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In Memoriam: Blagovest Sendov February 8, 1932–January 19, 2020

Blagovest Hristov Sendov was born on February 8, 1932 in Asenovgrad, Bulgaria. From a very early age, Sendov showed an exceptional talent for mathematics. His strong desire to study mathematics at the Sofia University however could not be realized immediately. Being from a bourgeois family he was not allowed to study at the University. The communist system in Bulgaria at that time did not let young people of unreliable bourgeois background into higher education. With his typical perseverance and creativity he managed to overcome this first serious obstacle in his life. After being a laborer for three years, cleaning the streets in Sofia, he was admitted to Sofia University. Bl. Sendov graduated from the Department of Mathematics at Sofia University in 1956 (a year earlier than his classmates). Immediately after that he was admitted as a graduate student in the same department, but again for political reasons he was not allowed to continue his education. He had to work as a teacher for two years. With the very strong support of the mathematics professors (most importantly Prof. N. Obreshkov) Bl. Sendov was appointed in 1958 as an assistant professor in the Department of Mathematics. With his enormous energy, perseverance, strong will and ingenuity Bl. Sendov succeeded in developing a brilliant professional career. He was promoted to associate professor in 1963 and to full professor 1968. In 1964 he was awarded a Ph.D. from the Moscow State University and in

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1967 he received his Second Doctoral Degree. In 1974 Bl. Sendov was elected Corresponding member of the Bulgarian Academy of Sciences (BAS) and in 1981 he was already a Member of the BAS.

Sendov's administrative and political carrier was also extraordinary. During the period 1970–1973 he was Dean of the Department of Mathematics, Sofia University, and Rector of Sofia University during the period 1973–1979. In 1980–1982 he was Vice-President of the BAS and Vice-President and Secretary General of the BAS during the period 1982–1988. From 1988 through 1991 Bl. Sendov was President of the BAS. During the period 1991–1993 he was Director of the Center for Informatics and Computer Technology at the BAS. Bl. Sendov was President of the Bulgarian Parliament (1995–1997) and Vice-President of the Bulgarian Parliament (1997–2000). He was the Bulgarian ambassador to Japan during the period 2003–2009.

Bl. Sendov was widely recognized internationally. He was elected Honorary Doctor of the Moscow State University in 1977, Foreign member of the Ukrainian National Academy of Sciences in 1998, Honorary member of the International Higher Education Academy of Sciences in 1998, and Foreign member of the Serbian Academy of Sciences in 2000. Bl. Sendov was actively involved in several international organizations. During the period 1980–1985 he was Vice-President and/or Acting President of the International Association of Universities (IAU) and Honorary President of IAU thereafter. During the period 1989–1992 he was President of the International Federation for Information Processing (IFIP) and Honorary President of IFIP since 1993.

A high point in Sendov's carrier was his role in the reorganization of the university education and modernization of the mathematics research organization in Bulgaria in the 1970s. As Dean of the Mathematics Department and Rector of Sofia University Bl. Sendov along with Ljubomir Iliev was instrumental in the creation of the Center of Mathematics and Mechanics, a joint venture of Sofia University and the Bulgarian Academy of Sciences. The main purpose of the Center was to modernize and strengthen the mathematics university education and integrate it with the research in mathematics. Bl. Sendov had also a big impact on the middle and high school education in Bulgaria by introducing and implementing his modern computer based educational system as early as 1979.

Very early on Bl. Sendov clearly understood the importance of the newly developed computers and computer science. The Institute of Mathematics organized and hosted the first computing Center in Bulgaria, and the era of the computers and information technologies found their way in Bulgaria. This new era needed a new generation of scientists and proper organization. Sendov saw very clearly the new horizons and the need of new organization in science including mathematics.

Bl. Sendov was a strong proponent of the development of Computational Mathematics in Bulgaria. As Dean of the Department of Mathematics he introduced a new qualification/specialization in Applied mathematics. For the needs of the newly minted specialization Bl. Sendov developed and taught the first course on "Numerical Analysis" in the academic year 1959/1960. In those years of early development of the computer industry Sendov played a prominent role in the Bulgarian computer science community. He was founder and first head of the Departments of "Operations Research", 1970, and "Mathematical Modeling", 1973, at the Center of Mathematics and Mechanics. Bl. Sendov also pioneered the application of Mathematical modeling in Biology and Medicine.

Bulgarian Group in Approximation Theory, Sofia, 1982
(left to right) front row: T. Boyanov, B. Bojanov, Bl. Sendov, M. Nikolcheva, K. Ivanov; back row: A. Andreev, V. Popov, P. Petrushev, S. Tashev, V. Hristov, G. Iliev

A critical role in shaping Sendov's research interests played his specialization at the Moscow State University in 1960, where he attended the seminars of A. Kolmogorov, S. M. Nikolski and S. B. Stechkin. His research interests were profoundly influenced by A. Kolmogorov. At that time Bl. Sendov began his work in Approximation Theory. He invested a great deal of time and efforts in developing the theory of approximation in the Hausdorff metric. Upon his return from Moscow Bl. Sendov started a weekly seminar in Approximation Theory, where the Bulgarian school in Approximation Theory was created with Bl. Sendov being its founding father. In the vibrant atmosphere of these seminars many new results were presented and new problems and ideas were posed and discussed. Several talented students of Bl. Sendov made their first steps while participating in the Approximation theory seminar, among them being his most brilliant student — Vasil A. Popov. Visitors from all over the world gave talks at Sendov's seminar. Sendov's *mathematics Tuesdays* were memorable extensions of his seminar. Almost every Tuesday evening mathematicians from Sendov's circle and others (many guests) frequented the "Bulgaria" restaurant in Sofia, where the latest news and mathematics problems were discussed over a glass of wine or a mug of beer. There was a lot of enthusiasm and excitement at that time. A principal reference for the theory of approximation in the Hausdorff metric is the monograph of Bl. Sendov, "Hausdorff approximations", Kluwer Acad. Publ. 1990. As a natural progression of the studies on approximation in the Hausdorff metric Bl. Sendov and his students developed the so-called *averaged moduli of smoothness* and their applications. This line of research resulted in the monograph "Averaged moduli of smoothness", written by Bl. Sendov and V. Popov and published by MIR, Moscow (in Russian) and by John Wiley & Sons, New York (in English) in 1988. A notable episode in Sendov's research activities was his contribution to the Whitney constant. For more details of this achievement we refer the reader to the reminiscences of Peter Binev below. Bl. Sendov is probably most famous for his conjecture about the zeros of polynomials and their derivatives in the complex plane. There

are more than 100 publications related to this conjecture and it is still unsolved. For a more detailed account of Sendov's conjecture see the reminiscences below.

Reminiscences by colleagues, friends, and students

Vladimir Tihomirov (Moscow State University, Moscow, Russia).
Friend. I am still shattered by the news that Blago has left us forever.

Remembering... Autumn 1960. A famous Kolmogorov's seminar was devoted to random processes, dynamic systems and classical mechanics and ε-entropy. One day a new student arrived in the room filled by Kolmogorov's students and disciples. During the break I talked to this modest young man with a timid smile who was standing in front of me. He turned out to be Blago Sendov, an intern from Bulgaria. He was interested in the problems of ε-entropy in functional classes. At that time, I was working on this topic myself. We started talking and soon we became friends. And this was a life-long friendship.

