Professor Leonid I. Manevitch (1938 – 2020)

The international scientific community has suffered an irreparable loss. Professor, DSc in Engineering, Leonid I. Manevitch, passed away on 20th August 2020 after battling with severe long-term illness. He was a world-leading authority in mechanics of solids and physics of materials.

L. I. Manevitch was born 2nd April 1938 in Mogilev (fSU, now R. Belarus). He received his high school and university education in Dnipro, Ukraine. After completing his undergraduate degree at the Faculty of Physics and Mathematics at Dnipro National University in 1959 he worked in the Design Bureau "Yuzhnoe" and was simultaneously a part-time postgraduate student under the supervision of Prof. Yu. A. Shevlyakov. In 1961 he completed his PhD in the area of shell stability and started working at Dnipro National University as an associate professor in the Department of Applied Elasticity, led by Prof. V. I. Mossakovsky. In 1970, at the age of 32, he completed his DSc thesis, concerned with asymptotic and group methods in mechanics of solids, and was promoted to a full professorship at the same department. In 1976, after relocating to Moscow, he was appointed as a senior research fellow and later on as Head of the Polymer Physics and Mechanics division at the Semenov Institute of Chemical Physics, USSR Academy of Sciences. From 1984 onwards, he was also a part-time professor of the Department of Polymer Physics at the Moscow Institute of Physics and Technology.

At the beginning of L. I. Manevitch's academic activities – during the span of 15 years – his main research focuses were on asymptotic analysis of elastic anisotropic media, strength and stability of anisotropic and stiffened plates and shells, as well as on the investigation of normal vibration modes in essentially non-linear systems. It is noteworthy that his asymptotic ideas were not just a technical tool for analysing difficult problems, but also became the cornerstone of his entire scientific philosophy; the key to the understanding of a variety of phenomena and physical theories. The peculiarities of L. I. Manevitch's approach involve the nontrivial choice of novel asymptotic parameters, as well as a combination of the asymptotic approach with group theory. This enables not only the broadening of the range of applications of

the asymptotic analysis, but also the understanding of it in more general perspectives. Based on these concepts, stimulating development of physical and engineering intuition, he supervised numerous students and established a strong scientific group in Dnipro.

The aforementioned ideas and methods appeared to be highly instrumental and robust at the next stage of L. I. Manevitch's research activity, which was mainly related to the modelling of a variety of problems in mechanics and physics of polymers and composites. At the same time, these ideas were naturally combined with several new techniques and procedures arising in modern nonlinear physics, in particular in the nonlinear wave theory. Namely the combination of asymptotic methodology and the recents achievements in nonlinear physics allowed L. I. Manevitch to solve a number of important problems in this field.

He established a general asymptotic theory for the deformation and fracture of highly anisotropic composites. In particular, he developed a powerful framework for analysing structural defects and nonlinear excitations in polymer crystals, predicted and studied the solitary nature of the propagation of chemical reactions and structural transitions in molecular and polymer crystals at the atomic scale, investigated the role of solitary phenomena in the mechanical destruction of polymer chains, etc.

In the last 15 years L. I. Manevitch was particularly active in the tackling of general problems in nonlinear dynamics and the investigation of localised nonlinear normal modes and solitons in oscillatory chains of complex structures as well as in energetically nondegenerate quasi one-dimensional models. In addition, he also concentrated on linear and nonlinear dynamics of carbon nanotubes. A universal approach was developed for modelling nonlinear normal modes and localised disturbances ("envelope solitons"), derived from a complex form of the equations of motion. For the first time, nonlinear dynamics of macromolecular chains, forming polymer crystals of zigzag or spiral form, was investigated, and localised nonlinear disturbances with an oscillatory degree of freedom (the so-called "breezers"), were studied both analytically and numerically.

In general dynamics of nonlinear systems, L. I. Manevitch introduced the concept of limiting phase trajectories, corresponding to the maximal energy exchange between particle clusters ("effective particles"). Its efficiency is demonstrated for vibration damping and synchronisation.

L. I. Manevitch's results are presented in 20 books, published in Wiley, Springer, and Kluwer, etc., and in around 400 papers. He was an invited speaker at several major international conferences and symposia, as well as at the seminars of multiple world-leading universities. Throughout many years L. I. Manevitch delivered original modules in the area of mechanics of polymers and composites at Moscow Institute of Physics and Technology, where he also supervised final-year projects. Under his guidance 35 PhDs were completed. 12 of his students became DSc.

Among of his awards is the prestigious Kargin Prize of the Russian Academy of Sciences, which he was awarded for outstanding contribution in the field of polymer physics.

It is difficult to imagine that a life so creative and productive has abruptly come to an end. L. I. Manevitch was always in the process of development, playing an active role in research until his final days. Working tirelessly, he managed to develop himself into an expert of unique competence. His exceptionally broad knowledge, high professionalism, and original vision of challenging scientific problems allowed him to constantly be finding new opportunities for generating fruitful ideas and concepts, addressed in his numerous influential publications, widely known worldwide.

L. I. Manevitch's research efforts make a fundamental contribution to theoretical elasticity, nonlinear dynamics, and mechanics and physics of materials. His phenomenal pedagogical ability enabled him to motivate a number of talented students and co-workers, who subsequently made their own contribution to modern science. His outstanding personality – his tactfulness, kindness, generosity, and modesty – will remain in the memories of all who knew him for a long time.