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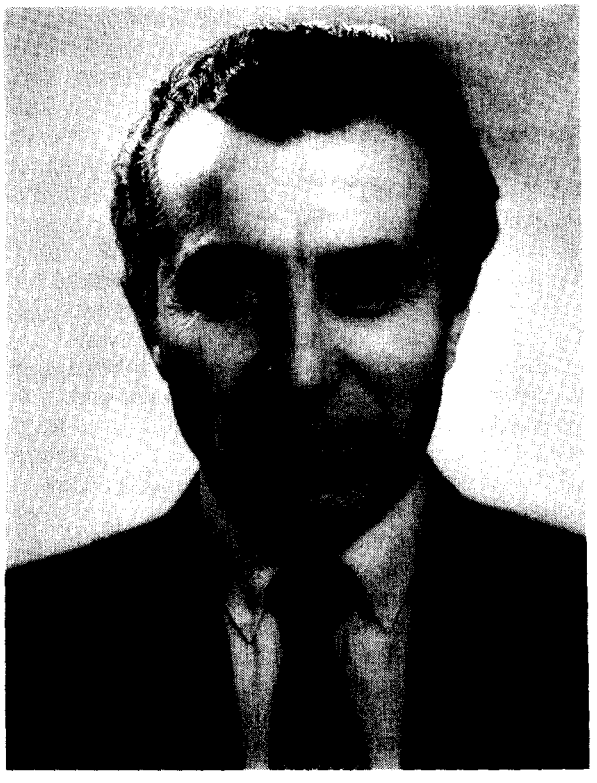
SAMVEL SAMVELOVICH GRIGORYAN (ON THE OCCASION OF HIS 70TH BIRTHDAY)†



The well-known mechanics specialist, Samvel Samvelovich Grigoryan, Academician, Director of the Moscow State University Institute of Mechanics, was born 70 years age on 18 March 1930 in Nagornyi Karabakh: In 1984 he completed secondary school in Baku with a gold medal and entered the Mechanics and Mathematics Department of Moscow State University (MGU), from which he graduated with distinction in 1953. In 1956 he completed a post-graduate course at MGU under the guidance of Academician L. I. Sedov and since then he has worked at MGU first as a junior research fellow, then as a senior research fellow, from 1961 to 1981 as Deputy Director of Research in the MGU Institute of Mechanics, from 1981 to 1992 as the Head of Department, and from 1992 to the present day as the Director of the Institute.

Grigoryan is a versatile scientist and has enriched modern mechanics and allied branches of science with his outstanding scientific achievements. In the 1960s he developed a mechanical and mathematical theory for the quantitative description of processes of motion, deformation and fracture of soils and rocks, long before similar studies abroad. Under his guidance and with his direct participation, specialists of many organizations have carried out laboratory and field experiments making it possible to specify the material functions and parameters which occur in the general theory and thereby transform it into a tool for specific practical applications. On this basis, in particular, the main problems concerning the effect of powerful explosions in soils and rock, and concerning the force and kinematic action of seismic explosive waves on objects and buildings located in such media, have been formulated and effectively solved. This has been used to ensure the necessary rate of development of both the scientific level of applied studies and technical developments in specialized establishments and departments of the defence complex of the country. His pioneering research played a leading role in this and has been generally recognized.

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Another great, fundamental scientific problem with which Grigoryan began to grapple in those same years was the mechanics of surface processes—snow avalanches, glaciers, and glacial flows, rock falls, landslides and mud flows. Here, he also conducted research of a general nature an analysis of the main mechanisms and determining factors for these processes and the construction of mechanical and mathematical models for their quantitative description and the formulation and solution of the most important and typical problems. On this general basis, Grigoryan and his coworkers, together with specialists from other scientific organizations of the country, carried out extensive specific research that has become part of the modern scientific pool of this area of knowledge.

In the course of this work, he discovered and formulated a new law of friction for flows of crushed materials (snow, rock, etc.) moving over a solid base, which differed substantially from the well known and widely used Coulomb's law. Using this new law, it was possible to explain and describe quantitatively the previously known but unexplained phenomenon of the abnormally high mobility of large masses of rock broken by earthquakes or by powerful explosions. The same law explains the effect of a change in the morphology of impact craters on the surfaces of the moon and planets of our solar system with an increase in the characteristic crater size. The mathematical model and new friction law were used for mathematical and physical laboratory modelling of well known large-scale fall effects (the Usoi fall and Sarez Lake formation in the Pamirs, the Nevado-Huascaran rock falls in South America, etc.), and also in the development of a project for constructing a high dam (of the order of 400 m high) for the Kambarata hydroelectric power plant on the River Naryn in the Kirgizstan region by means of explosive collapse of large masses of rock on the sides of the ravine of the river.

Theoretical research by him on the mechanics of snow avalanches and glaciers has given this area of modern theoretical glaciology the semblance of completeness and is used for the mathematical modelling of specific glaciological effects and to predict their evolution and consequences. This research in particular has made it possible to give a rational explanation of the 'puzzling' phenomena of 'air waves' of snow avalanches and rapid movements of 'pulsating' (surging) glaciers.

At the end of the 1970s, he developed a quantitative theory of processes of the flowing down and breakup of celestial bodies (asteroids and comets) entering the atmosphere of the planets and the Sun, by means of which a rational explanation was provided for the phenomenon of the Tunguska meteorite, the consequences of the collision of the Shumaker-Levi-9 comet with Jupiter in 1994 were predicted, and the behaviour of small comets close to the sun was explained.