In 1977, Blagovest Sendov, the Rector of Sofia University, was awarded the title of an honorary professor of Moscow State University (MSU). The ceremony was held by the then MSU Rector Rem Viktorovich Khokhlov. After the greetings addressed to the newly appointed professor, the floor was given to Blago. He said that he loved Moscow very much and was very happy to visit it over and over again. He mentioned that he had estimated the number of his visits to Moscow at about 100. During the more than 40 years since then, I believe that Sendov would find at least two opportunities a year to visit Moscow, and we would meet almost every time he came here. Thus, there were a lot of meetings with Blago, and as many bright memories about them.

There were two such memorable meetings in the year 2019. One was in March, when Sendov was invited to give a talk at the conference "University, Society and the Future of the Humankind." After the speeches by V.A. Sadovnichii, some public figures and rectors from different universities, Sendov took the floor. Yet he did not give a speech. Rather, he talked to his colleagues and shared his innermost thoughts about the future. One of the key ideas of this talk was that we should not rely on education only, we should strive for ethical upbringing of the new generation in the framework of decency, honesty, integrity, and kindness, in other words, humanity. During that trip, Blago was literally torn apart by numerous friends and colleagues who all wanted to spend time with him; nevertheless, he found some time to spend with me and Vassily Borisovich Demidovich, who had conducted a very interesting interview with Blago in 2012. During that meeting with us, Blago kept on talking about the humanistic upbringing, the topic that he felt so strongly about.

Later Blago came to Moscow in Autumn. He loved to visit me at home, and for me and my wife his visits were always special occasions. On that day, as usual, she cooked some very tasty food, and we were sitting there, as we always did during all those years, eating, drinking wine and discussing life around us. Blago told some interesting stories as usual. We were making plans: maybe we should go to Bulgaria in the summer of 2020 and meet in Sofia?

My wife and I keep remembering a wonderful car journey around Bulgaria in 1976 when Blago drove us around. He showed us Plovdiv, Rila Monastery, and his home-town Asenovgrad where he introduced us to his father.

It is painful to think that Blago will never visit us again.

Academic and Educator. The end of the last century saw a number of dramatic changes in the world caused by unprecedented development of information technology and computing tools. It also saw the rise of academics of a new type. One of such researchers was Blagovest Sendov. He started preparing himself for this role early on. In mathematics, he chose his own path,

essentially creating a new research direction straight away: approximation theory in spaces with Hausdorff metric. It was the topic of his Ph.D. Thesis, defended in Sofia, and it later became the theme of his Doctoral thesis defended at the Moscow Mathematical Institute in 1967.

However, from the very beginning Sendov's ambition went beyond mere professorship. From the early days of his first internship in Moscow and a two-year study here back in 1962–64, he attended a lot of courses and special seminars on computational methods, programming, and the Monte-Carlo method; he studied contemporary computers and contacted a lot of mathematicians and computer scientists of that time, for example, he contacted Academicians Dorodnytsyn and Tikhonov.

During his career, Sendov dealt not only with theoretical problems in mathematics, but also promoted the newest developments in computer science and information technologies. Moreover, he headed research projects where mathematics and information technologies were used to solve problems of natural sciences, biosciences in particular.

Public leader. Blagovest Hristov Sendov was involved in social activities and held various high civil offices. He was Dean of the Mathematics Department at Sofia University, Rector of Sofia University, President of the Bulgarian Academy of Sciences, Speaker of the Bulgarian Parliament, and Ambassador to Japan. He was awarded multiple titles and awards. However, he treated the honors with a smile. He once mentioned that together with the title of an honorable citizen of his home-town of Asenovgrad he was granted another wonderful privilege — to use the city sauna for free.

I first appreciated Blago's organizational talent and potential in 1967, when he together with my other Bulgarian friend Boyan Penkov organized a Congress of Bulgarian mathematicians chaired by Academician L. Iliev. Many of my colleagues from Mech-Math faculty of MSU were invited, and we spent a wonderful week in Bulgaria, which we still remember with gratitude.

In each of his public offices Sendov aspired not only to serve his country, but also to lay a path for humankind in the general. He pioneered a cyclic format of education before the Bologna system, and insisted that each student, whatever their specialization may be, should know the English language as the language of international communication, so that every individual could feel that they are people of the World. (Only Blago was capable of raising this issue and solving it with such elegance: the students were not sent to agricultural works in the Autumn. Instead, they had to have an extensive course in English!) Blago undertook to reform school education as well by working on programming skills from the earliest school years. I am certain that these are the steps which all countries would eventually take.

Personality. Blago Sendov's amazing charismatic personality and leadership traits were formed very early. At the age of 12 he helped his father in the enterprise that produced fruit jam. The boy was in charge of 40 workers who harvest the fruits and conserved them. He assigned jobs, oversaw the production, and paid wages.

Sendov was always punctual and precise. There were lots of hardships in his life: he lived through the Second World War and two revolutions. There were many obstacles, both from people and circumstances. However, he never blamed his fate, he just moved on and overcame the difficulties. And, he always had a radiant smile.

Ronald DeVore (Texas A&M University, College Station, TX, USA).

I first began hearing about Professor Blagovest Sendov during the early part of the 1970's, mainly because of his work on the approximation properties of piecewise polynomials which he did with Vasil Popov. When I finally got to meet him at a conference in Bulgaria in the 1980's, it was nice to put a face together with the name. In those days we did not have Google

to do this for us. Sendov was a shining personality full of charm, humor, and knowledge, ready to join in conversation on any subject but especially mathematics, politics, and the personalities surrounding them. I continued to meet him from time to time, not only in Bulgaria, but also in Russia and the USA where he occasionally visited. The more we met the more I uncovered his depth and importance not only in mathematics but also in the politics of Eastern Europe. On the latter subject, he gave me a quite different perspective from that in the West but he did so in the most gentle way. We became good friends enjoying our occasional crossing of paths. Sendov was quite humorous and I especially liked the fact he could accept the humorous jabs as well as give them out. He always seemed strong and in good health, so I was quite shocked by the news of his passing. We should all spill a little Rakia for this giant of a man.

Edward B. Saff (Vanderbilt University, Nashville, TN, USA).

I recall my first visit to Bulgaria in the 1980's when I was at a very early stage of my career. Academician Sendov was head of the Bulgarian Academy of Science in those Soviet Union times and he invited me to his office. It was an impressive environment — high ceilings, red carpets, immense in size compared with any office I had ever visited occupied by a mathematician or scientist. But he made me feel quite comfortable to talk frankly in those elaborate surroundings. And what we talked about was Blagovest's strong belief that mathematics transcends all geographical and political boundaries; mathematics, he emphasized, was and is a commonality that knows no borders.

I was anxious at the time to invite several among the many outstanding Bulgarian researchers to what would be their first visit to the West. Fortunately I was successful, but only thanks to Blagovest's support that was essential in making these hopes into a reality. The many fruitful collaborations between Bulgarians and Americans that ensued owe a great debt to Blagovest for his outreach that built these bridges to the West.

