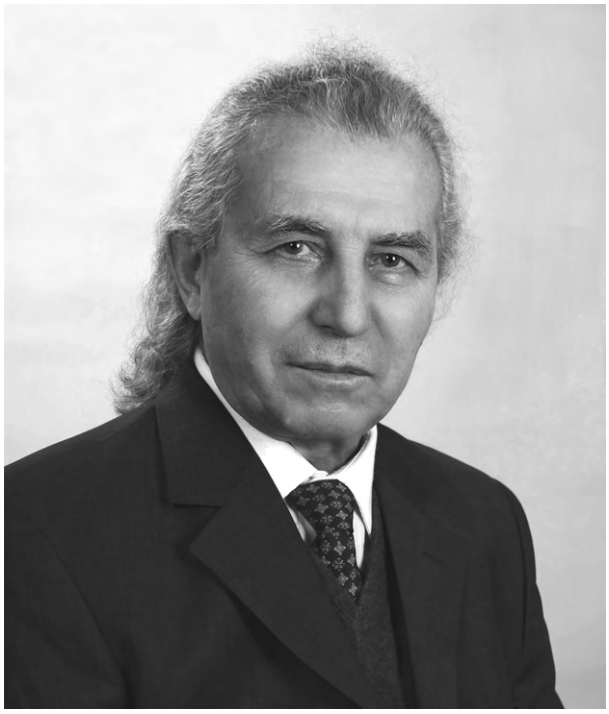
Journal of Applied Mathematics and Mechanics 74 (2010) 255–266

Contents lists available at ScienceDirect

Journal of Applied Mathematics and Mechanics

journal homepage: www.elsevier.com/locate/jappmathmech

Samvel Samvelovich Grigoryan (On his Eightieth Birthday)☆



Samvel Samvelovich Grigoryan, the great scholar in the filed of mechanics, Full Member of the Russian Academy of Sciences, Honoured Professor of the M.V. Lomonosov Moscow State University (MGU) and long-time member of the editorial board of the journal *Prikladnaya Matematika i Mekhanika*, is celebrating his eightieth year.

He was born on 18 March 1930 in Nagornyi Karabakh. In 1948 he left middle school in Baku with a gold medal and entered the Mechanics and Mathematics Faculty of MGU, from which he graduated with distinction in 1953. In 1956 he completed his postgraduate studies at the MGU under the supervision of Academician L.I. Sedov, and from that time he has worked at the MGU, where he progressed from junior research fellow to director of the MGU Institute of Mechanics. Since 2001 he has been head of the Department and Laboratory of Mechanics of Natural Processes.

He is a versatile scientist who has enriched modern mechanics and related sciences with his brilliant research results.

At the beginning of the 1960s he created a mechanical/mathematical theory for the quantitative description of the motion, deformation and fracture of soil and rock that was well ahead of similar research being conducted abroad. Under his supervision, and with his participation, laboratory and field experiments were carried out that made it possible to specify the material functions and parameters occurring in the general theory he constructed, and thereby transform it into a tool for practical applications. On this basis, the principal problems of the action of powerful explosions in soil and rock, and of the force and kinematic effects of seismic explosion waves on objects in such media, were formulated and solved. He also worked on solving other important problems of a defence-related nature, and for his part in this work he was awarded the USSR Soviet of Ministers Prize (1985). He constructed exact solutions of a number of gas dynamics problems and discovered the effect of the non-existence of solutions under certain conditions, which was important for solving problems of gas dynamics, aerodynamics and unsteady hydrodynamics. He consturcted an approximate solution of the problem of cavitating flows about

☆ *Prikl. Mat. Mekh.* Vol. 74, No. 3, pp. 355–374, 2010.

0021-8928/$ – see front matter
doi:10.1016/j.jappmathmech.2010.07.001

elongated bodies in water, which enjoyed various applications in research by others. In this same period he began to study the mechanics of slope processes – snow avalanches, glaciers and ice sheets, rock slides, landslides and mud flows. He organized a scientific seminar at the MGU Institute of Mechanics to address these problems. He and his colleagues, together with specialists from other scientific organizations, conducted extensive theoretical and experimental investigations, in particular, in field studies, the results of which added to the fund of scientific knowledge in this area. His research into the mechanics of snow avalanches and glaciers made it possible, in particular, to explain rationally the phenomena of "air waves" of snow avalanches and the rapid movement of "pulsating" glaciers.

