

## Preface: IWR Special Issue on Scientific Computing Dedicated to Willi Jäger's 75th Birthday

Hans Georg Bock<sup>1</sup> · Vincenzo Capasso<sup>2</sup> ·  
Maria Neuss-Radu<sup>3</sup> · Hoang Xuan Phu<sup>4</sup>

Published online: 5 January 2017

© Vietnam Academy of Science and Technology (VAST) and Springer Science+Business Media Singapore 2017

This is the first issue of a new annual series of Vietnam Journal of Mathematics, which is named *IWR Special Issue on Scientific Computing* and is lead by the Interdisciplinary Center for Scientific Computing (IWR) of the University of Heidelberg. This first issue is dedicated to Prof. Willi Jäger, the founding Director of IWR, on the occasion of his 75th birthday, which he celebrated on August 15, 2015. It includes 14 papers written by authors having close ties to Willi Jäger. Their contributions cover various areas of Mathematics and its Applications, reflecting on one side Willi Jäger's wide ranging scientific interests, and on the other side, the potential of Mathematics as a key methodology for Science and Technology.

---

✉ Hoang Xuan Phu  
hxphu@math.ac.vn

Hans Georg Bock  
bock@iwr.uni-heidelberg.de

Vincenzo Capasso  
vincenzo.capasso@unimi.it

Maria Neuss-Radu  
maria.neuss-radu@math.fau.de

<sup>1</sup> Interdisciplinary Center for Scientific Computing, University of Heidelberg, Im Neuenheimer Feld 205, 69120, Heidelberg, Germany

<sup>2</sup> Department of Mathematics, Università degli Studi di Milano, Via Saldini 50, 20133, Milano, Italy

<sup>3</sup> Department of Mathematics, Friedrich-Alexander-Universität Erlangen-Nürnberg, Cauerstraße 11, 91058, Erlangen, Germany

<sup>4</sup> Institute of Mathematics, Vietnam Academy of Science and Technology, 18 Hoang Quoc Viet Road, Cau Giay District, Hanoi, Vietnam



(Picture courtesy of Vincenzo Capasso and Susanne Krömker; based on a photo by Thomas Schmid.)

### **Prof. Dr. Drs. h. c. Willi Jäger—A Life for Science**

Willi Jäger is a leading personality in the field of mathematical modelling, analysis, and simulation of complex and mainly nonlinear systems. He is involved in a wide field of applications which include physical, chemical, biological, and also medical and industrial ones. He has always been an active scientist, with a strong ability to open new fields by mathematical modelling, designing scientific tasks and projects, and gaining new insights by establishing and analysing innovative mathematical models, up to their numerical simulations. His way of working is consistently interdisciplinary and permanently alternating between real experiment, modelling and analysis, and virtual experiment on the computer.

Willi Jäger is also a dedicated teacher and advisor. He attracted generations of students, guided them on fascinating topics and inspired them by his openness, his deep understanding of mathematical problems, and his interdisciplinary spirit.

By the leading participation in various national and international projects and by his activity as a founding member of various institutions, he contributed to the promotion of research in mathematics, the intensification of (inter)national scientific collaborations, the intensification of education and training in mathematics and related areas, and the promotion of young scientists.

Indeed, Willi Jäger is a unique combination of excellence as a scientist, as a promoter of science, and as an educator.

### **Scientific Vita**

Willi Jäger was born on August 15, 1940, in Kschellowitz, Bohemia. After his Diplom in Mathematics (1964) and the PhD in Mathematics (1966) at the University of Munich, he got his Habilitation in Mathematics at the University of Göttingen (1969). During 1969–1970, he was a Visiting Member of Courant Institute, New York, after which he was appointed Full Professor at the Institute of Mathematics at the University of Münster. Since 1974, he has been Full Professor at the Institute of Applied Mathematics at the University of Heidelberg.

## Scientific Merits

Starting from concrete applications, his studies lead to breakthrough results for the development of analytical methods for nonlinear partial differential equations (including elliptic and parabolic systems, as well as conservation laws), bifurcation theory, and pattern formation. He developed new techniques for the treatment of multi-scale problems, and he consistently pushed forward the design of appropriate numerical algorithms, which can be used for the simulation of the studied mathematical models. His investigations have led to significant contributions in various fields of applications including

