria Razmadze delivered his first lecture in Mathematics to the students of the Polytechnic Faculty, thus starting the educational process for the training of Georgian engineering staff and laying the foundation for the spread of higher technical education in Georgia. During the first semester Niko Muskhelishvili, Giorgi Nikoladze and Archil Kharadze, the founders of the Georgian Mathematical School, started teaching pedagogical work at the Polytechnic Faculty together with Andria Razmadze. Later on they were joined by Levan Gokieli, Konstantine Marjanishvili, Ilia Vekua, Viktor Kupradze, Shalva Mikeladze, Alexey Gorgidze, Ambrosi Rukhadze and other prominent mathematicians. The emergence of universities and various types of higher and special education institutions in Georgia has given impetus to the development of a number of fields of science, including engineering.

As a result of the reorganization of 2010, the Georgian Technical University (**GTU**) was joined by 15 research institutes of the National Academy of Sciences of Georgia, including the Muskhelishvili Institute of Computational Mathematics (**MICM**), which was founded in 1956

on the initiative of the then President of the Academy of Sciences of Georgia, a prominent Georgian scientist Niko Muskhelishvili, whose name the institute has been bearing since 1977. Niko Muskhelishvili correctly foresaw the prospects and importance of development of computational mathematics and informatics, both from a purely scientific and applied point of view. The first computer machine in Georgia was installed and put into operation at this Institute and the first computer software packages were developed here. Soon the Institute of Computational Mathematics took a decisive place in Georgia in the process of assimilation of electronic computing techniques, formation and establishment of traditions of its use. Specialists brought up at the institute made a significant contribution to the development of mathematics and informatics in Georgia. As of today many of them are successfully operating both in Georgia and in many countries of the world. Since its establishment the institute has been working on various applied tasks along with theoretical ones, among which are the optimal functioning of energy systems, creation of applied software packages for construction calculations, creation of expert systems and distance learning packages etc.

Introduction and development of advanced scientific knowledge determines the successful education system and vice versa. "School, University, Science" - these are integral parts of one whole. Each of them requires constant attention and care. Capital investments into education and science do not return immediately. One of its returns is the education of our children and their (therefore, the country's) successful future. It should be noted here that despite the difficult economic situation in the country, in 2015, the government increased the funding of scientific and research institutes by an average of three times. Such a significant increase is unprecedented during last decades. We are certain that attention of the government will not slow down in the future, the legislative base will be improved, and therefore the institute will be able to attract young personnel, establish a decent place in the process of rebuilding the country. Moreover, Georgia was constantly in the vanguard of engineering-technological news. For example, the prominent Georgian scientist, Giorgi Nikoladze, patented his invention "Direct Multiplication and Division Electronic Arithmometer" in Paris as early as in 1928.

Based on the experience gained over the years, it is possible to carry out such works in the institute today at that are essential for the further economic and social development of the country: analysis of multivariate situations related to the country's security and terrorism; analysis of the possible further development of the events in case of a natural or technical disaster; regulation of the operation of transport systems; climate modeling; construction and study of mathematical models for weather and earthquake forecasting; clinical decision support system; study of economic processes (including financial markets) using the mathematical modeling and analysis of problems and optimization these processes; analysis of demographic problems through mathematical and computer modeling; build and study of information security computer systems and many more.

All the above problems require high professionalism and processing of a large amount of information. To solve them, modern methods should be developed and researched, the most important of which are parallel computing algorithms and the use of **Grid** and **Cloud**

technologies. Their use will allow us to join the international computer network and use the computer technologies created and tested in the advanced research centers of the world.

The development of information technologies has been given a powerful push by the giant and technologically challenging scientific program in human history by the **LHC** implemented by **CERN**, the world's largest Nuclear Research Center, where many Georgians, including representatives of **GTU** work successfully. For the **CERN**, grid technology is an essential technological resource with computer centers of all the world's leading scientific organizations (**KEK**, **J-PARC (Japan)**, **Fermilab**, **BNL (USA)**, **INFN (Italy)**, **DEY (Germany)**, **IN2P3 (France)**, **TRIUMF (Canada)**). **GTU** closely cooperates with Japan's High Energy Accelerator Research Organization (**KEK**). Our group of scientists is an active member of the **COMET**-collaboration, one of the unique experiments of **KEK**, and takes an important part in the research work necessary for the implementation of the experiment.

