Operator Theory:
Advances and Applications
Vol. 32

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Topics in Operator Theory

Constantin Apostol Memorial Issue

Edited by

I. Gohberg

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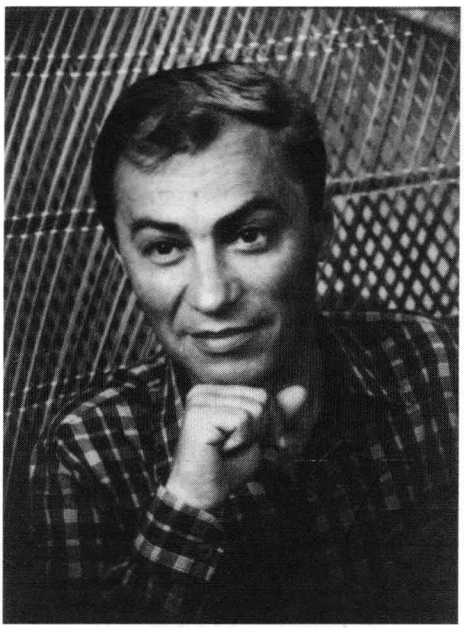

CONSTANTIN APOSTOL
(1936–1987)

FROM THE EDITOR

Autumn 1985 Constantin Apostol became interested in the problem of local and global spectral equivalence. He soon produced a manuscript with interesting results. Who could imagine that this manuscript was to be a draft of his last paper, and it is with this paper that this Memorial issue begins. The final touches in the preparation of this paper for publication were done by Domingo Herrero; the author was already in hospital.

Constantin Apostol will be remembered as an outstanding expert in operator theory, in which area he made very important and deep contributions. His friends and colleagues dedicate this volume to his memory.

Hearty thanks are due to Domingo Herrero for his assistance in preparing this volume.

I. Gohberg

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IN MEMORY OF CONSTANTIN APOSTOL

Domingo A. Herrero

Constantin Apostol was born on February 1st, 1936, in Iaşi, in the region of Moldavia, Romania. His father died when he was only one year old, and he was raised by his mother, in poverty conditions bordering hunger, in a Romania ravaged by the war. In spite of the material difficulties, his mother gave him a strict education; the best she could afford. He was a gifted child, with a passion for reading, especially Geography, History, travels, novels.

In 1961, he received his Master in Arts degree from the University of Bucharest, and in 1968, he received his Ph. D. degree from the same institution. The same year, he was awarded the Romanian Academy Prize "Gheorghe Ţiţeica" for research in Operator Theory. By this time, Bucharest was already a well-known center in that area. Constantin was part of the Romanian School of Operator Theory of the 70's (and a very important part, indeed!) Some day, some historian of Mathematics will analyze the rising and evolution of this outstanding group of mathematicians that suddenly appear in an Eastern European country, among socio-economico - political conditions far from optimal for the development of any kind of science.

We live in an age of massification. People go to a basketball game to see a group of ten individuals whose average height surpasses the two meter mark, and everybody considers that there is nothing special about this group. Sometimes, I think that in the same way, the Operator Theory community (all around the World) lived throughout the 70's expecting every year

a flush of exceptionally good results coming from Romania. That was the "natural", the "obvious" thing to expect...

In 1968, Paul R. Halmos introduced the notion of "quasi-triangular" (Hilbert space) operator, and two years later he published that wonderful survey article that has influenced so much the research in this area of Mathematics: "Ten problems in Hilbert space" (Bull. Amer. Math. Soc. 76 (1970), 887-933).

Around 1972, Constantin began to work on the spectral characterization of quasitriangularity, and wrote his article "Quasitriangularity in Hilbert space". It was not the solution of the problem but, clearly, it was pointing in the right direction. Shortly afterwards, the joint work of Constantin Apostol, Ciprian Foiaş and Dan Voiculescu produced the desired result: an operator T is quasitriangular if and only if $\text{index}(z - T)$ is non-negative for all z such that $z - T$ is semi-Fredholm.

