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Rudolf Gorenflo: a short outline of his life

Born on 31 July 1930 in Friedrichstal near Karlsruhe,
 1950 - 1956: student of Mathematics and Physics at Technical University in Karlsruhe,
 1956: diploma in mathematics,
 1960: promotion to *Dr. rer. nat.* (doctor rerum naturalium),
 1957 - 1961: scientific assistant at Technical University in Karlsruhe,
 1961 - 1962: mathematician at Standard Electric Lorenz Company in Stuttgart,
 1962 - 1970: research mathematician at Max-Planck Institute for Plasma Physics
 in Garching near Munich,
 1970: habilitation in Mathematics at Technical University in Aachen,
 1971 - 1973: professor at Technical University in Aachen,
 1972: guest professor at University of Heidelberg,
 since October 1973: full professor at Free University of Berlin,
 1976 - 1982 deputy leader of Free University Research Project *Optimization and
 Approximation* (Leader K.-H. Hoffmann),
 1982 - 1989 director of Third Mathematical Institute of Free University of Berlin
 1980 - 1984 president of *Berlin Mathematical Society*,
 1983 - 1988 head of Research Project *Modelling and Discretization* (Free University of Berlin),
 1989 - 1994 head of Research Project *Regularization* (Free University of Berlin),
 1995 - 2003 head of Research Project *Convolutions* (Free University of Berlin),
 1994 - 1997 leading member of NATO Collaborative Research Project *Fractional Order
 Systems*, with R. Rutman, University of Massachusetts Dartmouth,
 1995 guest professor at University of Tokyo,
 since October 1998: professor emeritus at Free University of Berlin.
 After emeritation: continued activity in teaching, scientific research and international collaboration,
 refereeing and reviewing, and editorial boards of journals

Rudolf Gorenflo is member of several scientific associations.
 Family status: married since August 1959, two sons, one daughter.

Fields of scientific work and interest

In my final student years (1950 - 1956) and in my time as a scientific assistant in Karlsruhe (1957 - 1961) I was mainly interested in the theory of functions of one complex variable, in particular in value distribution theory and growth properties. This is documented in my diploma thesis *Meromorphic periodic functions of finite order* (1956) and my doctoral thesis *On the Wiman-Valiron comparison method for power series and its application in the theory of entire transcendental functions* (1960).

During my time in the Department for Informatics at Standard Elektrik Lorenz in Stuttgart (1961 - 1962) I was working in development of electronic calculating machines. My main task was to devise simulation models for distant booking systems. This required investigation and use of pseudo-random numbers, Monte Carlo methods and theory of queues, and so I had opportunity to acquire some expertise in these matters.

For my work as a research mathematician in the Theory Department of the Max Planck Institute for Plasma-Physics in Garching near Munich (1962 - 1970) my knowledge of complex analysis (from my time in Karlsruhe) and of electronic computing machines (from my time in Stuttgart) were extremely useful. My principal activities were distributed on three areas:

- (1) application of complex analysis to plane problems of magneto-hydro-statics and stationary magneto-hydrodynamics,
- (2) application of Monte Carlo methods for simulation of particle flights in a rarefied gas,
- (3) numerical analysis, in particular theory and application of difference schemes to ordinary and partial differential equations (e.g. for large scale computation of magnetic fields), furthermore numerical methods for evaluation of spectroscopic measurements (in the rotationally symmetric case via Abel integral equations).

As leader of a group of mathematicians and computer programmers I was responsible for consulting and assisting physicists and engineers in the mathematical and numerical treatment of their problems.

During my time in Aachen (1970 - 1973) and in Berlin (since) 1973 for several years I divided my research interests between (a) integral equations (mainly of Abel type) and the neighboring subject of inverse and ill-posed problems and (b) difference schemes for parabolic differential equations.