After our fruitful meeting at his office that day, Blagovest invited me to lunch at a posh restaurant that was only three blocks away. Nonetheless, after walking down the red-carpeted stairs to exit the Academy, I was treated to my first chauffeur-driven car ride. (*If this was typical of how Bulgaria treated visiting mathematicians, I had better start planning my next visit.*) At the lunch, I was introduced to "Shopska Salad", which has since become one of my many favorite reasons for frequent visits to Sofia. During our meal, Blagovest spoke of his now famous conjecture on the critical points of polynomials. I was impressed by his willingness to share his ideas on that topic and many other problems in approximation theory where he made very significant contributions.

The Sendov conjecture is still an open problem and has led to a multitude of mathematical works. Indeed, while Blagovest's career spanned politics, prestigious government positions along with mathematics, his contributions to the latter continue to impress and inspire countless others. And when, many years after our first meeting, we invited Blagovest to participate in a workshop devoted to the Hausdorff geometry of polynomials, not only did he, at an age nearing 80, agree to participate but, as all participants agreed, he was its most active and innovative contributor. In so doing he well justified the words of the American poet and social activist Sam Ullman who wrote "Youth is not a time of life; it is a state of mind: it is a matter of the will, a quality of imagination, and the vigor of emotions." Some people can grow old even at 20, while others can die young at 100, he wrote.

Blagovest's passing in this sense was tragically premature — his imagination and diligence had much still to contribute to the mathematical community and his beloved country of Bulgaria.

Dany Leviatan (Tel Aviv University, Tel Aviv, Israel).

Last time I met Blagovest Sendov was when we had dinner together in Sofia on June 10th, 2019. I was in Sofia for a couple of days and was invited to dinner by the President of the Bulgarian Academy of Sciences together with two dear friends Sendov and Petar Kenderov. We had a wonderful evening, and Sendov was at his best, telling jokes and stories. He looked happy and vigorous, so the news of his departure in January 2020 came as a real shock to me. Earlier, in June 2019, Sendov and I attended a conference in Sozopol on the Black Sea, where I spoke about Whitney's inequality and having Sendov in the audience, both honored me but made me feel like the guy who spoke about his experience of surviving the flood that had destroyed his town, with Noah sitting in the audience.

I first met Sendov at a meeting in Varna in 1987, but I had followed and admired his work before that. In those days Bulgaria and Israel did not have diplomatic relations, and it was not trivial to invite a Israeli mathematician to a conference in Bulgaria, not was it easy for me to obtain the visa and to fly to Bulgaria. Presumably, Sendov's paramount position as member of the Bulgarian parliament together with his mathematical stature allowed him to "take the risk". Actually, he had already invited me to the conference in Varna in 1984, but I could not come. Of course, in those days we were politically far apart (I do remember once in Edmonton when Sendov said he was only drinking red wine ..., so I felt I must counter by saying that I was only drinking white beer, as I prefer beer to wine, but we were always good friends). Sendov visited Israel while serving as Chair of the National Assembly of Bulgaria, if I correctly recall, as guest of the Israeli parliament. He and his wife came to Tel Aviv and we spent a couple of hours together.

Sendov was the creator of the Bulgarian amazingly strong school in Approximation Theory, with his two late students Vasil Popov and Borislav Bojanov, and the next generation, of whom I will mention only those who I know and are still active, Pencho Petrushev, Kamen Ivanov, Peter Binev and Ogenian Trifonov.

He will be missed.

Allan Pinkus (Israel Institute of Technology, Technion, Israel).

It was with great sadness that I learned of the death of Blagovest Sendov. I first met Blagovest, and Anna, at the Varna approximation conference of 1981. Blagovest was a force of nature. Everything and seemingly everyone circled around him. He was, from a distance, the prototype of a cultured, energetic, polite, wise and personable mathematician. Of course I was blissfully ignorant of Bulgarian politics, both academic and otherwise. I subsequently met him at many of the other mathematical conferences I attended in Bulgaria, and also at his office in the computer science building of the Academy of Science in Sofia. These meetings were always a great delight to me, covering a wide range of topics.

In early 1997, while still president of the Bulgarian Parliament, Blagovest and Anna visited Israel. Blagovest arrived at my office in the Technion, ordered his bodyguard to take a break, and we sat and talked mathematics for an hour or two. A few years later, in 2002, I had the pleasure of attending a conference at a former Zhivkov hunting lodge near Varna honoring Blagovest on his 70th birthday.

The last time I saw Blagovest was in June of 2009. My wife and I were in Tokyo for a week and Blagovest invited us to his ambassador's residence for a delightful dinner where we discussed mathematics, mathematicians, Japan and Japanese moss. He had so much energy even at this age, and I could not but wonder whether this new hobby of moss was his antidote to boredom.

Blagovest was a man of great talents, who was able to accomplish many of his goals. He will be missed.

József Szabados (Alfréd Rényi Institute of Mathematics, Budapest, Hungary).

I have met Blagovest Sendov first in Budapest in 1969, at the Conference on Constructive Theory of Functions. He was the only Bulgarian participant at this conference, and gave a talk on the so-called *parametric approximation*. This method of approximation was his invention, and it proved to be a fruitful subject, mostly among Bulgarian and Hungarian approximators.

This was the first major conference on approximation theory in Hungary, followed by a series of conferences in Varna, Blagoevgrad and Budapest. It was Sendov's and Popov's initiative to establish a connection between the two mathematical institutes of the two academies which was realized by frequent visits and fruitful cooperation, for a long period of time.

Sendov, besides being an outstanding mathematician, was also an excellent organizer, not only in mathematics but in politics and administration as well. To achieve such high-ranking positions as he did, and not being member of the communist party, was quite exceptional at that time.

The last time I met him was at the 2010 Sozopol conference. Together with my wife, he invited us for dinner, and we had a pleasant evening, talking about the good old times.

Vilmos Totik (University of Szeged, Szeged, Hungary).

I met Blagovest only a couple of times, but of those meetings I have pleasant memories. Last time we saw each other in Sozopol, Bulgaria last June, and he looked extremely young for his age. Upon asking how he does that, he explained that he regularly gets some elixir from a medical doctor from Japan that is specially formulated based on his genetic information. During that conference we had several conversations on mathematics and gardening — he was a specialist in tomato growing, last year he had about 25 different types of tomatoes.

The first time we met was in Oberwolfach in the first half of the 1980's. He gave a talk on Whitney constants for which he was able to prove a huge bound, something like a tower in the degree n of the polynomial. Then he made the conjecture that the constants are actually bounded in n. There was a big laugh in the audience in view of the bound he had just presented, but actually in a few years he managed to show that, indeed, the Whitney constants are bounded by 6. I believe his improved conjecture that they are bounded by 1 is still open.

Of his mathematical achievements let me mention a very pretty one. The Gauss–Lucas theorem claims that if all zeros of a polynomial P lie in a convex set K, then the critical points (i.e. the zeros of the derivative) also lie in K. This is no longer true if K is not convex, e.g. if $K = K_a$ is the sector $\{z : |\arg(z)| > a\}$, with $a < \pi/2$. Nonetheless, in 2017 Blagovest showed with his nephew Hristo Sendov that if P has *nonnegative coefficients* then there is a sector version of the Gauss–Lucas theorem: if all zeros of P lie in K_a, then the same is true of all the critical points. This is a remarkable extension of a classical and well-studied theorem, an extension that had been overlooked for more than 150 years.

