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Irina Georgiyevna Goryacheva (On her birthday)☆

The 30th of May 2007 was the birthday of Academician Irina Georgiyevna Goryacheva, a prominent specialist in the field of the mechanics of deformable bodies, the mechanics of contact interaction and tribology. The fundamental results she obtained in these fields of science are widely known, as are her solutions of a number of important engineering problems.

Professor Goryacheva graduated with distinction from the Mechanics and Mathematics Faculty of the M.V. Lomonosov Moscow State University in 1970 (the Department of Plasticity Theory), completed her postgraduate studies in 1973 and in 1974, defended her Candidate dissertation on 'An investigation of rolling friction taking into account slippage and viscoelasticity', written under the guidance of L. A. Galin, Corresponding Member of the

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USSR Academy of Sciences. An outstanding scientist in the field of mechanics, Professor Galin played a key role in Goryacheva becoming an inquisitive researcher knowing how to formulate and solve complex fundamental and applied problems. In 1988 she was awarded the degree of Doctor of Physical and Mathematical Sciences for her work on 'Contact problems in tribology'.

Since 1973 she has worked at the Institute for Problems in Mechanics of the Russian Academy of Sciences in the tribology laboratory, which she has headed since 1996. At the same time she is a chief research fellow at the Institute of Mechanics of Moscow State University. In 1997, she was elected a Corresponding Member of the Russian Academy of Sciences, and in 2003 a Full Member of the Russian Academy of Sciences, specializing in mechanics.

Her scientific interests are concentrated mainly in the field of the mechanics of frictional interaction. In her research, a great deal of attention is paid to analysing the influence of surface microgeometry (roughness), the inhomogeneity of the mechanical properties of surface layers, and also the properties of the surface and thin surface films covering it on the contact characteristics interaction and the way these change when the surface layers of materials fail under friction (wear). Among the most significant scientific results she obtained, mention must be made of the development of the fundamentals of the mechanics of discrete contact, which made it possible for the first time to investigate the interaction of rough bodies and the processes occurring neare the contact spots as a result of the collective behaviour of elementary microcontacts. She developed a new approach to calculating the contact characteristics based on a consideration of the contact interaction of rough bodies on two scale levels, one of which corresponds to the macroshape of the contacting bodies, and the other to the characteristic size of an asperity. In her studies, she formulated and solved the problem of discrete contact for an elastic two-layer half-space with incomplete adhesion of the layers, which made it possible to investigate the influence of the properties of the surface layers and their degree of adhesion to the substrate on the stress state and the nature of coating the fracture for various loading conditions. The results obtained are of considerable importance in the development of engineering methods for calculating the rigidity of joints between homogeneous and inhomogeneous rough bodies.

She has made an important contribution to the development of the theory of interaction of elastic and viscoelastic bodies with adhesion forces of different nature, within the framework of which the combined effect of the physical, mechanical, and geometric properties of the surface and thin surface layers on friction and wear is studied. These studies take on particular significance today in view of the development of various kinds of micromachines. Analytical solutions of problems of the interaction of elastic bodies taking into account the adhesion forces caused by molecular interaction or by menisci of fluid formed near contacting tips of asperities (capillary effect) were obtained and used to analyse the influence of the surface microgeometry parameters, surface energy, properties of a thin surface film of fluid, and mechanical properties of contacting bodies on the contact stresses and the energy dissipation in the approach-separation cycle. A method was proposed for calculating the adhesion component of the friction force in the rolling contact of elastic bodies.

Professor Goryacheva has made an enormous contribution to the development of analytical methods for solving a number of mixed problems of elasticity and viscoelasticity that arise when investigating the sliding and rolling contact or contact with partial slip, when the region of contact interaction is split into stick and slip zones. The role of thin viscoelastic surface layers in the sliding and rolling contact of elastic bodies under conditions of boundary and hydrodynamic friction, including conditions of limited lubrication, was studied. The solution of these problems is particularly important when analysing the dependence of the coefficient of friction on the velocity for couplings operating under different lubrication conditions or having solid lubricant coatings on their surface.