The series of articles leading to this fundamental result contain an incredible number of "approximation tricks", that will strongly contribute to produce a whole body of work in the area of "non-commutative approximation" in the years to come.

1973 was a key year in Operator Theory: it was the year of the Apostol-Foiaş-Voiculescu Theorem, and the year of the Brown-Douglas-Fillmore Theorem, two cornerstones of the theory!

A year later, in 1974, the joint work of C. Apostol, C. Foiaş and D. Voiculescu solved one of the most difficult problems of Halmos: the spectral characterization of the norm-closure of the set of all nilpotent operators. In 1975, Apostol and Voiculescu extended the spectral characterization of quasitriangularity to operators on c_o, ℓ^p $(1 \leq p \leq \infty)$, and several other Banach spaces.

1976 was another exceptional year. Apostol introduced his "triangular model" of a Hilbert space operator, and showed that this model is a universal tool to solve problems related to the modification of the behavior by means of compact perturbations. In 1976, Voiculescu's Theorem was recent news; Apostol made one of the first nontrivial applications of this powerful tool in order to characterize the inner derivations with closed range: the inner derivation induced by an operator T has closed range if and

only if T is similar to A⊕(B⊗1), where A and B are operators acting on finite dimensional spaces. He also wrote two highly interesting articles with Kevin Clancey on one-side resolvents and generalized inverses of operators. The same year, "The Romanian Troika" proved that the only strongly reductive operators are "the obvious ones": normal operators whose spectra have empty interior and do not separate the plane. (C. Apostol had already done important work on the extension of the ideas of N. Aronszajn and K. T. Smith in connection with the existence of invariant subspaces. The characterization of the strongly reductive operators belongs to this circle of ideas.)

Some years later, in our Seminar at the Arizona State University, Constantin would dismiss his beautiful idea of a "triangular model" by saying that: "As you can see, the whole idea is very simple. It is incredible that nobody had though of it long time ago...".

In 1977, Constantin Apostol and Bernard B. Morrel answered another question of Halmos, by providing a spectral characterization of the closure of the set of all those operators whose spectra lie in a fixed subset of the complex plane. Even more important than the result itself, the paper contains the notion of approximation of operators by certain "simple models" (the "Apostol-Morrel simple models"). These models, Voiculescu's Theorem and Apostol's "simple idea" (of a "triangular model") are some of the main bricks for the construction of our most important joint work: the Apostol - Herrero - Voiculescu spectral characterization of the closure of the similarity orbit of a Hilbert space operator. (This result is the core of the monograph "Approximation of Hilbert space operators", written with the cooperation of Lawrence A. Fialkow.)

From 1965 to 1975, Constantin Apostol was a member of the Institute of Mathematics of Bucharest and, from 1975 to 1982, he was a Senior Research Scientist of the new National Institute for Scientific and Technical Creation (INCREST) of Bucharest.

In 1982, dissapointed with the situation in Romania, he defected to the USA. After a year as a Visiting Professor at the University of Nebraska (Lincoln), he was appointed Full-Professor

at Arizona State University. Two years later, Leiba Rodman joined our group. With Constantin Apostol and Leiba Rodman at ASU, and a good number of visitors (especially Carl Pearcy and Kenneth R. Davidson, who stayed there for a whole semester), the research life at ASU was a continuous exhilaration... A sort of uninterrupted Seminar on Operator Theory for several years in a row!

The communication was not always easy. Constantin came from the unique atmosphere of the INCREST, surrounded by a good number of the best operator theorists in the world, used to throw and catch challenging questions every day. No matter how serious his reasons to leave Romania, it was apparent that he missed that atmosphere. I, on the other hand, had spent a large part of my mathematical career in obscure corners of South America, with practically nobody to discuss my favorite problems, far from the big centers, without fluent communication with the rest of the world. Each situation produces, I suppose, some kind of professional deformation (of opposite signs).

