

## Preface

The present book is a memorial volume devoted to our friend, colleague and teacher Peter Jonas who passed away on July 18, 2007. It displays recent advances in modern operator theory in Hilbert and Krein spaces and contains a collection of original research papers written by participants of the *7th Workshop on Operator Theory in Krein Spaces and Spectral Analysis*, which was held at the Technische Universität Berlin, Germany, December 13 to 16, 2007. The articles in this volume contain new results for problems close to the area of research of Peter Jonas: Spectral and perturbation problems for operators in inner product spaces, generalized Nevanlinna functions and definitizable functions, scattering theory, extension theory for symmetric operators, fixed points, hyperbolic matrix polynomials, moment problems, indefinite spectral and Sturm-Liouville problems, and invariant subspace problems.

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The Editors



*Peter Jonas (1941–2007)*

## In Memoriam Peter Jonas (1941–2007)

Jussi Behrndt, Karl-Heinz Förster and Carsten Trunk

Peter Jonas was born on July 18, 1941, in Memel, now Klaipeda, which was at that time the most eastern town of East Prussia. After the war, Peter Jonas moved with his mother and grandmother to Blankenfelde – a small village near Berlin, where he lived until the end of his school education.

In 1959 Peter Jonas started to study Mathematics at the Technische Universität Dresden. There he met Heinz Langer, who held at that time exercise classes in analysis, and Peter Jonas wrote his diploma thesis on stability problems of infinite-dimensional Hamiltonian systems under the supervision of Heinz Langer.

After his diploma in 1964, Peter Jonas got a position at the Karl-Weierstrass Institute of the Academy of Sciences in East Berlin where he first worked with his PhD supervisor Josef Naas on problems in differential geometry, partial differential equations and conformal mappings. At this time he married his wife Erika and his children Simon and Judith were born. After his PhD in 1969, Peter Jonas joined the mathematical physics group around Hellmut Baumgärtel, and the theory of selfadjoint and unitary operators in Krein spaces became one of his main mathematical interests.

In these early years of his research on selfadjoint and unitary operators in Krein spaces he was mainly interested in the existence of a spectral function/distribution and on stability criteria for perturbations in Krein spaces. It was in 1979 when his paper with Heinz Langer *Compact perturbations of definitizable operators* appeared, where it was proved that definitizable operators are stable under finite-dimensional perturbations. This paper is one of the milestones in perturbation theory of selfadjoint operators in Krein spaces and has inspired many colleagues and essentially initiated further research.

Peter Jonas himself continued with this topic and wrote a series of papers on compact perturbations of various classes of operators in Krein spaces applying his results to the Klein-Gordon equation. After his stay in Odessa in 1981 these activities finally culminated in the cooperation with Vadim A. Adamyan, Mark G. Krein and Heinz Langer; and led to his Habilitation thesis *Die Spurformel der Störungstheorie für einige Klassen unitärer und selbstadjungierter Operatoren im Kreinraum* (1987).

Peters deep interest in perturbation theory led him naturally to a generalization of the class of definitizable operators which appeared already in 1967 in a paper of Heinz Langer without having a name at that time: Locally definitizable operators. Peter worked on these classes of operators from about 1986 till his death in 2007. For sure one of his main contributions to operator theory in Krein spaces is the systematic and comprehensive study of unitary and selfadjoint locally definitizable operators. In several papers Peter established the existence of a local spectral function, he developed a perturbation theory and applied the general results to the Klein-Gordon equation, to problems with floating singularities and to spectral problems with eigenvalue depending boundary conditions.

Closely connected to Peters research on definitizable and locally definitizable operators was the introduction and investigation of related classes of functions: Definitizable and locally definitizable functions. Roughly speaking, these classes of functions are related to definitizable and locally definitizable operators in a similar way as generalized Nevanlinna functions are related to selfadjoint operators in Pontryagin spaces. Making use of methods from the theory of distributions Peter was able to characterize local sign type properties of these functions. In the paper *Operator representations of definitizable functions* published in 2000 he proved the existence of a minimal representing operator (or relation) in a model Krein space and he showed how the spectral information of the representing operator is encoded in the definitizable function. It is amazing to see how efficient his abstract results work in applications. This theory plays nowadays an essential role in the analysis of Titchmarsh-Weyl-coefficients associated to indefinite Sturm-Liouville operators and is applied by various groups in Germany, Canada and Eastern Europe. We wish he could have witnessed it.

Throughout his career at the Karl-Weierstrass Institute, Peter Jonas established fruitful scientific contacts with many mathematicians in the Soviet Union and other Eastern European countries. Many of these colleagues became close personal friends, among them Vadim Adamyán, Tomas Azizov, Tsembeltsogt Bajasgalan, Branko Curgus, Aurelian Gheondea, Alexander Markus, Vladimir Matsaev, Franciszek Hugon Szafraniec, Vladimir Strauss and many others. At conferences in Eastern Europe Peter met with West European colleagues, but during the Cold War it was impossible for him to visit them in their home countries.

The political changes in 1989 had a tremendous influence on Peters life. The Karl-Weierstrass Institute was closed down in 1991, Peter lost his permanent position and became a member of the so-called Wissenschaftler-Integrations-Programm; a program that was initiated to incorporate employees of scientific institutions of the former GDR into German universities. However, this program was rather inefficient and, as a result, Peters situation was vague. But it was not Peter's to complain, rather he used this situation to obtain various positions at the Technische Universität Berlin, Freie Universität Berlin and at the Universität Potsdam. After a research stay in Bellingham (USA) he finally settled down with the help of Karl-Heinz Förster at the Technische Universität where he worked until his retirement in 2006. In his last years, Peter Jonas used the possibility to meet

various colleagues and friends in the USA, Israel, Austria, Venezuela, Turkey and the Netherlands. Beside his passion for mathematics, Peter was very interested in Asian culture, in particular, Buddhism; he undertook visits to countries such as Thailand, Laos, Burma and Cambodia.

The Functional Analysis group at the Technische Universität Berlin tremendously benefited from Peter. With passion he supervised PhD students (Carsten Trunk '02 and Jussi Behrndt '05) and diploma students (Antonius Gacinski '93, Carsten Trunk '95, Kai Anding '95, Michael Krause '97, Jussi Behrndt '02, Christian Kreuzler '05 and Friedrich Philipp '06). Peter was an excellent and exceptional teacher: he spent whole days, sometimes nights and numerous phone calls for explaining and advising. Whenever his students had questions he always had the patience for a detailed, helpful answer. Besides this, Peter gave courses and special lectures in operator theory. In addition, he invited specialists from all over the world for research stays and to the *Operator Theory Colloquium* at the Technische Universität Berlin. Moreover, Peter initiated, together with Karl-Heinz Förster, the series of *Workshops on Operator Theory in Krein Spaces* held annually since 2001 at the Technische Universität Berlin.

Many of Peters colleagues have experienced his friendship and his hospitality during research stays or while attending conferences in Berlin. This friendship was a result of Peters life-long ties and numerous visits to his colleagues, and it was a result of his personality and his way of doing mathematics. It was his special mixture of profound and deep knowledge, his modest, calm and well-balanced style, his silent but rigorous way of doing research and his uncompromising style of writing papers which made him to this impressive person he was.

In April 2007, Peter Jonas suddenly got serious health problems and after a surgery and a short time of recovery he died at his 66th birthday on July 18, 2007. We will remember and miss him as a friend, colleague and teacher.

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