

Preface

On October 8–9, 2008, we organized an IEEE MTT-S International Mini-Symposium on Electromagnetics and Network Theory and its Microwave Applications at Munich University of Technology (TUM), Munich, Germany. This symposium was dedicated to Peter Russer on the occasion of his 65th birthday and his retirement. During his career as researcher in the field of Electromagnetics and Network Theory Peter Russer achieved not only a multitude of outstanding scientific results but he also had the special gift to bring researchers together and to build up an international network of scientists in this field. This network was base of the successful symposium which provided an international forum for the discussion of the challenges and perspectives of electromagnetics and network theory and their microwave applications in various aspects. Invited presentations have been given by Josef A. Nassek of TUM, President of Association for Electrical, Electronic & Information Technologies, VDE, Franz X. Kärtner of Massachusetts Institute of Technology, MIT, and of course by Peter Russer, TUM. In oral sessions and an interactive forum 48 reviewed scientific contributions were presented. Half of those contributions have been further extended now to be combined in this book in order to give a compact overview about actual research in the field of Electromagnetics and Network Theory and its Microwave Applications.

The book is subdivided into basic topics of applications and theory in this field as there are antennas and wave propagation, microwave- and communication-systems and methods for the numerical modelling of components, networks and structures being part of these systems. In a first section an actual state of research in antennas and propagation is given since the description of antennas as well as wave propagation in RF-lines and electric networks is crucial for the investigation of microwave systems like radar-, radio-location- and communication-systems.

Especially in mobile applications, radar-, radio-location- and navigation-systems as well as microwave sensors are more and more in use. An actual state of research in this field is given in the second section. Actual results of research on such systems are shown for automotive radar, a high precision radio-location-system, RF-sensors and RF-measurement technologies. The wide field of communication systems is discussed in the third section where an overview about further progress in mobile communication and wireless data transmission is given and results of actual research are shown.

In the fourth section actual numerical methods are discussed which are essential for the estimation of electromagnetic effects in all the applications shown previously. In the scope between the treatment of very tiny structures and very large structures new ways are shown for the numerical modelling of the electromagnetic field in nanostructures as well as in macrostructures and large periodic structures. In the last chapter we present the autobiography of Peter Russer which shows in a very good example, that the combined treatment of all the aspects mentioned above leads to achievements which may seem almost impossible. But, speaking with his words, the impossible just takes longer.

At this point we would like to take the occasion to give a brief summary on the very successful scientific work history and Peter Russer's extraordinary achievements – both as an outstanding researcher and as a distinguished educator. Peter Russer was born in Vienna, Austria in 1943, during World War II. After finishing elementary school and gymnasium in Vienna, he studied Electrical Engineering at the Vienna University of Technology where he received the Dipl.-Ing. degree in 1967. He continued at his Alma Mata and became a young research assistant working towards the doctoral degree under the supervision of the late Professor Hans Pöttl on “Josephson electronics”, for which he received the Dr. techn. degree in 1971. Shortly after (1971) he joined the AEG-Telefunken Research Institute in Ulm, Germany, where, for ten years, he worked on fibre optic communication, solid-state electronic circuits, noise analysis, laser modulation and fibre optic gyroscopes. At the young age of 38 (in 1981), he was offered a Full Professorship at the TUM and to become Director of the Institute of High Frequency Engineering, where he has been since. His service to TUM was only briefly interrupted from 1992 to 1995 when he was selected the Founding Director of the Ferdinand Braun Institute in Berlin, Germany, a position which was also associated with a Guest Professorship at the Technical University of Berlin. In September 1995 he returned to TUM, and from 1997 to 1999 he served as Dean of the Faculty of Electrical and Information Engineering.

Peter Russer is a renowned scholar and highly respected teacher who is devoted to his students. He has developed and taught a large variety of courses in RF techniques, microwaves, quantum electronics and optical communications. His scripts and monographs are superb teaching tools and have served as basis for a couple of distinguished textbooks. Peter Russer was also the mastermind behind the international Master of Science in the Microwave Engineering curriculum at the TUM which is running very successfully since eight years. His fine teaching skills have attracted a great number of young talents to become his Master and Ph.D. students. Over the years he has graduated a total of nearly 500 students of which about 70 received their doctoral degree. Many of his students have started successful careers in industry and academia and continue to keep close ties with their mentor and ‘Doktorvater’. Quite a high number of his Ph.D. students like Erwin Biebl, Franz X. Kärtner, Gerhard Fischerauer, Gerd Scholl, Josef Hausner, Sebastian Sattler and ourselves have become University Professors, respectively at TUM, Massachusetts University of Technology, University of Bayreuth, Hamburg University of federal armed forces, University of Bochum, Munich University of federal armed forces,

and University of Erlangen-Nuremberg; and these so-called “Peter’s Boys” have greatly contributed to a special journal issue published in summer of 2008 (Peter’s Boys – Making Frequencies Think, *Frequenz – Journal of RF-Engineering and Telecommunications*, vol. 62, no. 7–8, July/August 2008, pp. 153–207).

