

VASILE DRĂGAN AT HIS 70th BIRTHDAY

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Abstract

This volume is dedicated to the 70th anniversary of *Vasile Drăgan*, an internationally recognized researcher in the area of system and control theory. The impressive scientific results of Vasile Dragan are the output of a life-time sustained work and his special talent for Mathematics. This is a story of "A Beautiful Mind". On this occasion, his collaborators and his colleagues wish him long life in good health and happiness, and more achievements in the field of science.

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The distinguished mathematician *Vasile Drăgan*, Senior Research Fellow of 1st (higher) degree at the Institute of Mathematics of the Romanian Academy - division of Differential Equations - was born on February 2, 1950 at Valea Bolvaşniţa, the County of Caraş-Severin, Romania. Between 1965 and 1969 he completed his high school education at the “Traian Lalescu” College in the town of Mehadia (the same county), followed by undergraduate studies in Mathematics, according to the educational structure of the time: 4 years of “bachelor-like” studies, followed by 1 year of “specialization” - “master-like” studies. This period of education (1969-1974) took place at the University of Bucharest, School (Faculty) of Mathematics and Mechanics. The first 4 years followed the cursus of *Mathematics* while the next year was dedicated to *Mathematical Analysis* - in large sense. His Ph.D. studies were done between 1976-1979, also at the Faculty of Mathematics and Mechanics, under the scientific guidance of Professor Aristide Halanay (1924-1997); it is not mistaken to conjecture that the life lasting interest and attachment of Vasile Drăgan to the field of Differential Equations and their Applications arose from the contact with Professor Aristide Halanay since the undergraduate studies.

The years of his studies, more precisely the first years of the decade 1970-1980 witnessed a contradictory period for Romanian research, in particular for the research in Mathematics. On one hand, between 1970 and 1975, several research institutes of the Romanian Academy were fully or partly suppressed (including the Institute of Mathematics). On the other hand, new research groups occurred, aiming to adapt to what was called “Integration of Research, Development and Practice”. Vasile Drăgan started his professional research activity in such a group - the System Theory Laboratory of the University of Bucharest - under the guidance and mentorship of Professor Aristide Halanay, whose expertise allowed to discern the genuine mathematical problems arising from engineering, biology and economics.

The large class of problems towards which Vasile Drăgan was guided, arose from control engineering, theory and industrial applications. To summarize, there was a revival of the *small parameter approach* on two directions: computer control implementation by sampling and piecewise constant control, leading to *regular perturbations* and dynamics with several time scales, leading to *singular perturbations*. Both directions are represented in the early results of Vasile Drăgan, in his Ph.D. thesis and publications. For instance, the Ph.D. thesis deals with piecewise constant control implementation of the LQG (Linear Quadratic Gaussian) methodology, a direction which will persist along decades under various forms for various classes of

systems. The singular perturbations methodology covers the “post-doc” period and was finalized by the monograph “Singular perturbations. Asymptotic expansions”, authored together with Professor Aristide Halanay and published in 1983. Worth mentioning that 1983 marks the joining by Vasile Drăgan of the research staff of the Institute of Mathematics in its “contracted form”, subordinated also to the University of Bucharest. To continue the discussion about the aforementioned monograph, let us mention its highly original approach which is still waiting extensions to infinite dimensional systems and its English version for deserved worldwide dissemination.

The years following 1983 - spent at the Institute of Mathematics (returned since 1990 in the structure of the Romanian Academy) - witnessed a remarkable scientific development of Vasile Drăgan, direct consequence of his activity and contributions enclosed in some 6 monographs, published in renowned international publishing houses and in more than 250 papers published in the best scientific journals of the field. It is useful to enumerate his research directions to recognize a large scale of competence and an extending scientific competence in the field of differential equations and control (aiming to equations on Banach spaces, stochastic control, differential games).

- The use of singular perturbations technique in the synthesis of some controls with prescribed performance in the case of controlled systems with several time scales.
- The analysis and synthesis of some classes of piecewise constant controls with applications in control problems with sampling.
- Exponential stability of linear differential (difference) equations with positive evolution on ordered Banach spaces with applications to characterization of exponential stability in mean square of large classes of linear differential (difference) stochastic equations.
- The robust control of continuous-time and discrete-time linear time-invariant systems and time-varying systems, in both deterministic and stochastic framework.
- Problems regarding the existence of global solutions of a large class of differential (difference) Riccati type equations.
- H_2 and H_∞ filtering of signals generated by dynamical systems affected by multiplicative white noise perturbations.

- Linear quadratic optimal control for several classes of stochastic linear systems.
- Stochastic linear quadratic differential games.
- Stochastic linear quadratic differential games with sampled measurements.
- Numerical computations of the stabilizing solution of Riccati differential (difference) equations arising in connection with stochastic linear quadratic optimal control problems and stochastic linear quadratic zero sum differential games.

Vasile Drăgan is a renowned and recognized researcher. Recipient of the “Gheorghe Lazăr” Award of the Romanian Academy in 1994, he was *Invited Professor* in several prestigious institutions of Germany, Canada, France and Bulgaria. Since 2018 is Member of the Academy of the Romanian Scientists. The list of his publications shows distinguished researchers being his co-authors. With more than 2500 citations, an *h-index* of 23 and an overall Research Gate index over 35, Vasile Drăgan is full of new ideas and eager of producing valuable research. His colleagues and co-workers who highly appreciate him, wish him all the best, together with his spouse *Viorica* “who always made everything possible”!