

Prof. Alexander Rachev 80th birthday



Alexander Rachev was born in 1939 in Sofia. In 1963 he graduated from the Higher University of Civil Engineering in Sofia. From 1963 to 1972 he worked at the Institute of Technical Mechanics at the Bulgarian Academy of Sciences (BAS) as a research assistant and research associate. In 1969 he received a doctoral degree in applied mechanics from the Institute of Basic Problems of Technics at the Polish Academy of Sciences in Warsaw. In 1971 Prof. Rachev was one of the founders of the Problem Group on Biomechanics at BAS that established the scientific investigations on biomechanics in Bulgaria. He worked as a research associate, and since 1973 as an associate professor at the Central Laboratory of Biomechanics, which in 1977 became a part of the Institute of Mechanics and Biomechanics, renamed in 1993 to the Institute of Mechanics. In 1984 Prof. Rachev became the first scientist to receive the degree "Doctor of Technical Sciences" in the field of biomechanics. In 1987 he became a professor, and he retired in 2004. He is currently an associate member at the Institute of Mechanics and an honorary member of the Bulgarian Biomechanics Society.

Having worked virtually with the same affiliation, in different periods of time Prof. Rachev served as a head of the scientific group of Cardiovascular Biomechanics, scientific secretary of the Central Laboratory of Biomechanics, section head of Biomechanics of Tissues and Processes at the Institute of Mechanics, chairman of the Scientific Council of the Institute of Mechanics, representative of the Institute of Mechanics in the General Assembly of BAS, member of the Hager Testimonial Commission (VAK), member of the National Council of Theoretical and Applied Mechanics, etc.

The research activity of Prof. Rachev is in the field of applied mechanics, and since 1972 predominately in vascular solid biomechanics. He published and co-authored two monographs, two lecture notes of specialized biomechanics courses, and over 240 peer-reviewed scientific articles having more than 2,700 citations (h-index 25, i10-index 36). Prof. Rachev's most significant scientific achievements are in building mathematical models of properties and performance of arterial vessels as follows: i) A continuum mechanics-based mathematical model of the arterial tissue that accounts for the generation of active stress by smooth muscle cells, considering the medium as an open thermodynamic system. In the Session Lecture of Cardiovascular Biomechanics at the Fifth World Congress of Biomechanics (Munich, 2006) the model was described as establishing a new direction in studying arterial biomechanics; ii) Mathematical models for adaptive remodeling of arteries to changes in arterial

pressure and blood flow that account for coupling between local mechanical descriptors and the change in the tissue mass (the so-called “global growth approach”). In the Plenary Lecture of the Eighth World Congress of Biomechanics (Dublin, 2018) the global growth approach proposed by Prof. Rachev in 1996 and the volumetric growth approach proposed in the same year by L. Taber (USA), were marked as seminal papers that establish a new trend in biomechanical studies on arterial vessels; iii) First study on dynamic stability of arteries; iv) A nonlinear dynamic model of spontaneous arterial oscillations; v) Development of methodology for optimal design of arterial stents and vascular prostheses. The scientific contributions of Prof. Rachev’s research advance mechanistic understanding of normal and pathological operations of arterial vessels, promote a better understanding of experimental and clinical data, and motivate new avenues of theoretical and experimental investigations.

Prof. Rachev was a principal investigator on biomechanics projects in the framework of the scientific cooperation between BAS and Academies of Sciences of Poland, Czechoslovakia, Germany, former USSR, the Royal Society of Great Britain, Bioengineering Center of The University of Stratford, and projects funded by the Swiss Research Fund, by NATO with the International University of Florida in Miami and University of North Carolina in Winston-Salem, etc. He gave lectures on Theory of membranes, plates and shells at the Center for Mathematics and Mechanics at the BAS. Under his supervision, nine masters students graduated and three doctoral theses were defended. He was a member of organizing and program committees of many scientific meetings in Bulgaria, such as the National Congresses of Theoretical and Applied Mechanics, Euromech 68, Summer School of Biomechanics in Varna, etc. For his academic activity, Prof. Rachev was awarded with a badge of distinction of the BAS.

Professor Rachev has been a member of the editorial boards of the Bulgarian Biomechanics series since its first issue in 1974, and was on the editorial boards of the Russian Journal of Biomechanics (Russia), the Journal Biocybernetics and Bioengineering (Poland), the international journal Biomechanics and Modeling in Mechanobiology, and the International Journal of Cardiovascular Medicine and Science. He served as an editor and co-author on mechanics and civil engineering related topics in Physical-Mathematical and Technical Encyclopedia, BAS Publisher, 1990.

Professor Rachev had significant scientific activity abroad. He was a guest researcher and visiting professor in Japan (three times), Italy, Switzerland (six times) and the United States (for twelve years). He had given biomechanics courses for undergraduate and doctoral students at the Georgia Institute of Technology in Atlanta (USA), the University of South Carolina in Columbia (USA), the Federal Polytechnical University in Lausanne (Switzerland), and was a lecturer at specialized summer schools on biomechanics, organized by the International Center for Mechanics in Udine (Italy), the University of Nottingham (England), the Polytechnic in Milan (Italy), the Institute of Basic Problems of Technics at the Polish Academy of Sciences in Warsaw (Poland), and Temple University in Philadelphia (USA). Under his supervision several masters students and four Ph.D. students in Switzerland and five in the US graduated. He was the co-principal investigator and external expert on biomechanics projects funded by research agencies in Switzerland and the USA. He has been for a full mandate of 12 years a member of the World Congress of Biomechanics, a member of the International Scientific Council of Biocybernetics and Bioengineering at the Polish Academy of Sciences, and a member of the American Society of Mechanical Engineers.

Apart from his scientific research Prof. Rachev has participated in engineering projects such as increasing the efficiency of production of hot-rolled steel sheets in MK Kremikovtzi and DMK Pernik, optimizing the design of electrical carts, etc. For several years he worked as an associate engineer at the Institute for Cultural Monuments in Sofia and took part in the restoration of the Tzarevets fortress walls in Veliko Turnovo, and in the seismic reinforcement of historic buildings and churches in Plovdiv, Melnik, Arbanasi, etc.

The Editorial Board of the Series Biomechanics passes sincere greetings to Prof. Alexander Rachev on his 80th birthday celebration, proudly acknowledges the breadth and importance of his contributions to the scientific and engineering communities to which he devoted his career, and wishes him many years of a healthy, active and happy life.

Editorial Board