At the end of the 1980s, he formulated a quantitative theory of the formation and evolution of earthquake sources, the origin of an earthquake onset, the transformation of seismic waves as they propagate through a heterogeneously layered rock. Using this theory, he was the first to derive theoretical formulae for the main empirical laws of modern seismology and to develop the fundamental concept of monitoring the precursors of fields of geophysical abnormalities arising during the evolution of an earthquake zone to forecast strong earthquakes.

At the same time, he built a new hydrodynamic model describing the slow flows of water in large, shallow expanses of water (the deltas of large rivers and estuaries), which was simpler than classical models but reproduced fairly accurately the real characteristics of the effects described. This model, in particular, made it possible to assess quantitatively the possible influence of protective constructions in the Neva Gulf and to show the unimportance of this influence.

At the end of the 1960s, Grigoryan became interested in problems of biomechanics. In the MGU Institute of Mechanics, a seminar on biomechanics then began, and specialists from allied fields of knowledge—mechanics and mathematics, biology, medicine and biophysics—from many regions of the country became involved in research in this field. Studies of biomechanics acquired an All-Union (and later, an All-Russian) nature, symposia and conferences began to be held, and a seminar (minicongress) on biomechanics has been taking place annually over a period of 30 years, alternately in Moscow at the MGU Institute of Mechanics and in Leningrad (now St Petersburg) at the I. P. Pavlov Institute of Physiology of the Russian Academy of Sciences. Grigoryan was one of the initiators of a new scientific branch of the Higher Certification Commission of the country—biomechanics.

He also carried out a series of original studies in biomechanics, in which a rational explanation was provided for the phenomenon of Korotkov sound, widely used in measuring arterial blood pressure; a new effect was discovered—the possibility of control the pressure in the blood circulation system of animals and humans by introducing small additives of high-molecular polymers, and a biopolymer fulfilling this regulatory function was isolated from blood; new problems were encountered and solved in the optimality of the structure and the function in living creatures.

His many scientific achievements described above, relating to very different objects and processes, have a certain generality, which enables them to be categorized as a single scientific area, termed the Grigoryan mechanics of natural processes. This name has also been given to the scientific department founded and led by him at the MGU Institute of Mechanics.

He has also examined many other scientific problems. He obtained important results from determining the action of explosive waves on objects located in water and in air, from the discovery and detailed study of new resonance vibratory effects in gas-liquid systems, and from the mechanics of processes in the oil and gas industry (in particular, a simple, effective device has been developed for eliminating the serious wards that often arise when drilling deep wells). Certain fundamental problems of sports mechanics were formulated and solved, as a result of which Soviet sportsmen in the sledge and bobsleigh events won the highest awards in the Olympic Games and World Championships for the first time, and Grigoryan himself for many years headed the USSR Federation of Sledge and Bobsleigh and was a member of the USSR National Olympic Committee.

Grigoryan and his colleagues synthesized a new polymer-mineral composite, which they called kavelast, which possesses the dramatic property of increasing in volume by a factor of 50 when moistened. This gives the material many possible applications-for firefighting, for increasing the water- retaining capacity of soils in arid regions, for waterproofing the underground parts of buildings and storage pits for harmful waste, for eliminating water losses form reservoirs, canals, and water storages, and for applications in the oil and gas industry. Successful practical applications of kavelast have already been found.

Working for a long time as a manager of the MGU Institute of Mechanics (Deputy Director of Research and then Director), Grigoryan has achieved significant scientific and organizational results, playing an importance role in transforming the institute into one of the leading scientific centres in the world in the field of modern mechanics.

For this scientific achievements, he has been awarded the M. V. Lomonosov (MGU) and S. A. Chaplygin (USSR Acad. Sci.) prizes, the M. A. Lavrent'yev Gold Medal and Prize (USSR Acad. Sci.), prizes of the USSR Soviet of Ministers, and Ukrainian State prizes.

Grigoryan was elected as a Corresponding Member, and recently a full member of the USSR Academy of Sciences (now the Russian Academy of Sciences) and a full member of the International Academy of Astronautics, the International Academy of Information Science, the International Academy of Spiritual Unity of World Nations, the Russian Academy of Artillery and Rocket Sciences, the Russian Academy of Natural Sciences and the Engineering Academy of the Ukraine. He is member of the National Committee of Russia for Theoretical and Applied Mechanics.

He is the author of several hundred scientific papers, including a number of monographs, and scores of inventions.

Under his scientific guidance, many of his scientists have gained master's and doctoral degrees in branches of the physicomathematical, geological-mineralogical, technical, biological, medical and geographical sciences.

For the past 10 years, he has been actively and effectively involved in social work in the field of the development of international harmony and friendship between different ethnic groups living in Moscow, and in tackling problems of the Armenian community in Moscow and Russia, heading the Armenian community in Moscow and the Regional National-Cultural Autonomy of Armenians in Moscow. In this post he has again achieved considerable results, highly valued by the ethnic communities of Moscow and by the Mayor and the Council of the city with whom the Armenian community is collaborating closely and fruitfully.

The editorial team and board of the journal *Applied Mathematics and Mechanics* warmly congratulate him—a member of the editorial board of the journal—on his noteworthy anniversary and wish him good health, continued activity and fruitful collaboration with his colleagues, new brilliant achievements in our fine branch of science—mechanics, the fulfilment of all his ideas and plans, and good fortune.

Translated by P.S.C.