Gradimir V. Milovanović (Mathematical Institute, Serbian Academy of Sciences and Arts, Belgrade, Serbia).

I have known Professor Sendov for over 35 years. Our first official meeting was during my visit to the Bulgarian Academy of Sciences in Sofia in 1984 (together with my colleague Miodrag Petković). At the time, I was an associate professor at the University of Niš, Serbia, when I started working more seriously on polynomials and quadrature formulas. Sendov was known in the world at the time, and it was a great honor for me to be a guest of such an eminent scholar. My active collaboration with Bulgarian mathematicians began practically since then,

especially with Borislav Bojanov (1944–2009), who was a Ph.D.-student of Sendov and one of his closest associate. Very often we have organized joint meetings in Sofia and Niš, including a joint SCOPES project (with ETH Zurich), supported by the Swiss government.

Bl. Sendov and Gr. Milovanović in Belgrade, Serbia, 2017

In my monograph *Topics in Polynomials: Extremal Problems, Inequalities, Zeros*, World Scientific Publ. Co., Singapore – New Jersey – London — Hong Kong, 1994, written jointly with D. S. Mitrinović and Th. M. Rassias, several results of Sendov were presented, including three sections on the well-known Sendov conjecture, formulated in 1958, which states that if $P(z) = \prod_{k=1}^{n}(z - z_k)$ is a polynomial with all its zeros in $|z| < 1$, then each of the closed disks $|z - z_k| \leq 1$, $k = 1, \ldots, n$, must contain a zero of $P'(z)$. The conjecture was verified in many particular cases, but the problem has not yet been settled completely.

Academician Sendov was a longtime foreign member of the Serbian Academy of Sciences and Arts (SASA) and very often would come to Belgrade, give interesting lectures and discuss many mathematical problems, in particular those in the geometry of polynomials, for which he always had a wide audience, especially among the younger generation of mathematicians.

Finally, I would like to mention his arrival in Belgrade during NATO's aggression against Serbia in 1999, when he simply asked: *What can I do to help?* Such a gesture of a dear friend cannot be forgotten!

Andrey Andreev (Institute of Mathematics and Informatics — BAS, Sofia, Bulgaria).

Sendov — how sometimes, something good comes out of wrong policy. Blagovest Sendov graduated in 4 instead of 5 years, 1952–1956, and after getting his diploma in 1956 passed successfully the tests for becoming a Ph.D. student and at the same time taught for half a semester as an assistant professor in mathematics. But the events in Hungary in 1956 united "the true forces" in the ruling Communist Party and for the "enemies of the people" (as Sendov was then labeled) came a difficult time. Sendov had to leave the University and become a teacher in mathematics in the small towns of Boboshevo and Elin Pelin. In 1958 Nikola Obreshkov, the most influential academician in mathematics at the time, a member of parliament (although not a communist party member), succeeded in obtaining permission from the authorities to take Sendov as an assistant professor in his Algebra Department. In an expression of gratitude for the support received from Academician Obreshkov, Sendov felt obliged to fit in the subject of the Algebra department. However, during his studies Sendov had been mainly engaged with

Functional Analysis and even at the age of 24 submitted for publication his first scientific paper *"On a class of regular-monotone functions", Dokl. AN SSSR, 110 (1) (1956) 27–30*. What is more, Bernstein personally presented it for publication.

To join the research subject of the Algebra Department Blagovest Sendov changed his topic and in 1959 shared with Acad. Obreshkov (as his assistant) a conjecture that became known in the next 60 years as "Sendov's conjecture". This conjecture deals with the relationship between the locations of the zeros of polynomials in the complex plane and the zeros of their derivatives. Namely, Sendov made the following conjecture:

If all the zeros of an algebraic polynomial $P(z)$ of degree n ($n \geq 2$) lie in the unit disk, then for each zero of $P(z)$ there is a zero of its derivative $P'(z)$ within unit distance of it.

It follows from the classical theorem of Gauss–Lucas (which is a natural generalization of the well-known Rolle's theorem form 1691) that all the zeros of $P'(z)$ lie in the unit disk, but Sendov's conjecture refines the relationship between the locations of the zeros of an algebraic polynomial in the complex variable and the zeros of its derivative.

This conjecture provoked a heated interest among many mathematicians — so far, more than 150 articles have been published on Sendov's conjecture, including papers by Bulgarian mathematicians. Although being "almost" proven, this mathematical problem, which stands out with its simple and elegant formulation (due to which it is maybe so attractive) remains unproven.

Peter Binev (University of South Carolina, Columbia, SC, USA).

I became a student at the University of Sofia in 1975 and majored in Mathematics under the new program of study developed by Blagovest Sendov as Dean of the Faculty of Mathematics and Mechanics in the early seventies. In 1975 he was already Rector of Sofia University and this program was well established. In addition to the well organized curriculum and that we were taught by faculty from both the University and the Academy of Sciences, we had several perks which supported the feeling that we were in an elite program: we had special notebooks for homework and exams, the grades and attendance during the semester were kept in a computer database, so we did not have to wait for a signature from the professor to prove that we were in good standing as all other majors at the end of the semester. Most importantly, all the classes in the first three years of study were strictly between 7 am and 1 pm, so we were able to audit, and sometimes take for credit, a variety of graduate level courses that were usually offered in the afternoons. This gave me a good understanding about the research areas, so I was confident in my choice to specialize in Approximation Theory for my Masters. Part of the specialization was a yearlong course in Hausdorff Approximation lectured by Professor Sendov. It was exciting to be taught by the Rector of the University but even more exciting was the content of the course based on the recent research in the area. This definitely played a role in my decision to become a researcher and to continue in the doctoral program under the supervision of Vasil Popov, a former student of Sendov.

I got to know Professor Sendov much better in the eighties. Then, I was teaching the Calculus sessions for his course in Mathematical Analysis for five years, first as a graduate assistant and then as an Assistant Professor. He made clear what he wanted to be covered but never micromanaged and let his assistants be creative. I learned from him how to perform efficiently oral exams that have to be taken by all students in the class at the end of the year. He was very good in asking pointed questions to reveal whether the student knows the basic ideas. Sometimes, he used humor to resolve tense situations saying one of his favorite quotes, like "anything can be done but not everyone can do it" or "not all of us can be both smart and

pretty". As a result, the students felt comfortable about taking his exam although it was the most difficult one for the year.