Specific steps have already been taken in this direction by the Georgian Technical University. Namely, by the end of this year, a powerful computing complex will be set up and put into operation at **MICM**, which will serve both local and international requests. Regarding the prospects, **GTU** leadership has a preliminary agreement with **CERN**, undertaking close cooperation and assistance in the field of personnel training and retraining. Specialists from **CERN** systematically arrive at **GTU**. At the joint workshops ongoing problems are discussed and future scientific cooperation is planned. It should be noted that a number of students of **GTU** have successfully defended their master's and doctoral thesis prepared at **CERN**.

We plan to further develop and intensify the international cooperation of **MICM** with leading European scientific centers. Our aims become credible due to the path taken by the institute along its existence and the finalized and current European Commission grants coordinated by the institute.

The demand for scientists and scholar-experts is clearly on the agenda in the modern crisis era. We have been in crisis for the three years in a row. First, there was a crisis caused by **COVID-19**, which seemed to be a medical-epidemiological problem, but covered all the social systems of the global world, and now we have to coexist in the war-torn crisis in **Ukraine**. Most of the time, despite its negative connotation, the crises produce at least one positive opportunity; As mentioned above, this is the increased demand and trust towards the scholars and experts. Engineering technologies and natural sciences, since their emergence, have been with more or less intensity in demand at different times, but their benefits should not be determined only by the financial profits, but also by the more humanistic load in order to make people's lives more comfortable and safe. Either way, academic professionalism becomes unequivocally popular during and after the crises, which requires a new understanding and determination of the education system and, especially, the correct functioning of the higher education system and the choice of relevant priorities. This **a**) is reflected in the integration of the research and study, and **b**) creates a prerequisite for creating relevant decisions and

recommendations for the society. Thus, the full integration of research and study is one of the main conditions for the formation of a new academic environment.

In 2010-2012 MICM was the coordinator of the **European Commission 7th Framework Programme grant project N 266155 Geo-Recap ("Re-creation and building of capacities in Georgian ICT Research Institutes". FP7 Capacities Work programme 2010; Activity 7.6 Integrating Europe's neighbours into the ERA; Area INCO. 2010-6.1: Eastern Europe and South Caucasus)**. Our partners involved in the project were the leading European research organizations: **DFKI, GIRAF (Germany), ERCIM (France), V. Chavchanidze Institute of Cybernetics** and the **NGO ICARTI from Georgia**. The aim of the project was to integrate Georgian Information and Communication Technology Profile Institutes, in particular, **two institutes of the GTU – MICM and V. Chavchanidze Institute of Cybernetics** in the **European Research Area (ERA)**; Support and encourage their participation in **EU scientific projects**; Support in the development of a sustainable and developing strategy, etc.

This year, **Georgian Technical University** has achieved significant success on the European scientific-technological arena. Namely, the **2022 Horizon Europe grant project "Georgian Artificial Intelligence Networking and Twinning Initiative (GAIN)"** is the winner of the prestigious international grant competition, and the coordinator is again **MICM**. **GAIN** is a three-year project with a total budget of over one million Euros. The partners are the undisputed leaders of European studies: **DFKI - German Artificial Intelligence Research Center (Germany)** and **INRIA - National Institute for Digital Science and Technology Research (France)**, as well as the high technology spin-off company **EXOLAUNCH (Germany)**. Within the framework of the project, it is planned to take strategic steps towards the integration of Georgia in the European system, one of the main tasks of which is to lead Europe in the present and future technologies of artificial intelligence. In order to achieve this goal, some research profiles of **MICM** will be aligned with the profile of artificial intelligence and linked to the European Society for Research and Innovation.

It can be said with confidence that the **Georgian Technical University** is a powerful educational-scientific unit, which, together with its research institutes, is celebrating its 100th Anniversary and will continue to contribute to the prosperity and strength of the country.