Peter Russer is well known internationally for his many innovative and significant contributions to Josephson electronics, fibre optic communication and gyroscopes, laser modulation, solid-state electronics, noise analysis techniques, Bragg cell-based spectrum analyzers, integrated optics, surface acoustic waves, hyperthermia, microwave superconductivity, linear/nonlinear circuit design methods, design of integrated microwave and millimetre-wave circuits, numerical techniques in computational electromagnetics, and lately also to electromagnetic compatibility (EMC). In most of these fields, Peter Russer has clearly pioneered the research from numerous points of view. Let us give just three examples: (1) The publication *H. Hillbrand, P. Russer, “An Efficient Method for Computer Aided Noise Analysis of Linear Amplifier Networks”*, *IEEE Transactions on Circuits and Systems*, vol. 23, no. 4, April 1976, pp. 235–238 laid the basis for the theoretical foundation for the noise analysis of two-ports using correlation matrices, a technique which meanwhile is being used in nearly all network analysis computer codes. (2) On December 21, 1978, Erich Kasper and Peter Russer, who in those days were colleagues at AEG-Telefunken in Ulm published their patent (Germany, no. DE2719464) entitled *Verfahren zur Herstellung von Hochfrequenztransistoren* which describes the invention of the SiGe heterobipolar transistor (HBT), a semiconductor device which is crucial for the implementation of silicon integrated millimetre-wave circuits (SIMMWICs) which nowadays are very successfully applied in communications, sensing and radar at millimetre-wave frequencies. (3) Peter Russer’s pioneering work on the foundations of the Transmission Line Matrix (TLM) modelling of electromagnetic fields has been widely acclaimed as the most rigorous approach to put this technique on solid ground. In all his research areas, Peter Russer’s work demonstrates an exceptional quality, originality, and technical impact. Many times he has been able to transfer his scientific results into innovative application beneficial for the economy and for the society. To this date, Peter Russer has authored and co-authored more than 140 refereed journal publications, more than 500 conference papers, 6 books and 20 book chapters. The impact of his academic work is complemented by the numerous novel ideas and approaches he developed for industry as evidenced by the more than 50 patents he holds or has applied for. Reflecting on all these merits, it is no surprise that Peter Russer has received several high-ranking awards and honours including the 1979 NTG award for his seminal paper “Electronic circuits for high-bit rate digital fibre optic communication systems”. In 1994 he was elected IEEE Fellow for his fundamental contributions to noise analysis and low-noise optimization of linear electronic circuits with general topology. In 2006, he received the IEEE Microwave Theory and Techniques-Society Distinguished Educator Award, also in 2006 the Fellowship of the Council for Technical Sciences in Germany (ACATECH), and in 2007 the Honorary Doctoral degree from the Moscow State University of Aviation.

During his professional career, Peter Russer was not only very active in research and teaching, he has also greatly contributed time and talent to the well-being of the scientific community. He is a member of IEEE, EuMA, URSI, ITG, DPG and ÖPG. Besides serving as chairman, organizer, member of technical program and steering committees of numerous conferences, workshops, society chapters, sessions etc., he also serves the scientific community as reviewer for national and international journals, conferences and research foundations. Just to note a few of these activities: Peter Russer organized and chaired the European Microwave Conference in Munich in 1999, has been chair of the German IEEE MTT/AP Joint Chapter, has been chair of URSI's commission D – Electronics and Photonics, has been a member of the German Science Foundation's (DFG) senate board for collaborative research centres, has been Associate Editor of the IEEE Transactions on Microwave Theory and Techniques, has been chair of the IEEE MTT-Society's Technical Committee on Field Theory, and has been a member of the EuMA board of directors.

It always was and still is an honour to know Peter Russer personally and for so many years. He has now moved into his status of an Emeritus of Excellence which has been awarded to him by his university TUM and which shows, that his university still counts on his very valuable contributions. We are sure he will go on in continuing his service to the scientific society and we are looking forward to it.

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Stefan Lindenmeier
Robert Weigel

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