The usual perception about scholars taking high administrative positions is that they are not very active in their research and the most they can do is to provide general guidelines to their research group. Professor Sendov was a noticeable exception to this perception. He was always eager to talk mathematics and the problem he was engaged with. And always there was such a problem. One of his famous conjectures was about the Whitney constant W_n. In 1957 H. Whitney proved that for any continuous function f on a finite interval, say $[0, 1]$, there exists a polynomial P of degree at most $n-1$ such that

$$\sup_{x\in[0,1]} |f(x) - P(x)| \le W_n \omega_n(f),$$

where $\omega_n(f) := \max\left\{|\Delta_h^n f(t)| = \left|\sum_{j=0}^n (-1)^{n-j} f(t+jh)\right| : t, t+nh \in [0,1]\right\}$ is the nth modulus of smoothness. While Whitney established good bounds for similar constants in the cases of an infinite interval, he proved only existence of a constant W_n independent of f. It was widely assumed that a good estimate could be $W_n = O(2^n)$ and Sendov's conjecture that $W_n \le 1$ faced a lot of skepticism when he made it in the early eighties. The conjecture was based on linear programing estimations of W_n for $n \le 6$ [4], while the best general estimate at the time was worse than $W_n = O(n^n)$. Sendov involved his student Milko Takev in this research and later asked Kamen Ivanov to check the calculations when Takev came with an idea how to prove that $W_n = O(C^n)$ in early 1985. Soon, Ivanov and Takev announced that they were able to prove that $W_n = O(n \log n)$ and presented their result [3] at Sendov's Approximation theory seminar. During their talk I got the impression that their approach can be modified by representing the relationships between the values of the function f at different subintervals of $[0, 1]$ through a system of $n+1$ ordinary differential equations. Two weeks later, I presented my result [1] that $W_n = O(n)$ obtained by showing that each component of the solution of the system is dominated by the solution of a single ODE and estimating its solution. Estimating each component individually seemed to be an enormous endeavor and I opted for pursuing other ideas. Two weeks later Professor Sendov came with his result $W_n \le 8$ published in [5]. It was a complete surprise to me that he actually found the exact solution of the system of ODEs. This definitely required an excellent intuition and amazing problem-solving abilities considering the short amount of time and his very busy schedule. He explained that he was traveling and had much more time to immerse himself into the problem. The solution of the system was expressed as a nice representation formula that once known could be proved easily with other methods. Sendov's original proof was presented in [6] with the estimate $W_n \le 6$ received by explicitly designing P as an interpolation polynomial. In the circle around Sendov's seminar it was known that this estimate can be easily reduced to $W_n \le 2 + \frac{2}{e}$ if P is the polynomial of best L_∞ approximation but was never published since it was based on the same ideas. The best known estimate so far is $W_n \le 2 + \frac{1}{e^2}$ obtained in [2], where it was also shown that $W_n \le 2$ for $n \le 82{,}000$. The conjecture $W_n \le 1$ is still open.

I always enjoyed meeting with Professor Sendov and tried to do this every time I was back in Bulgaria. It was nice to see him in his office and discuss some mathematical problems with him. We met for the last time at the Approximation Theory conference in Sozopol, Bulgaria in June 2019. He was in good health and I hoped to see him again in the years to come. I will miss him a lot!

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[3] K. G. Ivanov and M. D. Takev, $O(n \ln n)$ *bound for Whitney constant*, C. R. Acad. Bulgare Sci. 38 (1985), 1129–1131.
[4] Bl. Sendov, *On the constants of H. Whitney*, C. R. Acad. Bulgare Sci. 35 (1982), 431–434.
[5] Bl. Sendov, *The constants of H. Whitney are bounded*, C. R. Acad. Bulgare Sci. 38 (1985), 1299–1302 .
[6] Bl. Sendov, *On the theorem and constants of H. Whitney*, Constr. Approx. 3 (1987), 1–11.
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Stefka Dimova (Sofia University "St. Kliment Ohridski", Sofia, Bulgaria)

I met Blagovest Sendov as a first year student at Sofia University — he was our assistant in the algebra course of the prominent Bulgarian mathematician Nikola Obreshkov. Later on, when I specialized in Computational mathematics, he taught Numerical Methods and Programming. These were new courses and we, the students, were impressed by the clear well-prepared presentation of the novel ideas, especially on programming, taking into account that there were no computers in Bulgaria at that time (1960–1963). The choice of a Master thesis turned out to be very important for my further work. Sendov proposed two nonstandard topics dealing with modeling purely human activities: a card game and composition of music. R. A., as a "game expert", and I, as someone who had played the piano, were chosen. Studying the paper on composition of 8-bar melodies Sendov gave me, I found the task difficult to formalize so we agreed that I model the process of harmonization instead, in view of its more algorithmic nature. Thus, Sendov's research challenge determined my interest in mathematical modeling for the years to come, up to my involvement in the European Consortium for Mathematics in Industry (ECMI). As for the process of composition of melodies, it was later modeled by my student E. K. for her MS thesis. The two processes (composition and harmonization) were implemented on the "Minsk 2" computer and the resulting eight-bar melodies in four part harmony were performed on the piano at an international conference in Varna and assessed by the audience as "similar to Christmas songs". Fifty years ago Sendov kept proposing visionary thesis topics on modeling human activities (e.g. translation from Russian to Bulgarian and vice versa).

As many of my colleagues, I felt Sendov's support, encouragement, and attention at every important step in my career: When the purchase of the first computer for Bulgaria, "Minsk 2", was made in 1963, Sendov chose me and four other colleagues to be on training in Minsk (then in the USSR). Writing the first three textbooks on Numerical methods for the mathematical classes of the high schools was also a Sendov's initiative and he offered me to be one of the authors. In 1969 Sendov recommended me for specialization in the Computing Center of the Soviet Academy of Sciences, Moscow, and required that I come back with a research direction that may result in a Ph.D. thesis. Sendov's insistence, fueled by Acad. Samarskii and Corr. Member Kurdyumov, that I put together my results in a dissertation for Doctor of Science, was also decisive for my professional development.

Thank you for all this, dear Professor! I will treasure your memory forever!

Svetozar Margenov (Institute of Information and Communication Technologies, Sofia, Bulgaria)

Sendov was the "driver" in every turn in my professional career. In 1974 as a second year student at Sofia University his enthusiastic lectures on numerical methods impressed me very much and helped me to see the beauty of the algorithms and their analysis and to understand that they are the soul of my life's destiny. So I ended up in the group specializing in computational mathematics. Sendov, as Director of the Institute of Parallel Processing, hired me and made me part of the pioneering research activities in parallel algorithms in Bulgaria in the 90s. He supported in a fundamental way the work in parallel and large-scale scientific computing in Bulgaria. I will be always grateful for his stimulating and revealing comments, suggestions, and advice related to my latest research topic, where some classical results in the theory of the best uniform rational approximations resulted in a new development of advanced methods and parallel algorithms for numerical solution of fractional diffusion problems. Finally, during the last decade, with his office just next to mine at the Institute of Information and Communication Technology, he shared his wisdom, foresight, and experience to persevere, strengthen, and consolidate this newly established unit of the Bulgarian Academy of Sciences.