During research into the mechanics of slope processes, he discovered and formulated a new friction law for the flow of granular materials (snow, rock, etc.) over a solid base, that differed considerably from the well-known Coulomb's law. It proved possible to explain and quantitatively describe the phenomenon of the abnormal motion of large masses of rock that had collapsed as a result of an earthquake or an intense explosion. The same law explains the effect of change in the morphology of impact craters on the surfaces of the Moon and planets of our Solar System with the growth in the characteristic size of the crater. He used it to solve a number of other important problems. These include the problem of the nature of the well-known Painlevé paradox and the explanation of the experimentally established effect of the "abnormal" ultradeep penetration of solid metal microparticles, accelerated by an explosion to high (km/s) velocities, into solid metal materials. Using the new friction law, an explanation was found for the common cases of failure in the practice of building large irrigation channels using explosives (in Central Asia, in the Krasnodar region); a version of the scheme for placing explosive charges in the ground was proposed, which was introduced into practice. The new friction law has been used successfully by others to solve problems of contemporary mechanics.

At the end of the 1970s, he developed a quantitative theory of the deceleration and disintegration of celestial bodies (asteroids and the cores of comets) entering the atmosphere of the planets and the Sun, by means of which an explanation was proposed for the phenomenon of the Tunguska meteorite. The consequences of the collision of the Shoemaker–Levy 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 constructed a quantitative theory of the inception and evolution of the centres of earthquakes, the transformation of seismic waves as they propagate in layered inhomogeneous near-surface rock masses and resonance effects, which determine the destructive action of earthquakes. Formulae were derived for the main laws, established by earlier observations, governing modern seismology, and the concept underlying the organization of the monitoring of precursor fields of geophysical abnormalities which arise during the evolution of the centres of earthquakes was developed for predicting of strong earthquakes. At this time, he constructed a simple hydrodynamic model of slow flows of water in shallow expanses (the deltas of large rivers and estuaries). This model made it possible, in particular, to assess quantitatively the possible effect of the protective structures then begun by the building industry in the Neva Bay of the Gulf of Finland on water flows within it, and to show the insignificance of this effect, which played an important role in taking the decision to continue suspended construction.

At the end of the 1960s, he also became interested in problems of biomechanics, and he became one of the scientific managers of the biomechanics seminar at the MGU Institute of Mechanics and was one of the instigators of the new scientific field of 'Biomechanics' being included in the list of specialities of the Higher Certification Commission of the country. He conducted a series of original investigations into biomechanics: he gave a rational explanation for and constructed a quantitative theory of the phenomenon of Korotkov sounds, widely used in measuring arterial blood pressure; he discovered a new effect – the possibility of regulating the pressure in the blood circulation system of animals and humans by introducing into it small additions of high-molecular-weight polymers, he isolated from blood the natural biopolymer that achieves this regulation and he formulated and solved new problems concerning the optimality of the structure and function of the blood circulation system.

At the start of the 2000s, he became interested in several other problems of the mechanics of natural phenomena. In 2002 he constructed a simple theory and a model of ball lightning, and also a very simple quantitative model of a typhoon, and, quite recently, a model of a tornado. In 2008 he proposed a model of modern volcanism in interaction zones of plates of the Earth's crust. He constructed a model of non-linear thermomechanical processes in the interior of the Earth. The model possesses the property of strong peaking (of the thermal explosion effect type) and explains the main large-scale effects accompanying the geological evolution of the Earth. He proposed a simple model of the thermomechanical equilibrium of the atmospheres of the Earth and the planets.

He recently began to study cosmology problems. He proposed a model of an essentially inhomogeneous Universe that differed fundamentally from that generally accepted, postulating its homogeneity and isotropicity "in the large".

Most of his scientific results described above have a certain generality, which enables them to be grouped with a single scientific direction, which he called the "mechanics of natural processes". The same name is given to the scientific department that was set up and run by him in the MGU Institute of Mechanics.

He also studied many other scientific problems. He obtained important results concerning the mechanics of processes in the oil and gas industry (in particular, a simple and effective device was constructed for eliminating severe emergencies often arising during deep-well drilling). He formulated and solved certain fundamental problems concerning the mechanics of sport, and he himself for many years headed the Federation of Sleigh and Bobsleigh Sports of the USSR and was a member of the USSR National Olympic Committee.

With colleagues, he synthesized a new substance – a polymer–mineral composite (Kavelast) possessing the remarkable property of increasing its volume up to 50-fold when wet, which has numerous possible applications: a fire extinguishment, increase in the water-holding capacity of soils in arid regions, waterproofing of the underground parts of buildings and depositories of harmful waste, the elimination of water losses from bodies of water, canals and reservoirs and applications in the oil and gas industry. The practical use of Kavelast has begun.

Working for a long time as a manager of the MGU Institute of Mechanics (deputy director of scientific research and director), in the difficult years after the break-up of the Soviet Union and cessation of the financing of economic contracts, he was able to preserve the scientific schools and the directions of the institute, to find means of financing work on replacing complex equipment of the aerodynamic test complex and to maintain the creative scientific potential of the MGU Institute of Mechanics.

