Pergamon
www.elsevier.com/locate/jappmathmech
PII: S0021-8928(04)00134-5
J. Appl. Maths Mechs, Vol. 67, No. 6, pp. 793–807, 2003

0021-8928/$—see front matter

EDUARD IVANOVICH GRIGOLYUK
(80th birthday tribute)†

Eduard Ivanovich Grigolyuk, an outstanding scientist in the field of the mechanics of deformable solids and its applications to problems of aerospace, ship and automobile design, was born on 13 December 1923 in Moscow. His father was Ivan Osipovich Grigolyuk (1893–1943), a metallurgical engineer, Professor at the Moscow Steel Institute and the creator of stainless steel, and his mother was Mariya Timofeyevna Shpak (1900–1991), a teacher of foreign languages in Moscow.

In 1944 he graduated from the Aircraft Construction Department of the Moscow Aviation Institute (MAI). He completed his diploma on a 'Single-engine attack plane with an air-cooled engine' under the direction of chief designer S. A. Kocherigin. In the period from 1944 to 1947 he was a postgraduate student at the Moscow Aviation Institute in the department of the famous aircraft designer N. N. Polikarpov and in the Department of the Strength of Materials. In 1947, in the Motor Building Department of the MAI, he defended his Master of Technical Sciences dissertation on "The Design of Conical Discs of Variable and Constant Thickness. Theory and Applications", which was related to gas turbine design in the Experimental Design Office of V. V. Uvarov (CIAM). In 1951, at the Institute of Mechanics of the USSR Academy of Sciences, he defended his Doctor of Technical Sciences dissertation on "The design of thin-walled shells of rocket engines", in which the main strength problems of Glushko engines were solved for a Korolev carrier rocket and a Bondaryuk supersonic ramjet engine.

All his subsequent scientific, engineering and teaching activity was related to the solution of the most important problems of improving the strength of components and designs in the military-industrial complex of this country. He was fortunate to work with such outstanding designers as V. P. Glushko, S. P. Korolev, V. N. Chelomei, P. D. Grushin, A. M. Lyul'ka, N. D. Kuznetsov, S. K. Tumanskii, S. A. Lavochkin, V. M. Myasishchev, R. L. Bartini, I. P. Bratukhin, and others.

For over 20 years, beginning in 1948, he worked in the Bondaryuk 'Red Star' Engineering Design Office and was also scientific manager of this enterprise. He then worked in the Institute of Mechanics of the USSR Academy of Sciences (1953–1959), in the Institute of Hydrodynamics of the Siberian Branch

†*Prikl. Mat. Mekh.* Vol. 67, No. 6, pp. 899–920, 2003.

of the USSR Academy of Sciences (1959–1964), the Siberian Scientific Research Institute of Aviation (1959–1964) and the Institute of Mechanics of Moscow State University (from 1966).

He developed methods for designing ramjet engines and made a major contribution to the design of nuclear powered space stations. The theory of bimetallic shells was specially created by him for calculating the strength of Glushko engines. He took part in the development of projects of the 'Burya' (chief designers S. A. Lavochkin and M. M. Bondaryuk) and 'Buran' (chief designers V. M. Myasishchev and M. M. Bondaryuk) intercontinental winged carrier rockets. For these rockets, the powerful ultrasonic ramjet engines RD-012U and RD-018A respectively were designed in the Bondaryuk Design Office. In the Bartini Design Office, he worked on the strength problems of heavy, multimotor seaplanes intended for flight over the North Pole.

He also participated in the design of the RD-1A subsonic engine. In the design of an adapter from the main engine to the Bratukhin helicopter rotor, he set and solved the problem of the stability of a cylindrical shell loaded by inertial forces perpendicular to its axis. For the LA17 target drone, he built a new model of a shell with rigid longitudinal framing and assessed the strength of the design.

Practically all his theoretical investigations were in the interests of industry. Thus, he developed the general theory of the strength and stability of bimetallic, layered and inhomogeneous thin-walled structures. He introduced the productive hypothesis of the broken line for designing inhomogeneous shell structures (1956). He developed the theory of the stability of shells under elastoplastic strains and under conditions of creep. He studied the stress–strain state of perforated plates and shells as applied to nuclear power engineering problems. He investigated the interaction of weak shock waves with thin-walled structures in water and air, and also the vibrations of thin-walled shells of revolution containing liquid. He studied the contact interaction of the plates and shells of aircraft, and also the problem of optimizing the heating of shells. His last work was awarded a State Prize and was devoted to problems of the strength of rocket casings (including the well-known R-7 rocket) and rocket engines – urgent problems facing the State in the mid-1960s. He investigated the non-linear vibrations of rods, plates and shells, including in gas and liquid. He was the first to solve the problem of the asymmetrical snapping of thin elastic shells (1949).