Raytcho Lazarov (Texas A&M University, College Station, TX, USA)

After my graduation with a Master's degree in computational mathematics from Wroclaw University, Poland, in 1966, I was assigned to work in Sendov's research group at the Computer Center of the Institute of Mathematics. This was the first organization in Bulgaria that got a computer and many scientists from BAS institutes and Universities around the country were coming to solve particular problems in engineering, biology, physics, chemistry, and economics that needed extensive computations. Sendov and Acad. Iliev, the Director of the Institute of Mathematics at that time, understood (better than anybody else from the old generation of mathematicians) that the Center needed qualified experts in "computing" in many areas of mathematics and statistics. One day in 1967 I asked Prof. Sendov to support my application for a Ph.D. study in Poland. He surprised me in a way that changed the path of my career forever. He said: "Well, I have given some thought about you and I have even a suggestion regarding your career. I have a preliminary agreement with Acad. Samarskii from Moscow State University, that you be admitted for a Ph.D. study there after passing the proper entrance exams here in Bulgaria". This was exactly his style, thinking in advance and then taking care of the problem, small or big, personal or institutional. After my Ph.D. study I returned to Bulgaria and worked in Sendov's department of "Mathematical Modeling" at the Institute of Mathematics and Informatics for about 20 years. Thus, Sendov became my mentor for life and I got from this great man a lot of help and many valuable lessons in science and life as well.

I remember quite well one of my meetings with Sendov in 1968. At that time my best friend Borislav Bojanov was graduating from Wroclaw University and was assigned by the government to work at the Institute of Economy and Accounting in the small town of Svishtov. I knew that he was a very talented mathematician and I told Sendov that this young man would be a tremendous asset for the Center. Sendov met Bojanov and decided to get a position for him at the Center. This was a highly nontrivial task, since Borislav's father was a priest and, according to the communist ideology and practice at that time, his upbringing put him in the category "not to hire in BAS". Nevertheless, Sendov managed the impossible — he hired Bojanov, who later became an Academician of the BAS and a prominent member of the international mathematical community. According to one of his favorite sayings "everything is possible, but only few can make it happen", Sendov was one of these few.

I was blessed to have Sendov as my mentor, supervisor, and friend! He will be missed very much!

Ivan Dimov (Institute of Information and Communication Technologies, Sofia, Bulgaria)

I had the privilege to attend his honorary lecture at the International Conference on High-Performance Computing in September of 2019 in Borovets, Bulgaria, where he shared his vision and wisdom on "Why supercomputers need super mathematics?". Sendov has always been a pioneer in formulating great challenges and creative tasks in computational mathematics. In this last lecture Sendov gave an analysis of the current state of the art, pointed to new specific trends in numerical analysis and indicated the need for novel quality algorithms that are relevant to the "mathematical technologies" while using supercomputers.

Oleg Iliev (Fraunhofer Institute for Industrial Mathematics, Germany)

I first met Sendov in person in 1981 at his department in the Institute of Mathematics, where after my graduation from Moscow State University I got a position. At that time Sendov was a well known scientist and an outstanding leader. It was something new for me to see a person who, despite his high position, was speaking with respect to young and old, to beginners and prominents, patiently listening to what others are saying. I saw a great scientist who continuously motivated his colleagues for digging deeper in their research for new and better results.

As in many other cases, Sendov played a decisive role in my career. Back from Moscow State University, I got a recommendation to continue for a Ph.D. study there. At that time only the Bulgarian government had the authority to decide who could go for a Ph.D. study abroad. I went with my recommendation to the Ministry of Education thinking that this is a mere formality. However, the Ministry clerk said that they do not honor this recommendation and added that they have their plans for me. Luckily for me, Sendov intervened, and after passing all formalities, I was enrolled in MSU. I am very thankful to Sendov for opening for me the way to the big science. But this is not just my story. During the years I witnessed many cases when Sendov was helping people to find their way in science and not only for people working in his area or employed in his department. His credo as a leader was that each one deserves a chance and he gave chances to many of us. Moreover, he was very happy with other people's successes, regardless of whether or not this was beneficial for him.

Rest in peace, Big Scientist and Great Man!

Hristo Djidjev (Los Alamos National laboratory, Los Alamos, NM, USA)

Prof. Sendov was my MS and Ph.D. advisor, but that happened quite by chance. I was just starting my MS study and we, a group of a dozen or so new MS students, were supposed to look through a list of possible advisors and topics, before a meeting of the department at which the final assignment of advisors to students would take place. Prof. Sendov did not offer any topic and he has not had MS students for several years in a row because of his commitments as a Rector (President) of Sofia University, so nobody expected him to have any new students that year either. At that time, I was interested in topics related to artificial intelligence (AI), so neither of the proposed topics, being mostly in approximation theory, excited me enough to go to talk to the proposing advisor. This was rather irresponsible from my side, but worked to my advantage. When Prof. Sendov unexpectedly showed up in the middle of the meeting to get a student, everybody else has already picked up a topic and an advisor, and I was the only one available.

When I met with Sendov after that to discuss a possible thesis topic, he had on his desk a bunch of technical reports from Stanford University in the area of graph algorithms. "Do you

know what a graph is?" he asked me. In Bulgarian, "graph" sounds the same as the nobility title "count", but other than that I did not know what a graph was. He went to the blackboard, drew several points and lines between them, and said "This is a graph". That was probably the shortest introductory class in graph theory in the world, and all the formal education I ever got on the topic. But it worked for me! I went on reading and learning about graphs from research papers and books. Sendov gave me to read recent papers by Richard Lipton and Robert Tarjan, then at Stanford University, on graph separators and their applications. I found the topic very interesting, and both my MS and Ph.D. thesis were related to graph separators. After that, I continued my research in graphs and theoretical computer science. As for the AI, the area experienced several decades of decline and failures until about five years ago, when it finally made a spectacular comeback. But it would have been too long for me to wait for that to happen. It was fortunate for me that Sendov steered me then away from the AI topic.

As many of my colleagues, I am also indebted to Prof. Sendov for helping me overcome the many obstacles the communist bureaucracy at the time was raising for people it considered "politically unreliable". I will only mention that I was not allowed to enroll into the Ph.D. program because of my "bourgeois" family, until Sendovs personal intervention, when he probably endangered himself by helping me.

Sendov had a way to inspire people. He has taught me only one class, in Approximation Theory. In this class, for the first time I felt that Mathematics was a live subject, full not only with well-established facts and achievements of the past, but also with many open problems. Spotting such problems and solving them should be the main goal for a researcher. He used to offer open problems in his lectures and I was able to solve one of them. He was also very good at spotting emerging and promising trends in science and technology. One such example is parallel computing. At the time, in the early eighties, the topic was largely an uncharted territory in Bulgaria, probably due to the lack of access to parallel computers, which were then under an embargo. Nevertheless, Sendov saw opportunities in investigating the algorithmic aspects of parallel computing. He asked Andrey Andreev, Nicola Yanev, and me to write a survey on parallel algorithms, summarizing the state-of-the-art in subtopics closely related to the previous work and expertise of Bulgarian mathematicians. That effort led to the creation of a team focusing on different aspects of high-performance computing, which put the foundations of what is today the Institute of Information and Communication Technologies (IICT) in Sofia. Nowadays, access to parallel computers in Bulgaria is readily available, and IICT is one of the most active and successful institutes of the Bulgarian Academy of Sciences. Sendov's vision has paid off!

It is hard to accept — he is gone now. Farewell, Professor, we will miss you, with your humor, your inspiration, your wisdom. Rest in peace!