- Reactive flow, diffusion, transport, and reaction in complex media
- Modelling of physical, chemical, and biological processes
- Multiscale analysis for surface reactions, transport through membranes
- Multiscale modelling of mechano-chemical properties of cells
- Motility and tactic behaviour
- Differentiation of stem cells
- Adhesion processes
- Coagulation of blood, processes in brain infarct
- Dynamics of neurotransmitters in brain, computational pharmacology
- Drug resistance and dynamics of diseases
- Growth in chemical gradients
- Growth of biofilms
- Modelling and simulation of plant growth
- Visualization and image analysis, development and applications of nonlinear filters
- Modelling and simulations of geothermal flows and energy production
- Price dynamics of commodity markets
- Image processing and visualization in computational humanities
- Data analysis, restoration and preservation of historic documents and monuments

His excellent research results are reflected in 107 disciplinary publications in reviewed journals and proceedings, 31 interdisciplinary publications, and 24 edited books. In addition, Willi Jäger was the main adviser for about 100 PhD thesis.

## Promotion of Science and Technology

Willi Jäger has strongly promoted the dialogue between different sciences and mathematics. His interest in interactions across disciplines becomes visible through the leading participation in various DFG (German Research Foundation) and BMBF (German Federal Ministry of Education and Research) projects and industrial cooperations.

He has contributed substantially to the development of new fields such as computational science and scientific computing by establishing the Interdisciplinary Center for Scientific Computing (IWR) in 1987.

He has been a key member of the Steering Committee in the foundation of the European Society for Mathematical and Theoretical Biology (ESMTB) during 1988–1991.

The foundation of BIOMS (Center for Modelling and Simulation in the Biosciences) in 2004 and BIOQUANT (the Center for Quantitative Analysis of Molecular and Cellular Biosystems) in 2006 are milestones in the research of stronger quantitatively oriented biosciences.

He has been a Founding Director (2007–2011) of the Mathematics Center Heidelberg (MATCH).

Through his active commitment in the activities of the Academy of Sciences and of the Mathematical Institute Oberwolfach, Willi Jäger contributed to the promotion of research in mathematics and the intensification of (inter)national scientific collaborations. As a member of the European Academy of Sciences (EURASC), he has actively supported the promotion of young scientists by the Kepler Prize for European Young Scientists (KEYS).

He has initiated and fostered scientific cooperations within Europe by participation in European networks, and by scientific contacts and exchange programs with Eastern Europe including Czech Republic, Poland, Romania, Russia, and Slovakia.

By recognising that industrial innovation is increasingly based on the results and techniques of scientific research, and this research is inextricably linked to mathematics, he promoted the role of mathematics as a key technology for the future. He has been Chairman of the Committee of the BMBF Program Mathematics for Industry. Furthermore, as Chairman of OECD Global Science Forum Mathematics for Industry (2005–2007), he stimulates the interaction between mathematics and industry, and contributes to a stronger coordination and cooperation on a national and international level. As one of the recognitions for his active role in promoting Mathematics in Industry, he has been included among the Honorary Editors of the Journal for Mathematics in Industry (the official journal of ECMI).

## Honours and Awards

The various awards given to Willi Jäger express once more his outstanding position within the international scientific community, and his merits in promoting science and technology.

- Bolzano Medal, Prague 1981
- Medal of the University of Heidelberg, 1992
- State Prize for Research, Baden-Württemberg 1994
- Member of the Heidelberg Academy of Sciences and Humanities, 1994
- Honorary Doctor and Honorary Senator of the Babes-Bolyai University of Cluj-Napoca, Cluj-Napoca 1995/96
- Commemorative Medal of the Faculty for Physics and Mathematics, Charles University of Prague, Prague 1995 and 2003
- Honorary Doctor of the State University St. Petersburg, St. Petersburg 1999
- Alwin Walther Medal, University of Darmstadt, Darmstadt 2000
- Honorary Doctor of the Moscow Aviation Institute, Moscow 2004
- Medal of the University of Warsaw, Warsaw 2005
- Medal of the Charles University, Prague 2006
- Bundesverdienstkreuz Erster Klasse (Cross of Merit, First Class), Stuttgart 2007
- Blaise Pascal Medal for Mathematics 2008, European Academy of Sciences 2008
- Honorary Doctor of Vietnam Academy of Science and Technology, Hanoi 2009
- Honorary member of ECMI (the European Consortium for Mathematics in Industry), 2010
- Honorary Doctor of the People Friendship University of Russia, 2014
- Visiting Professor Charles University Prague, 2015

At this point, we would like to express our sincere thanks to all of the authors for their interesting and inspiring contributions, as well as to the many reviewers for their invaluable and indispensable support.

On the occasion of his 75th birthday, we express our deepest respect to Professor Willi Jäger and wish him good health and many productive years to come.