In (a) this led to my book (no 49 of my list of publications) with **Sergio Vessella** on *Abel Integral Equations: Theory and Applications*, Lecture Notes in Mathematics **1461**, Springer-Verlag 1991, and to my book (no 122) with **D. D. Ang**, **V.K. Le**, and **D. D. Trong** on *Moment Theory and Some Inverse Problems in Potential Theory and Heat Conduction*. Lecture Notes in Mathematics **1792** (2002), Springer-Verlag, Heidelberg. Later, as can be seen from my list of publications, this work was (in collaboration with co-authors) extended to inverse problems in heat conduction, asymptotic properties of singular values, nonlinear inverse problems, problems of recovery of a function from knowledge of its moments.

In (b), a field which I had begun already in the Max Planck Institute, I carried out my particular intention to develop and investigate difference scheme that imitate essential properties of the diffusion processes that were modelled, namely properties of conservation of mass or energy, preservation of non-negativity, damping properties. In this way, the obtained difference schemes allow a double interpretation, namely (i) as that of a process of discrete redistribution of an extensive quantity on the grid-points, (ii)

as that of a random walk discrete in space and time, of a particle wandering according to a diffusion process described by the parabolic equation at hand. The connection between these two interpretations lies in the fact that probability itself can be viewed as an extensive quantity.

In 1992 (stimulated by a research visit to Prof. R. Rutman at University of Massachusetts in Dartmouth) I began working on ordinary fractional differential equations and related special functions, and later (beginning in 1995) I intensified this work in collaboration with Prof. F. Mainardi and other investigators. For information and for downloads I recommend the website <http://www.fracalmo.org> Soon these interests were extended to cover partial fractional equations (fractional in time or in space or in both time and space), equations suitable for modelling non-classical diffusion processes. In this collaboration various types of random walk models were devised and analyzed. For me personally, this activity is a fascinating generalization of my earlier investigations, see (b) above, of difference schemes conserving mass or non-negativity (or energy) in classical diffusion processes. Present interests are also in applications of such processes.

During my time in Aachen and in Berlin I have given courses and held seminars in several fields, e.g. *Numerical Mathematics, Introduction to Computer Science, Basic Analysis, Ill-posed Problems, Integral Equations, Integral Transforms, Functional Analysis*. I was furthermore engaged in courses for non-mathematicians: e.g. *Differential Geometry for students of geodesy, Mathematics for physicists, Mathematics for biologists and mineralogists, Statistics for biologists*.

As can be seen in my publications I have been especially active in international cooperations, having had scientists from many countries, near and far, as long term visitors, several of them as co-authors.

I am a member of several scientific societies and a reviewer for *Zentralblatt für Mathematik* and *Mathematical Reviews*.

My favourite formulas:

$$\sum_{k=1}^{\infty} \frac{1}{k^k} = \int_0^1 \frac{1}{x^x} dx, \quad \sum_{k=1}^{\infty} \frac{(-1)^{k-1}}{k^k} = \int_0^1 x^x dx.$$

My Erdős Number is 3. To my knowledge there are two connections:
 Rudolf Gorenflo coauthored with **Dang Dinh Ang** MR1178288 (93g:45005),
 Dang Dinh Ang coauthored with **T. K. Sheng** MR0245510 (39 #6816),
 T. K. Sheng coauthored with **Paul Erdős** MR0379404 (52 #309),
 Rudolf Gorenflo coauthored with **Hari M. Srivastava** MR1644941 (99g:33057), born 1942,
 Hari M. Srivastava coauthored with **Joel Lee Brenner** MR0374522 (51#10722), 1912 - 1977,
 Joel Lee Brenner coauthored with **Paul Erdős** MR0902513 (88j:20006), 1913 - 1996.

My Einstein number is 4:

Rudolf Gorenflo coauthored with **Hari M. Srivastava** MR1644941, born 1942,
 Hari M. Srivastava coauthored with **Leonard Carlitz**, 1907 - 1999,
 Leonard Carlitz coauthored with **Ernst Gabor Strauss**, 1922 - 1983,
 Ernst Gabor Strauss coauthored with **Albert Einstein**, 1879 - 1955.