Nikolay Kyurkchiev (Institute of Mathematics and Informatics — BAS, Sofia, Bulgaria)

After completing my higher education at the Faculty of Mathematics at Sofia University "St. Kliment Ohridski", I had the good fortune to work in 1970 in the prestigious Department of Numerical Methods, led by Prof. Bl. Sendov at the Institute of Mathematics of the Bulgarian Academy of Sciences.

My first meeting with Prof. Sendov (at a talk he delivered at the Permanent Seminar of the Department) was memorable (hopefully for other, then young, colleagues). During the usual discussions on the subject of the talk, it was not uncommon for older, erudite colleagues to sharply criticize "our achievements", often in the sense that "the result was a direct consequence of an already-known result". In such a situation, in order to calm the spirits, Prof. Sendov would wholeheartedly say: "Something that has not been published — is not always trivial!" It was his

typical "Acad. Sendov's style" to encourage young researchers and win them for the scientific cause he devoted his life to.

I always remember his call to seek, as he used to say, "other elegant applications of the Hausdorff apparatus for approximation" in different branches of scientific knowledge (later referred to as the achievements of the Bulgarian School of Mathematics).

I bow deeply in gratitude, my teacher!

Roumen Anguelov (University of Pretoria, Pretoria, RSA), Svetoslav Markov (Institute of Mathematics and Informatics — BAS, Sofia, Bulgaria)

Interval structures in real analysis — contribution of Blagovest Sendov to the theory of interval functions

The contribution of great scientists is measured by the impact of their work on future developments: research directions, new theories, new fields. The work of Blagovest Sendov on Interval Analysis can definitely be measured in such terms. Interval structures were first introduced by Sunaga. They got popularity after intervals were introduced in practical applications leading to the design of the so called *validated numerical method*. The beginning of this development is associated with Ramon Moore who is also often credited as founder of Interval Analysis. While the main preoccupation of the researches was the numerical computations – algorithms, reliability, speed – Blagovest Sendov saw a different aspect in this new development, namely, the spaces of interval valued functions. This new direction gave a new understanding of Interval Analysis (probably closer to its name) as Analysis of Real Interval-Valued Functions with associated concepts of order, limit, algebraic operations, calculus, etc. Naturally, as in all areas of Analysis, the spaces of functions with particular topological, order or algebraic structure are essential role players. The topic of Interval Computations and Interval Analysis was introduced in Bulgaria via a series of meetings and publications initiated by Blagovest Sendov. During this early time of development of the interval ideas in Bulgaria he also defined two of the most important functional spaces, namely the space of S-continuous interval functions and the space of H-continuous interval functions. These two spaces are essential tools in the Sendov's Theory of Hausdorff Approximations [4]. However, future developments showed their importance for other areas of Mathematics like Real Analysis [1] and the General Theory of PDEs [3] not to mention the Interval Analysis itself [2].

[1] R. Anguelov, *Dedekind order completion of $C(X)$ by Hausdorff continuous functions*, Quaestiones Mathematicae 27 (2004), 153–170.
[2] R. Anguelov, S. Markov, B. Sendov, *The set of Hausdorff continuous functions — the largest linear space of interval functions*, Reliable Comp. 12 (2006) 337–363.
[3] R. Anguelov, E. E. Rosinger, *Solving large classes of nonlinear systems of PDEs*, Computers and Mathematics with Applications 53 (2007), 491–507.
[4] B. Sendov, *Hausdorff Approximations*, BAS, 1979 (in Bulgarian), Kluwer Academic Publisher, Boston, 1990 (in English).

Hristo Sendov (Western University, London, ON, Canada)

Blagovest Sendov was the second child in his family with my father being the eldest. Even though we would see each other mainly on family gatherings, he exerted an enormous influence over me. At these family gatherings he always made me feel special. During one period, in my early childhood, he would come home often, having taken on the burden to teach me how to pronounce the sounds *s* and *r*, for before then my name was Hihto Hendov.

I knew from an early age that I wanted to be like him. For that I had to be both a politician and a mathematician. Politics quickly turned me off but mathematics, I liked.

We started working together by accident in the Winter of 2012, when Blagovest was 80 years old. My wife and I were on a sabbatical leave and after five months in France, we were supposed to stay there for the entire duration of the sabbatical, but we failed, we moved to Bulgaria for another eight months. I hardly new any of the mathematicians in the country, since I had left it 18 years earlier and many of my teachers and friends had left too. One day in January I popped up in Blagovest's office and suggested that we do some math together. The beginning was slow and sinuous, painful at times. But once we gained speed, the sky was the limit. With hindsight, I think that we could have never had such a successful professional relationship if I had not left the country and established myself independently. For results like ours to be achieved, both parties have to feel very comfortable with expressing ideas freely and defending them with confidence. The confidence and persistence to ask questions until all details are cleared is essential.

Blagovest visited us several times for extended periods of time. He was a very easy guest. He became a wonderful role model for everyone in my family. He was always extremely punctual, generous, with fine sense of humor. We communicated a lot with and without the aid of wine and spirits. I never heard him say a bad word about anybody even though his life was probably full of disappointments dispersed among his successes. My children, having never met my father, embraced him as a grandfather. I think he enjoyed that. I was lucky to have had two fathers.

List of Doctoral Students of Blagovest Sendov

1. Vasil Popov (1971)
2. Vasil Veselinov (1973)
3. Todor Boyanov (1973)
4. Borislav Bojanov (1975)
5. Georgi Iliev (1977)
6. Spas Tashev (1979)
7. Svetoslav Markov (1979)
8. Panayot Vassilevski (1984)
9. Hristo Djidjev (1984)
10. Tania Kostova (1985)
11. Milko Takev (1990)

List of Publications

Mathematical Papers

1. On a class of regular functions, Dokl. AN SSSR 110 (1) (1956) 27–30 (in Russian).
2. On a subcone of the cone of the regular-monotone functions, the signs of the derivatives of which change periodically, God. Sof. Univ. Phis.-Math. Fac. 50 (1) (1958) 109–120 (in Bulgarian).
3. On the expansion of regular-monotone functions in Goncharov series, Dokl. AN SSSR 118 (3) (1958) 450–453 (in Russian).
4. On a type of regular-monotone functions, Izv. Math. Inst. BAS 3 (1) (1958) 89–104 (in Bulgarian).

