

75th birthday of Anatoly Alekseev



October 12, 2003 is the 75th birthday of Academician Anatoly Alekseev and 50 years anniversary of his scientific and teaching carrier. He is an honorary member of the Presidium of Siberian Branch of the Russian Academy of Sciences, a State Prize winner, and Counsellor of the Russian Academy of Sciences. Anatoly Alekseev is a well-known scientist, a specialist in the field of theoretical and computational geophysics, mathematical modeling of geophysical phenomena and digital processing of observations, author and co-author of more than 200 scientific papers, including three monographs.

In 1952, Anatoly Alekseev graduated from Leningrad State University (LSU). In 1955, he finished his LSU post-graduate courses and was awarded the candidate degree (Ph.D).

In 1966, he got a degree of Doctor of Sciences (Full Professor). In 1973, he was elected corresponding member, and in 1984 academician of the Russian Academy of Sciences.

As a student, Anatoly Alekseev was involved in theoretical problems of seismology, in particular, dynamic problems of elasticity theory, which form the background of the description of seismic wave propagation in the Earth. Later, this interest developed into one of his main scientific priorities. For

instance, the development of asymptotic methods for solving wave problems performed by Prof. Alekseev jointly with his colleagues during the Leningrad period of his life, gave rise to the so-called ray method for the calculation of seismic wave fields in complex media. In the last 30 years, this method has become a major tool in theoretical and numerical investigations of the wave dynamics and a basis for many training courses in seismic waves theory. In 1982, Prof. Alekseev and his colleagues from Leningrad were awarded the State Prize of the USSR, which was one of the highest awards in the Soviet Union.

A short period (1958–1962), Anatoly Alekseev worked at the Tajik Complex Seismological Expedition (TCSE) of the USSR Academy of Sciences, a large test site for seismological investigations in our country at that time. In those years, the TCSE had one of the greatest concentrations of scientific researchers who worked on seismological problems, and were ready to attack the problem of earthquake prediction, a challenging problem of the Earth's sciences. The Garmsky test site in those years could be called the seismologists' mecca.

The young man's work at the TCSE had a great impact on him: his rigorous mathematical theories were always based on realistic statements of relevant investigations with available databases, recording equipment, and observation systems.

It is this work at the Garmsky test site on important problems of modern seismology, in continuous cooperation with outstanding experimental seismologists that gave Anatoly Alekseev the necessary experience to develop a new class of problems of mathematical physics, namely, the so-called inverse problems of geophysics, an appropriate theoretical tool for meeting practical demands. These problems, as well as new numerical-analytical methods for solving direct problems of dynamic seismics, have become his main scientific interest in the Siberian period of his life, which started his work at the Institute of Computational Mathematics and Mathematical Geophysics (the former Computing Center) of the Siberian Branch of the Russian Academy of Sciences.

Prof. A. Alekseev's research results opened up the new prospects for the creation of a closed cycle of mathematical modeling of real wave processes in complex media. The Siberian School of Theoretical Geophysics was brought to the forefront of the world science. Anatoly Alekseev and his colleagues were first to perform the processing of real observations by using schemes of seismic tomography, holography, and the Earth's vibrational sounding.

When doing computational experiments, Prof. Alekseev and his colleagues discovered the new types of "non-ray" waves, which are very important in seismic data interpretation.

Some of important practical results obtained are the following: principles for determining the nature of deep waves in the Earth's crust have been

revised and defined more precisely; more correct schemes of the practical interpretation in regional geophysics have been created; the zoning structure of the Earth's asthenosphere has been identified by using geophysical data.

Since the late 70-s, Prof. Alekseev has been supervising the development of scientific fundamentals of a new high-resolution method for studying the deep Earth's structure, aimed at solution of serious problems of seismology. In this method, a medium is sounded by regular vibrations excited by powerful low-frequency artificial sources. Here, the new results on distance, depth, and accuracy of sounding have been obtained for the first time. They served as a basis for the creation of new vibrational geotechnologies for the investigation of deep structure of the Earth's crust and upper mantle of Siberia, active monitoring of seismic prone zones, and increase of oil recovery.

Anatoly Alekseev is one of the leading specialists in the field of Geoinformatics in Russia. He is engaged in the development of methods of automated processing of aerospace images. He has proposed, jointly with his colleagues, a conceptual framework for the Geoinformation Processing Center (the GPC). His ideas played an important role in theoretical grounds of the creation of the State Network of Remote Sensing Data Processing Centers, which is one among complex scientific and technical developments in aerospace monitoring. Prof. Alekseev supervised the creation of a large multi-access center for computer processing by the GIS technologies and high-performance multiprocessor computers in the Computing Center. His research into the interaction between various data on natural resources, as well as deep understanding of applied problems, enabled Anatoly Alekseev to formulate the main principles of an entirely new technology of acquisition, transmission, and processing of information about natural resources.