He devoted considerable attention to the study of the mechanical properties of metal materials. Under his management, in Experimental Design Office 670 of the USSR Ministry of the Aircraft Industry, a machine was designed and manufactured for testing thin-walled cylindrical tubes under tension, torsion and internal pressure, which also enabled the transverse strains of the tube to be measured; this unit was transferred to the Institute of Mechanics of the USSR Academy of Sciences (1956). In the Siberian Scientific Research Institute of Aviation of the USSR Ministry of the Aircraft Industry, two testing machines were designed and manufactured for plotting the stress–strain diagram of a sample under nuclear irradiation and of a sample in the flow of a heated liquid-metal coolant; they were both transferred to the Institute of Nuclear Energy of the USSR Academy of Sciences (1966).

In recent years, in collaboration with the automobile industry, he constructed a theory of the non-linear deformation of multilayer reinforced structures, as applied to the design of pneumatic tyres. The most important problem of setting up strength standards for automobiles for different purposes was formulated and then solved in practice.

To his great credit, he succeeded in attracting, stimulating and interesting many talented young people in the central problems of mechanics, and they became his students. He is now head of the largest mechanics school, from which over 235 doctors and 80 masters of sciences have graduated.

He has always attached great importance to the education and training of scientific staff. He taught at the Moscow Aviation Institute (1994–1947 and 1965–1977), at the N. E. Bauman Moscow Higher Technical School (1946–1950), at the Academy of the Armaments Industry of the USSR Ministry of Armaments (1948–1951), at the Moscow Correspondence Polytechnic Institute (1953–1955), at Moscow State University (1954–1957), and at the Moscow Automotive Institute, where, since 1977, he has been head of the Department of Applied and Computational Mathematics.

He has devoted much time to popularizing the Russian classics in the field of natural science. His work on the history of Russian mechanics, devoted to I. G. Bubnov, G. V. Kolosov, A. N. Krylov, S. P. Timoshenko, and others is well known. He published a four-volume collection of original studies of S. P. Timoshenko (1971–1975), accompanying this collection with a detailed analysis and commentaries, and he also published several books about him.

He was the editor of translations from the English and German of 48 books covering different areas of mechanics. He took part in the publication of the encylopaedic handbook "Vibrations in Engineering" as deputy chief editor and deputy chairman of the editorial board (1978–1981).

In 1952–1980 he was editor of the review journal *Mekhanika*, in 1965–1989 he was executive secretary of the editorial board of the journal *Izvestiya Akademii Nauk SSSR. Mekhanika Tverdogo Tela*, and he

was a member of the editorial board of the journals *Prikladnaya Mekhanika i Tekhnicheskaya Fizika* (1960–1965) and *Problemy Mashinostroeniya i Nadezhnosti Mashin* (from 1996).

He devoted much effort to the development of Russian engineering. From 1954 he was a deputy chairman and from 1960 the chairman of the Commission on the strength of Engines of the USSR Academy of Sciences (the Russian Academy of Sciences), and from 1980 he chaired the section "Dynamics and Strength of Automobile Designs" of the USSR Academy of Sciences (the Russian Academy of Sciences). The regular international conferences and meetings on these problems that he runs still attract many skilled engineers and scientists.

He has been awarded numerous scientific titles and awards: Corresponding Member of the USSR Academy of Sciences (1958), professor (1959), full member of the International Academy of Aeronautics (1969), member of the New York Academy of Sciences (1995), member of the Russian Academy of Transport (1992), winner of the State Prize (1975) and honoured scientist of the Russian Federation (1996). He has been awarded: the orders of "The Badge of Honour" and "The Friendship of Nations"; medals of the USSR Academy of Sciences and the Siberian Branch of the USSR Academy of Sciences in connection with the 250th anniversary of the Academy; the "S. P. Korolev", "M. M. Bondaryuk", "V. N. Chelomei", "P. L. Kapitsa", "300th Anniversary of the Russian Fleet" and "40 Years of the Space Era" medals; the V. N. Chelomei diploma for his "outstanding contribution to the design of space rocket equipment prototypes and to the conquest of space" (1998); and also the Peter I medal.

A talented engineer and scientist, he possesses a truly encyclopaedic knowledge in the field of mechanics and its applications. But that is not all. The history of Russia, the philosophical problems of the nature of existence, the Silver Age of Russian poetry and, finally, the creative genius of Pushkin – these are just a few of his personal interests. He is an enthusiastic and successful collector, above all a collector of books. His library is vast and contains a large number of rare publications from the sixteenth to the twentieth century. He is the owner of a number of the rarest autographs.

He shares his knowledge generously with his students and colleagues. His marvellous stories and public speeches are unforgettable.

The editorial staff and editorial board of the journal *Prikladnaya Matematika i Mekhanika*, his students, his friends and his colleagues send him the warmest greetings on his eightieth birthday and wish him good health, happiness and further creative success.

LIST OF THE MAIN SCIENTIFIC PUBLICATIONS OF E. I. GRIGOLYUK

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Translated by P.S.C.