5. A note on the theorem of Gauss for the distribution of the zeros of a polynomial in the complex plane, Fiz.-math. sp. 1, (3–4) (1958) 169–171 (with T. Genchev, in Bulgarian).
6. An integral inequality for algebraic polynomials with only real zeros, God. Sof. Univ. Phis.-Math. Fac. 53 (1) (1959) 19–32 (in Bulgarian).
7. Symmetric flow around circular cylinder with two vortices behind it. Trajectory of the vortices and resistance of the cylinder, Dokl. AN SSSR 128 (1) (1959) 53–59 (with Bl. Dolapchiev, in Russian).
8. On some properties of the regular-monotone functions, Izv. Math. Inst. of BAS 3 (2) (1959) 63–68 (in Bulgarian).
9. The trajectory of a vortex pair behind a circular cylinder and it's connection with the resistance of the cylinder, Izv. Math. Inst. of BAS 3 (2) (1959) 213–243 (with Bl. Dolapchiev, in Bulgarian).
10. The theorem of Vahlen for singular continued fractions and continued fractions of the nearest natural number, God. Sof. Univ. Phis.-Math. Fac. 54 (1) (1961) 251–258 (in Bulgarian).
11. On the equations in words, Z. Math. Logik Grundlagen Math. (Berlin) 7 (1961) 289–297 (with D. Skordev, in Russian).
12. ε-entropy and ε-capacity of the set of continuous functions, Vestnik MGU 17 (3) (1962) 15–19 (with S. Dimiev and B. Penkov, in Russian).
13. ε-entropy and ε-capacity of the set of continuous curves, Vestnik MGU 17 (3) (1962) 20–23 (with B. Penkov, in Russian).
14. Approximation of functions by algebraic polynomials with respect to a metric of Hausdorff type, God. Sof. Univ. Phis.-Math. Fac. 55 (1962) 1–39 (in Bulgarian).
15. Eine Aufgabe aus der Kombinatorik, C. R. Acad. Bulgare Sci. 15 (1) (1962) 5–8.
16. Graphs connected with mechanisms, C. R. Acad. Bulgare Sci. 15 (2) (1962) 111–113 (with N. Martinov, in Russian).
17. Frequencies of letters in written Bulgarian, C. R. Acad. Bulgare Sci. 15 (3) (1962) 243–244 (with B. Penkov et al.).
18. ε-entropy and ε-capacity of the space of continuous functions, Izv. Math. Inst. of BAS 6 (1962) 27–50 (with B. Penkov, in Bulgarian).
19. Rational zeros of algebraic equations, Mathematica, Sofia 1 (1962) 27–30 (in Bulgarian).
20. Graphs with completeness operation, God. Sof. Univ. Phis.-Math. Fac. 54 (1) (1963) 127–139 (with N. Martinov, in Bulgarian).
21. On the best approximation by algebraic polynomials with respect to Hausdorff distance, God. Sof. Univ. Phis.-Math. Fac. 56 (1) (1963) 195–207 (in Bulgarian).
22. ε-entropy and ε-capacity of the set of the monotone functions, Uspehi Math. Nauk 18 (2) (1963) 155–158 (in Russian).
23. Approximation bezüglich einer Hausdorffschen Metrik mittels algebrai-scher Polynome, in: Int. Kolloquium über aktuelle Probleme der Rechentechnik. II. Dresden, 1962. Vorträge, Dresden, 1963, 121–122.
24. On the graphs with a completeness operation, God. Sof. Univ. Phis.-Math. Fac. 57 (1964) 291–305 (with N. Martinov, in Bulgarian).
25. Entropy of the continuous functions of many variables, C. R. Acad. Bulgare Sci. 17 (4) (1964) 335–337 (with B. Penkov, in Russian).
26. On widths of the space of continuous functions, C. R. Acad. Bulgare Sci. 17 (8) (1964) 689–691 (with B. Penkov).

27. On a method for approximation of periodic functions by trigonometric polynomials, Magyar Tud. Akad. Mat. Kutató Int. Közl., 9 (3) (1964) 491–494. (with G. Freud, in Russian).
28. Figures with constant width, Mathematica, Sofia 3 (1) (1964) 12–15 (in Bulgarian).
29. On the theory of graphs, Mathematica, Sofia 3 (6) (1964) 1–5 (in Bulgarian).
30. On some linear methods for approximation of periodic functions with respect to the Hausdorff distance, God. Sof. Univ. Phis.-Math. Fac. 58 (1965) 107–140 (in Bulgarian).
31. Linear methods for approximation of periodic functions with respect to a metric of Hausdorff type, Dokl. AN SSSR 160 (5) (1965) 1023–1025 (in Russian).
32. Linear methods for approximating periodic functions with respect to a metric of Hausdorff type, C. R. Acad. Bulgare Sci. 18 (5) (1965) 253–255.
33. On an estimate of the approximation of functions with Bernstein polynomials, Mathematica, Cluj 7 (1) (1965) 145–154.
34. Orthogonale Systeme in einigen Klassen von Polynomenfolgen, Wiss. Z. Hochsch. Architektur Bauwesen, Weimar 12 (5–6) (1965) 517–519 (with L. Iliev).
35. On some properties of the Hausdorff metric, Mathematica, Cluj 8 (31) (1966) 163–172 (with V. Popov, in Russian).
36. On the best approximation with respect to the Hausdorff distance, God. Sof. Univ. Phis.-Maih. Fac. 59 (1966) 85–103 (in Bulgarian).
37. A model of the regulatory mechanism of cellular proliferation, C. R. Acad. Bulgare Sci. 19 (9) (1966) 835–838 (with R. Tsanev).
38. A model of the regulatory mechanism of cellular multiplication, J. Theoret. Biol., New York 12 (1966) 327–341 (with R. Tsanev).
39. Hausdorffsche Metrik und Approximationen, Numerische Math., Berlin 9 (1966) 214–226 (with B. Penkov).
40. Approximation of plane point sets with polynomial curves, God. Sof. Univ. Math. Fac. 60 (1967) 211–222 (in Bulgarian).
41. On the convergence of a sequence of linear positive operators, God. Sof. Univ. Math. Fac. 60 (1967) 279–296 (in Bulgarian).
42. On P. Korovkin's theorems for convergence of sequences of linear positive operators, Dokl. AN SSSR 177 (3) (1967) 518–520 (in Russian); Soviet Math. Dokl. 8 (6) (1967) 1445–1447.
43. On the interpolation process of Fejer, Izv. Math. Inst. BAS 9 (1967) 133–145.
44. Approximation with stepwise functions with respect to Hausdorff distance, Math. Zametki 2 (1) (1967) 61–67 (in Russian).
45. Distance, Fiz.-math. sp., Sofia 6 (2) (1967) 14–17.
46. On the numerical calculation of a class of polynomials of best approximation, God. Sof. Univ. Math. Fac. 61 (1968) 17–27 (with Sv. Markov, in Bulgarian).
47. Modeling of the regulatory mechanism of the cellular proliferation in the liver, Central. Biochem. Lab. BAS 3 (1968) 21–35 (with R. Tsanev).
48. Approximation with respect to Hausdorff distance, Math. Zametki 3 (4) (1968) 481–494 (in Russian; DSc thesis, Moscow, 1967).
49. Computer studies on the mechanism controlling cellular proliferation, in: Effects of radiation on cellular proliferation and differentiation. Vienna, Int. Atomic Energy Agency, 1968, 453–461 (with R. Tsanev).
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52. A possible mechanism for cellular differentiation, C. R. Acad. Bulgare Sci. 22 (12) (1969) 1433–1436 (with R. Tsanev).
53. On the widths of the space of continuous functions, Izv. Math. Inst. BAS 10 (1969) 5–15 (with B. Penkov, in Bulgarian).
54. Certain questions in the theory of approximation of functions and sets in Hausdorff metric, Uspehi Mat. Nauk 24 (5) (1969) 143–180 (in Russian); Russian Math. Surveys 24 (5) (1968) 143–183.
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