The kinds of problems that attracted Constantin were very much the same that attracted me. To hear him in the Seminar was a real pleasure. There, a whole structure was constructed on the basis of a few, simple, geometric ideas. Somehow, however, he failed to transmit these simple underlying ideas to the paper. I found it difficult to reach the core of many of his articles. The geometric intuition is there, but (many times) it has been buried under several layers of unintuitive analytic lemmas.

To discuss and analyze the flow of ideas, problems, points of view on mathematical subjects, etc., coming from Constantin, would have required a whole team, not just one person. It was transparent, most of the time, that I was not enough challenge for him for the discussion of mathematical ideas. But, anyway, we felt that we were having a reasonably good time working together.

After the book was ready, he immediately began to apply some of our tools to work on stably invariant subspaces with Ciprian Foiaş and Norberto Salinas. We also wrote another paper on a recalcitrant question: the still open part of "the closure of a similarity orbit problem". The work with Filakow on "elementary

operators" is also connected with the ideas in the book.

As a continuation of his work with Frank Gilfeather in Nebraska, they completely classified the isomorphisms of the "discrete" nest algebras, modulo the compact operators. This article was followed by another one, in cooperation with K. R. Davidson, on the analogous problem for general nest algebras.

But the bulk of his work at ASU was done in cooperation with Hari Bercovici, Ciprian Foiaş and Carl Pearcy. Sprouting from the fertile ideas and techniques invented by Scott Brown for the solution of the invariant subspace problem for subnormal operators, they (with Scott Brown, Béla Sz.-Nagy, Allen L. Shields, and a large number of Pearcy's Ph. D. students) created a whole new body of theory about the structure of a Hilbert space contraction whose spectrum includes the unit circle. During the NSF - CBMS Conference held at ASU in May, 1984, Carl Pearcy (the main speaker of the Conference) emphasized the role of Constantin in these developments by remarking that "The $\mathbb{A}$ (of the $\mathbb{A}_{\aleph_0}$ class of contractions) is for Apostol". It is difficult to single out a particular result to illustrate this enormous body of discipline, but here is one that is dear to my heart:

Let B be the Bergman shift operator on $A^2(\mathbb{D})$; given an arbitrary strict contraction A, there exist two invariant subspaces, M(A) and N(A), with $M(A) \subset N(A)$, such that

$$B = \begin{pmatrix} * & * & * \\ 0 & A & * \\ 0 & 0 & * \end{pmatrix} \begin{matrix} M(A) \\ N(A) \ominus M(A) \\ A^2(\mathbb{D}) \ominus N(A) \end{matrix} .$$

Hundreds of pages of explanations could not give a clearer picture of the incredible pathology of the invariant subspace lattice of the Bergman shift! (More than one operator theorist used to imagine it "pretty much like the unilateral shift".)

Constantin had a quiet, but good sense of humour. He was always ready to enjoy a good joke and a good beer.

He was a gregarious mathematician (as one can easily check from his long list of joint articles), and very generous with his ideas. His last article, which is to appear in this issue, was originated by some problems raised by Leiba Rodman in our

Seminar at ASU.

Unfortunately, there was a cloud in the horizon. Constantin suffered from several ailments. It was clear to his friends that he was (perhaps subconsciously?) concentrating all his energies almost exclusively on Mathematics and on the care of his wife Valentina and his daughter Catalina whom, after serious efforts, he had finally managed to bring with him into the USA. Since he was a chain smoker, we attributed those ailments to minor respiratory and circulatory problems. But, from the beginning on the Fall Semester, 1986, it was clear that something wrong was going on. He looked and felt more and more tired every day. In the first week of November, his health began to deteriorate very rapidly. He was hospitalized and diagnosed lung cancer. He died in the hospital on January 21st, 1987.

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