

DJORDJE DJUKIĆ
1943–2019

Djordje DJUKIĆ, a full member of the Serbian Academy of Sciences and Arts, university professor, graduate mechanical engineer and a longtime member of the Yugoslav, i.e. Serbian Society of Mechanics. From 1995 to 2001 he was editor in chief of the journal *Theoretical and Applied Mechanics* (*Teorijska i primenjena mehanika*) published by the Yugoslav, i.e. Serbian Society of Mechanics.

He was born on February 20, 1943 and passed away on February 9, 2019 in Novi Sad, the city where he spent his whole life.

He received an associate degree at the Faculty of Mechanical Engineering at the Department of Thermal Engineering in Novi Sad, and a bachelor's degree at the Department of Aeronautics – Group for Ballistics, at the Faculty of Mechanical Engineering in Belgrade in 1966. He earned a Master's degree at the Faculty of Natural Sciences and Mathematics in Belgrade, at the Department of Mechanics in 1969. In February 1971, only five years after finishing his undergraduate studies, at the age of 28, he successfully defended his PhD thesis entitled “Stationary Laminar Boundary Layer of a Non-Newtonian Fluid with a Power Law Rheological Equation of State” at the Faculty of Natural Sciences and Mathematics in Belgrade. His PhD thesis advisor was prof. Viktor Saljnikov.

In October 1967 he started working at the Faculty of Mechanical Engineering in Novi Sad as a teaching assistant, and in June 1972 he was elected assistant professor for the subject Mechanics. He was elected full professor of the University of Novi Sad in March 1983. During the academic year of 1978–1979 he worked at the University of Cincinnati, Ohio, USA, at the Department of Engineering Science, where he taught different courses of engineering mechanics, analytical mechanics and stability theory.

At the Faculty of Technical Sciences in Novi Sad he taught Statics, Kinematics, Dynamics, Oscillation Theory, Stability Theory, Optimization Methods, as well as Analytical



Mechanics and Nonholonomic Mechanics (which he designed and introduced for the students of mechanical and electrical engineering). At the Faculty of Mechanical Engineering in Srpsko Sarajevo in the Republic of Bosnia and Herzegovina he held lectures on Kinematics for four years. Professor Djukić was the lead author of four textbooks for the students of faculties of technical sciences: Statics, Kinematics, Dynamics and Mechanics, all of which went through more than five editions. The well-known publishing house LAP Lambert printed his textbook on dynamics in English. Professor Djordje Djukić supervised a number of undergraduate theses on mechanics at the Department of Mechanical Engineering of the Faculty of Technical Sciences in Novi Sad, as well as 4 Master's and 3 PhD theses, and he was a member of several Master's and PhD committees. The candidates who completed their PhD theses under prof. Djordje Djukić's supervision are very successful scientists and professors at the faculties of the University of Novi Sad and beyond.

From 1993 to 2001 professor Djukić was the Head of the Department of Mechanics at the Faculty of Technical Sciences in Novi Sad. In addition to his membership and work in the organs and councils of the faculty, he was also a member of the Council and Professional Boards of the University of Novi Sad for several terms.

Professor Djukić had a very rich scientific production. He published over 120 scientific papers in domestic and international journals and proceedings from conferences in the country and abroad. It should be noted that from 1973 to 1993 he published over 80 papers in the journals from the SCI list (Science Citation Index), which was a real rarity and huge success at the time and even nowadays would be very rare. That is what ranked him among the leading scientists in the country and abroad in the field that he studied. Numerous papers that prof. Djordje Djukić published in international journals brought the University and Faculty recognition abroad, which is attested by a very high citation index according to the data published in the SCI edition. He held a number of opening and plenary lectures, as well as general lectures at domestic and foreign conferences. Professor Djukić held visiting lectures at the following universities: University of Newcastle, England, University of Turin, Italy, University of Cincinnati, Ohio, USA, University of Kentucky, Lexington, Kentucky, USA, Vanderbilt University, Nashville, Tennessee, USA, University of California, Berkeley, California, USA, University of California, Davis, California, USA. The National Science Foundation of the USA (NSF) approved an international project which he ran and for which he was the lead researcher for six full years from 1985 to 1991. Unfortunately, war developments in the country hindered further project research.

Scientific fields that prof. Djukić dealt with were primarily: boundary layer theory, non-stationary heat conduction and diffusion problems, nonholonomic mechanics, optimal control, conservation laws and extremum variational principles. Using the colossal apparatus of modern analytical mechanics (Hamilton's variational principles, dual variational principles, Lyapunov's theory of stability of motion etc.) in his scientific works Djukić managed to make a significant engineering contribution to the rational description of non-stationary processes of mechanical engineering, ranging from the flow of viscous fluids, thermal and diffusion processes, optimal control theory, nonlinear vibration phenomena theory, problems of mechanics of nonholonomic systems, elastodynamics, all the way to the most contemporary studies of exact and adiabatic invariants (i.e. conservation laws) on which these processes are rationally based. His contribution to the field of analytical mechanics of nonholonomic systems should be particularly pointed out. Professor Djukić undertook the task of generalizing all differential equations of linear nonholonomic system motions into nonholonomic constraints of higher order and applying them in an analysis of a number of problems, including the famous Lanchester problem of duel or combat

tactics. With the help of canonical transformations of variables he established a relationship between Pontryagin's maximum principle and Bellman's dynamic programming method and thus made a significant contribution to the field of optimal control. Professor Djukić made a generalization of the Lagrange–d'Alembert principle of dynamics by introducing generalized displacements in the directions of possible displacements of system points after liberation from the constraints. In addition to Lagrange equations of the second kind, he also derived the equations of "equilibrium in normal directions" from which reaction forces of ideal constraints in the system can be derived. This procedure can be of particular significance in the dynamics of robotic systems. However, academician Djukić made the most important contribution to the field of extremum variational principles of mechanics. Using the theory of dual variational principles, a variational principle was constructed which was extremal in a much larger class of problems of engineering than the primal and dual principles. Based on the values of functionals of the approximate solution to the problem, a procedure was developed for the error estimate of that solution with regard to the unknown exact solution to the same problem. Using canonical transformations, i.e. moving from the original phase space of mechanics to a new one, one always extremum variational principle was formulated for classical mechanical systems in that new phase space.

Professor Djukić introduced the couple as an independent and fundamental element to mechanics and formulated new axioms of statics relating to couples. These results were published in papers and they also entered the textbooks used for teaching statics at the Faculty of Technical Sciences in Novi Sad.

Professor Djukić worked also practically on solving concrete engineering problems, so he developed a completely new method for balancing rotating parts of machines in their bearings. The method was used for practical balancing of over 100 rotating machines in various factories and plants in Vojvodina. In that application this method proved faster and more efficient than the procedures offered by famous manufacturers of the equipment for balancing such machines in the world.

He received awards for his work a number of times, and the most significant ones should be noted: "Rastko Stojanović" Award of the Yugoslav Society of Mechanics, presented to him at the Yugoslav Congress of Mechanics in 1974 for the achievements of young scientists under the age of 35, October Award of the city of Novi Sad for achievements in science in 1983 and the Plaque for an outstanding contribution to the development of the Faculty of Technical Sciences in 2010.

In view of the achieved results and great contribution to science he was elected corresponding member of the Serbian Academy of Sciences and Arts in Belgrade in 1994, and full member in 2003.

It should be pointed out that Djordje Djukić was an excellent sportsman. He defended the honour of our country in tennis several times as a junior national team member of Yugoslavia. Academician Djukić left behind two very successful children and five grandchildren.

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