

## Georg Heinig (1947–2005) In Memoriam



On May 10, 2005, Georg Heinig died unexpectedly of a heart attack in his apartment in Kuwait. We have lost one of the top experts in the field of structured matrices, an irreplaceable colleague, and a good friend. He was an active member of the editorial boards of the journal *Integral Equations and Operator Theory* and the book series *Operator Theory: Advances and Applications* since 1993. Our heartfelt condolences go out to his wife and his family.

Georg Heinig was born on November 24, 1947 in the small town of Zschopau in the Ore Mountains (Erzgebirge) in East Germany. From 1954 to 1964 he attended the school in Zschopau and from 1964 to 1966 the elite class for mathematics at Chemnitz University of Technology. Such elite classes were established to provide especially gifted pupils with an extraordinary education in mathematics (but also in the natural sciences and in languages) under the guidance of experienced university teachers. The careers of many successful East German scientists started at elite classes. None of these classes has survived the German reunification.

He studied mathematics at Chemnitz University of Technology from 1966 to 1970 and graduated with the diploma degree in 1970. His diploma thesis was written under the supervision of Siegfried Prössdorf and was devoted to certain properties of normally solvable operators in Banach spaces.

After defending his diploma thesis with the best possible grade, Georg Heinig was given the opportunity of entering a PhD program abroad. He decided to continue his studies at Kishinev (now Chisinau) University under the supervision of the second of us. His wife Gerti accompanied him in Kishinev and also completed a dissertation during that period. Georg Heinig was a very talented and dedicated researcher. In Kishinev he embarked on research into the theory of Toeplitz, Wiener-Hopf, and singular integral operators with scalar and matrix-valued symbols, and it was during those wonderful years that he has fallen in love with all the exciting mathematics of structured matrices. His deep results in this area formed the basis of his excellent PhD thesis, which he defended in Spring of 1974. Many other mathematical insights gained by Georg during the years in Kishinev went into his habilitation thesis, which he completed in Chemnitz. The early paper Gohberg/Heinig, Inversion of finite Toeplitz matrices consisting of elements of a non-commutative algebra (Russian), *Rev. Roumaine Math. Phys. Appl.* 19, 623–663 (1974) became one of his most frequently cited works.

Georg Heinig returned to Chemnitz in 1974. In the following five years the first of us had the pleasure of attending his classes as a student, the third of us received an outstanding member of his research group, and the second of us was proud of Georg's outstanding mathematical achievements. Georg Heinig integrated several young people into his research, Karla Rost being the most prominent figure of them. In 1979 he defended his habilitation thesis, which was on the spectral theory of operator bundles and the algebraic theory of finite Toeplitz matrices. His two children Peter and Susanne were born in 1974 and 1977.

The scientific outcome of the research directed by Georg Heinig in the 1970s and early 1980s is summarized in his and Karla Rost's book *Algebraic Methods for Toeplitz-like Matrices and Operators*, which was originally published by Akademie-Verlag, Berlin in 1984 and was republished by Birkhäuser Verlag, Basel in the same year. This book has found a warm reception and perpetual interest by a large community for now about twenty years. Some of its basic ideas, such as the so-called *UV* reduction (which later received more popularity under the name

displacement operation), have become important tools for workers in the field of structured matrices. Moreover, the scientific collaboration of Georg Heinig with Karla Rost lasted three decades until the day of Georg's death. Their joint research resulted in more than 30 papers. The results and methods of these papers are an essential ingredient to the present-day mathematical high-technology one is encountering in connection with structured matrices.

In 1982, Georg Heinig was a guest professor at Aleppo University in Syria, and from 1987 to 1989, he held a guest professorship at Addis Ababa University in Ethiopia. In the late 1980s he was appointed full professor at Leipzig University.

After the political events in Germany at the turn to the 1990s the life for Georg changed dramatically. All people working at East German universities were formally dismissed and had to apply for a position anew. Those who had shown a certain extent of political proximity to the former socialist system had no chance of receiving a new position at a German university, neither in East Germany nor in the subsequently reunified Germany. The situation was extremely difficult, and the efforts of Georg's friends to help him did not bring any positive results. Certainly Georg was very disappointed and despaired. Some time he planned to take over his father's store for vegetables, but eventually he looked for a job at a foreign university.

In 1993, Georg Heing went to Kuwait University, where he worked as a professor until his tragic death. The scientific conditions at Kuwait University were excellent and Georg has always thankfully acknowledged the recognition and friendship he received from his Kuwaiti colleagues. In 2003, he was awarded as the Scientist of the Year by the Amir of Kuwait. Despite all these successes, his and his wife's dream was to endure the university job only until the age of 60 years and then simply to relish life together, including travelling around the world. His unexpected death at the age of 57 abruptly dispersed this dream.

Georg Heinig's scientific legacy is immense. In more than 100 publications he made outstanding contributions to a variety of fields, including

- theory and fast algorithms for several classes of structured matrices,
- periodic Jacobi, Toeplitz, and Wiener-Hopf operators,
- classes of singular integral operators,
- resultants and Bezoutians for operator-valued polynomials,
- continual analogs of resultants and Bezoutians,
- numerical methods for convolution equations,
- applications in systems and control theory and signal processing.

Discoveries by Georg and his co-workers, such as the structure of the kernel and of the pseudoinverse for certain classes of structured matrices, significantly shaped the development of numerical algorithms. He also remarkably enriched various areas of operator theory, for example by deep results on the spectral theory of Jacobi matrices and of Toeplitz and Wiener-Hopf operators. He supervised 6 dissertations.

Georg Heing was a very pleasant person and an inspiring colleague. His sense of humor and his characteristic bright laughing will be missed by everyone who was lucky enough to meet him. His permanent endeavor for disclosing the absolute essence of a matter and his untiring aspiration for clearness and brevity were challenges for his co-workers on the one hand and have resulted in grateful appreciation by his students and the readers of his publications on the other.

Another dream of Georg Heing was a joint textbook with Karla Rost on structured matrices, ranging from the basics for beginners up to recent developments. About one year ago they started writing this book and three chapters are already more or less complete. It is unimaginable that he will never have this book in his hands some day. This tragedy bitterly reveals the gap that Georg has left and painfully reminds us of the projects and ideas that passed away with him. However, his work will endure and we will always remember this outstanding mathematician, excellent colleague, and wonderful friend.

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