For his scientific achievements, he was awarded the M.V. Lomonosov Prize (MGU), the S.A. Chaplygin Prize (USSR Academy of Sciences), a gold medal and the M.A. Lavrent'ev Prize (USSR Academy of Sciences), the USSR Council of Ministers Prize, the State Prize of Ukraine, the S.N. Fedorov Prize and the title 'Knight of the Sciences and Arts' and a medal from Russian Academy of natural Sciences. He is a member of the National Committee of Russia on Theoretical and Applied Mechanics, and a member of the International Society of Applied Mathematics

and Mechanics. He was elected a Corresponding Member of the USSR Academy of Sciences in 1987, a Full Member of the Russian Academy of Sciences in 2000 and a member of a number of other Russian and also international and foreign academies, including the Armenian Academy of Sciences in 2000. In the period from October 1959 to January 1960 he worked in China, where he taught a year's course on supersonic aerodynamics and gas dynamics to a large group (about 80 people) of young specialists from the aviation sector. Many of them have subsequently gone on to become professors and generals. For this work he was awarded the 'Chinese–Soviet Friendship' medal, and in 2006 he was elected a member of the Chinese Academy of Sciences.

He is the author of several hundreds of scientific publications, including a number of monographs and inventions. Under his supervision, many of his students have defended their Candidate and Doctoral Dissertations in various specialities. Two of them have become Members of the Russian Academy of Sciences, two have become Members of the Chinese Academy of Sciences and one has become a Corresponding Member of the Tajikistan Academy of Sciences. Many have become professors in the USSR, Russia and in other countries.

For the past 20 years, he has been actively and fruitfully engaged in social work to promote the maintenance of interethnic concord and friendship between various ethnic groups in Moscow's population, and in solving problems of the Armenian community in Moscow and Russia, heading this community in Moscow and the Regional National/Cultural Autonomy of Armenians in Moscow. For this work, the Moscow government awarded him a special gold medal. He is one of the founders of the Union of Armenians in Russia and the World Armenian Congress, and he helps run these public organizations. In 2002 the Union of Armenians in Russia honoured him with its highest award – the "Silver Cross".

The colleagues and students of S.S. Grigoryan and the editorial board and team of the journal *Prikladnaya Matematika i Mekhanika* send him heartfelt best wishes on his 80th birthday, wish him good health, continuing activity and good will in his relations with colleagues, new brilliant achievements in our fine science – mechanics – and, as previously, in related sciences, the fulfilment of all his ideas and plans and total happiness in life. Here's to many more years, dear Samvel Samvelovich!

LIST OF S.S. GRIGORYAN'S PRINCIPAL SCIENTIFIC PUBLICATIONS

1954

The theory of the gas ejector. In: Collection of Papers of the USSR Ministry of the Aviation Industry. No. 13. Theoretical Hydromechanics. Issue 5. Ed. by L.I. Sedov. Moscow; TsIAM; 1954; 62–91.

1955

The formulation of dynamic problems for ideal plastic media. *Prikl Mat Mekh* 1955; **19**(6): 725–33.

1956

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1957

Axisymmetric motions of a granular medium. *Prikl Mat Mekh* 1957; **21**(2): 221–30.

1958

Some exact solutions of the equations of gas dynamics. *Dokl Akad Nauk SSSR* 1958; **121**(4): 606–9.

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Limiting, self-similar, one-dimensional, unsteady a gas motions (the Cauchy problem and the piston problem). *Prikl Mat Mekh* 1958; **22**(3): 301–10.

The heating and melting of a solid by friction. *Prikl Mat Mekh* 1958; **22**(5): 577–85.

1959

Modelling of the shock-wave motion of a massive solid under the action of a shock wave. *Dokl Akad Nauk SSSR* 1959; **124**(1): 48–50 (coauthors A.G. Sokolov and Yu.I. Spasibukhov).

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1960

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1961

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Unsteady gas motions of gas in variable-cross-section shock tubes. *Zh Prikl Mekh Tekh Fiz*, 1961; **4**: 109–13 (coauthors T.V. Marchenko and Yu.L. Yakimov).

1962

An approximate solution of some soil dynamics problems. *Prikl Mat Mekh* 1962; **26**(5): 944–6.

Allowance for moisture content in soil motion equations. *Zh Prikl Mekh Tekh Fiz*, 1962; (2): 128–30.

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On the papers by Ye.I. Shemyakin on "Expansion of a gas cavity in an incompressible elasto-plastic medium (for studying the effect of an explosion on soil)" and by N.S. Medvedev and Ye.I. Shemyakin on 'Load waves in undergound explosions in rock'. *Izv Akad Nauk OTN Mekhanika i Mashinostroyeniye* 1962; **5**: 173–7 (coauthors A.A. Grib, N.V. Zvolinskii, L.M. Kachanov and G.I. Petrashen').

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1964

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Translated by P.S.C.