

AO. UNIV. PROF. MAG. DR. MANFRED KÜHLEITNER
(1967–2022)
AN OBITUARY



(The photo was taken by Kühleitner's family.)

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Manfred Kühleitner was born on January 9, 1967 in Salzburg, where he grew up and received his school education. He studied mathematics at the University of Vienna and graduated 1990 with a Master Thesis “ Ω -Abschätzungen für das Teiler- und Kreisproblem”. Related results were published in his first paper “An omega theorem on differences of two squares” (Acta Math. Univ. Comenian (N. S.) 61 (1992)). In 1992 he finished his PhD thesis “Lower and upper bounds for certain arithmetic functions based on recent methods of analytic number theory” (supervisor W. G. Nowak and co-supervisor V. Losert) and was promoted to Dr. rer. nat. at the University of Vienna. The third author (R. T.) met Manfred Kühleitner first at a conference which he organized jointly with F. Halter-Koch (1991) in Graz. There Manfred found a solution of a problem concerning the sum

$$\sum_{n \leq x} r(n)^2$$

addressed by A. Schinzel ($r(n)$ denotes the number of representations of n as a sum of two squares). In the period 1992–2013 he published 25 papers in number theory (according to MathSciNet), some of them as a single author and some jointly with his mentor W. G. Nowak or with other coauthors. This is about one third of his publications. Most of the papers are concerned with the asymptotic analysis of arithmetic functions or related problems in analytic number theory such as counting lattice points in large regions or counting finite groups or rings.

In the following, we give some details on a few selected papers. M. Kühleitner and W. G. Nowak (Math. Nachr. 1994) obtained an interesting lower bound for a certain exponential integral involving Dirichlet series which leads to nice applications in elementary and algebraic number theory. Of special interest is joint work with W. G. Nowak, J. Schoissengeier and T. D. Wooley (Acta Arith. 85 (1998)) which improves the asymptotics for the number of pairs (m, n) of integers satisfying

$$|m|^3 + |n|^3 \leq t^{2/3}, \quad \text{as } t \rightarrow \infty.$$

Clearly, this problem is closely related to the famous circle problem and an upper bound for the remainder term in the asymptotic expansion is due to G. Kuba (also a member of the Mathematical Institute at BOKU Vienna). The 1998 result with Kühleitner derives a very good lower bound by a quite general new technique. Several papers of Manfred Kühleitner contain improved lower bounds for counting lattice points in various regions. He always uses the best available methods for the considered problem with original ideas in applying the rather involved machinery. Some of his papers were carefully reviewed by R. Heath-Brown in *MathSciNet* (pointing out many details and indicating the main tools for the proofs).

The most influential work of Manfred Kühleitner (jointly with A. Ivić, E. Krätzel and W.G. Nowak) is a survey article on lattice point problems and related arithmetical functions (Schr. Wiss. Ges. Johann Wolfgang Goethe Univ. Frankfurt am Main (2006)). W. Schwarz writes in his review: “This paper is an up-to-date (2004) and most interesting survey paper ...” and “... this article is an important paper for people working in analytic number theory”. Like his first paper, also the last number-theoretic work of Manfred Kühleitner addresses a question of A. Schinzel asked at the 20th Czech and Slovak International Conference on Number Theory (2011). This paper (jointly with W.G. Nowak) contains a lower bound for the remainder term in a certain asymptotic expansion.

Since 2014 Manfred Kühleitner focused his research on problems arising in life sciences, agricultural sciences and related very applied areas. The driving force were questions asked by his colleagues from other research groups at BOKU Vienna. This work covers also about one third of his publications and the focus lies on growth models for animal sciences and microbiology. An example for a recent research paper is “Bertalanffy-Pütter models for avian growth”, published in PLOS ONE 16, 2021. Ornithologists fitted simple growth models to size-at-age data of nestlings, used them to estimate biologically meaningful parameters, such as the asymptotic mass (adult size) or the inflection point (change of diet, when the growth is fastest), and used statistical tests to identify environmental factors that may affect growth. This method worked well for the comparison of clearly distinct environments, such as primeval forests and urban parklands. This paper investigated more fine-scaled differences in growth of 81 nestlings of blue and great tits within an urban parkland of Warsaw. It compared the ratios of mass at the inflection point over the asymptotic mass, using the Bertalanffy-Pütter model, as it is more versatile than the simple models used hitherto. (For the simple models, the ratio is fixed, e. g., 0.5 for logistic growth.) For female and male blue tits, high levels of impervious area around the nests and light pollution were significantly associated with lower ratios, indicating a slower growth.

Another third of his publications is about teaching of applied mathematics. Manfred Kühleitner promoted the use of the well-known spreadsheet program MS Excel for undergraduate education to make mathematical content more accessible through numerical simulations. An example is a paper about real estate financing: “Immobilienfinanzierung: Kreditvergleich mit unterschiedlicher Zinsbindungsdauer”, published in 2021 in Stochastik in der Schule volume 41. The paper addresses the question whether it would be better to take out a loan with a fixed commitment period and a higher interest rate or a short-term commitment period at current market interest rates. A bootstrap simulation in Excel using EURIBOR data has shown that in the past the short-term commitment period fared better, in general.

Manfred Kühleitner was an important member of the Mathematical Institute of BOKU Vienna. He started there as a University Assistant 1993 and after his habilitation at the University of Vienna he was promoted to an Associate Professor at BOKU, where he served as a chair and a deputy chair at the Institute of Mathematics. He was very active as a teacher at BOKU Vienna. His courses were devoted to various topics such as “Mathematics for Agricultural Sciences”, “Mathematical Modelling in the Life Sciences”, “Geometry and Computer Aided Design for Engineers”. He was advisor for six master theses at BOKU and advisor of the PhD-thesis of Katharina Renner-Martin (“Optimal exponents for the generalized Von Bertalanffy growth model”, 2021). Manfred Kühleitner was also very active in teaching at other universities, for instance, at the Free University of Bozen-Bolzano, at the University of Applied Sciences for Management and Communication (FH), and at FH Campus Wien (University of Applied Sciences).

In 2006 Manfred Kühleitner was awarded with the Edmund and Rosa Hlawka Prize of the Austrian Academy of Sciences for his impressive work on the asymptotic analysis of arithmetic functions and related lattice point problems. During the decade 2011–2020 he served as a Managing Editor of the international journal “Uniform Distribution Theory”. During this period the journal was based at BOKU Vienna and Manfred was responsible for most of the administrative work. A few years ago the base of the journal moved to Liverpool and it seemed that now Manfred has more freedom to follow his own research interests. So all his colleagues and friends were shocked when they got to know that he died after a surgery. Manfred Kühleitner is survived by his wife Monika and his three daughters Judith, Hannah and Regina.

The authors jointly with Gerald Kuba, W. Georg Nowak, Wolfgang Ruppert, Klaus Scheicher, Paul Surer and all close to Manfred Kühleitner remember his outstanding friendliness, responsibility and kindheartedness. This obituary appears both in “Internationale Mathematische Nachrichten” (IMN) and “Uniform Distribution Theory” (UDT).

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