The conceptual framework developed by Prof. Alekseev and the experience gained from his work at the GPC, contributed to the creation of "Siberian Space Monitoring Center".

Anatoly Alekseev's scientific results in the field of remote sensing have greatly contributed to the solution of problems of development of Siberian natural resources and brought to a high level the achievements of Russian science of research.

Another area of Prof. Alekseev's scientific interests was the study of tsunami long gravitational waves, generated in the ocean by strong submarine earthquakes, volcanic eruptions and slumps. Being involved in the research of dynamic problems of seismic waves propagation, he considered that tsunamis could also be treated within the model of elastic media consisted of the layer of compressible liquid overlying the elastic halfspace in the presence of gravity field. Using methods of dynamic theory of elasticity, an exact mathematical solution of this task was found, and the dependence of tsunami intensity on the parameters of the internal seismic source was investigated. The first numerical models of tsunami generation and propagation

in an ocean with real bathymetry were developed. It gave to researchers a powerful instrument to study tsunami behavior in concrete parts of the Pacific ocean. In the recent years, the information-expert system "Tsunami" has been developed in the department of mathematical problems of geophysics. The core of the system is the comprehensive historical tsunami database covering all the Pacific and the full historical period of available observations provided with the GIS-type graphic shell for easy data retrieval, visualization and handling.

In recent years, Prof. Alekseev has been engaged in the development of mathematical fundamentals of multidisciplinary mathematical modeling methods of objects and phenomena in the Earth's sciences. On the basis of these methods, he has created, jointly with his foreign colleagues, a multi-disciplinary model for estimation of the "integral" earthquake precursor. This model underlies a physical-mathematical concept of earthquake prediction.

Anatoly Alekseev and his colleagues are involved in the modeling of geological and geophysical consequences of falls on the Earth of large celestial bodies, such as asteroids, meteorites, or fragments of comets.

Prof. A. Alekseev is a great organizer of scientific research. For many years, he has been chairing the United Scientific Council on Mathematics and Informatics of SB RAS, the Council on the Earth's Vibrosounding at SB RAS, and the Applied Geophysics Council at the Department of Geology, Geophysics, Geochemistry, and Mining Sciences of RAS.

For twenty years (from 1980 to 1999) Anatoly Alekseev was Director of Computing Center of RAS. After Academician Gury I. Marchuk was appointed to work at the State Committee for Science and Technology in Moscow, Academician Alekseev continued to intensively develop informatics in SB RAS. In 1984, he headed the project on creation of a network of the Novosibirsk Scientific Center, called known as the "Computational Multi-Access Center" (the CMAC). A corporative cable network belonging to SB RAS (not to the Novosibirsk Telecommunication System (NTS)) which connects the research institutes of SB RAS, was created under this project. This network plays an important role, when ber-optical telecommunications, which are becoming more and more expensive in the NTS, came into use. Under Prof. Alekseev's supervision, the old CMAC network was reconstructed, in 1995, into updated system based on multiprocessor RM-600 computers as well as MBC-1000M supercomputers.

At present, this Computer Multi-Access Center is an open system called Siberian Supercomputer Center (SSC), which performs high-speed computations for more than ten SB RAS institutes.

Being not operational in 1993 due to technical reasons, the CMAC was again put into operation in 1996. The speedy reconstruction of the CMAC made it possible to keep most of the SB RAS specialists in the field of

computational technologies from leaving their services.

Anatoly Alekseev is a member of the American Mathematical Society, a member of editorial boards of two international journals on applied mathematics, and editor-in-chief of the Siberian Journal of Computational Mathematics.

Anatoly Alekseev was awarded the medal "For Valiant Labor" (1970), "October Revolution" Order (1971), "Decoration of Honor" (1975), and "Red Banner Labor Order" (1982).

Prof. A. Alekseev is Professor and Chairman at the Department of Mathematical Geophysics in the Novosibirsk State University. Under his scientific supervision, thirty two PhDs have been defended, and eight of his disciples have got the degrees of Doctor of Science.

*B.G. Mikhailenko, G.M. Tsibulchik, V.A. Tsetsokho,
A.V. Belonosova, V.K. Gusiakov, V.P. Pyatkin,
O.K. Omelchenko, B.M. Glinsky, M.S. Khairtdinov*