She proposed approaches to modelling the fracture of surfaces under friction, based on methods of the contact mechanics and fracture mechanics, and constructed a model of fatigue fracture of the surface layers of rough bodies, which made it possible, from a common point of view, to describe two types of surface fracture: surface fracture, (wear) characterised by the continuous loss of material from the friction surface, and subsurface fracture, which occurs at discrete instants of time and leads to the separation of particles of finite size. This model was used for a qualitative and quantitative analysis of the process of the formation of contact fatigue defects on railway wheels and rails.

Professor Goryacheva has developed a new area in the theory of contact problems, begun by A. S. Pronikov, M. V. Korovchinskii, and L. A. Galin – contact problems taking into account the surface shape variation during the wear process (wear contact problems). In this field, she obtained the following main results: she constructed a general method for solving wear contact problems with a fixed region of contact; she derived the necessary conditions for the existence and asymptotic stability of a steady-state wear regime; and she constructed a general form of the stationary solution. The theory of wear contact problems was developed further in her studies taking into account the discrete

nature of the interaction of rough bodies, and also in solving the wear contact problems for bodies with a variable wear coefficient, which made it possible to study the shape variation in the wear process of wavy, rough and locally hardened surfaces, and to solve the inverse problem of the purposeful development of inhomogeneous surfaces satisfying certain requirements to the wear process and to the shape of the worn surface. On the basis of these results, methods were developed for calculating the kinetics of wear of plain bearings, piston rings, slide guides, drilling tools, railway wheel and rail profiles evolution, etc.

She is the author of over 150 scientific papers, three monographs and a number of inventions. Her publications are noted for their mathematical rigour and practical value.

She successfully combines her research work with her teaching activity. She is a professor in the Faculty of Controllable and Gyroscopic Systems of the Moscow Institute of Physics and Technology and supervises the research of students and postgraduates and their preparation for degree and Candidate thesis. The school of the contact mechanics in tribology that she set up is well known among scientists in Russia and beyond.

At the Institute for Problems in Mechanics, over a period of many years she has been running the laboratory of tribology and the work of the seminar on the mechanics of frictional interaction, and has carried out active work in the youth committee at the Presidium of the Russian Academy of Sciences. She sits on expert councils of the Higher Certification Commission (VAK) and the Russian Foundation for Basic Research (RFFI), is chair of the Scientific Tribology Council at the Russian Academy of Sciences, the Ministry of Science and Technology of the Russian Federation and the Union on Science and Research Societies, she is chair of the "Problems of the Mechanics of Transportation" section of the Transport Council of the Russian Academy of Sciences, sits on Russian national committees for theoretical and applied mechanics and for tribology and is a member of the Committee of Congresses of the International Union on Theoretical and Applied Mechanics. She is a member of the editorial board of a number of leading Russian and foreign journals, is deputy editor-in-chief of the journal *Treniye i Iznos* (Friction and Wear), is a member of the editorial board of the international journal *Wear* and carries out a great deal of work on the organisation of Russian and international scientific conferences in the field of mechanics and tribology. For 9 years (1998–2006) she has represented our country on the European Mechanics Society (Euromech) Council and has been a member of the scientific committee of Euromech conferences on the mechanics of deformable solids.

Professor Goryacheva's scientific achievements have been recognized in Russia and abroad. For her cycle of papers on "The application of methods of the theory of elasticity to problems of friction, wear and contact rigidity", she was awarded the Lenin Komsomol prize in the field of science and technology (1979). In 2006, as part of a team of authors, she won the Russian Federation Government prize.

Simplicity, modesty and friendliness in her everyday dealings with colleagues are her the distinguishing features, and at the same time she has a high sense of responsibility for the tasks with which she is entrusted and is highly principled in her work.

The editorial board and staff of our journal and her colleagues and students warmly congratulate her on her birthday and wish her good health and future success in her many activities.

Translated by P.S.C.