Continuous Media with Microstructure
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This book is dedicated to
Prof. Dr. Krzysztof Wilmański
on the occasion of his 70th birthday.
Preface

This book is a collection of papers dedicated to Professor Dr. Krzysztof Wilmański on the occasion of his 70th birthday. The book contains 25 contributions of his friends and colleagues. He met the invited authors at different stages of his scientific career of almost 50 years so that the contributions cover a wide range of fields stemming from continuum mechanics. This happened at numerous universities and research institutes where he both taught and did his excellent research work, e.g.

- the University of Łódź, Poland, where he studied Civil Engineering and did his diploma work on Elastic-plastic thermal stresses in a thin ring and where he graduated with his PhD-work in the field of Continuous Models of Discrete Systems,
- the Institute of Fundamental Technological Research of the Polish Academy of Sciences in Warsaw, where he got his habilitation in the field Nonlocal Continuum Mechanics and where he was the head of the Research Group Continuum Thermodynamics. He collaborated with W. Fiszdon, L. Turski, Cz. Wozniak, H. Zorski and others on the topics axiomatic and kinetic foundations of continuum thermodynamics, theory of mixtures, phase transformations in solids,
- the Johns Hopkins University in Baltimore, US, where he worked together, e.g. with C. Truesdell, J. Ericksen and W. Williams, on axiomatic and kinetic foundations of continuum thermodynamics,
- the College of Engineering, University of Baghdad, Iraq, where he was a Visiting Professor and taught many courses,
- the University of Paderborn and the Technical University Berlin, Germany, where he had an Alexander von Humboldt Stipend and contracts as a Visiting Professor (works on a model of crystallizing polymers, on a nonlocal thermodynamic model of plasmas and electrolytes and on martensitic phase transformations),
- the Wissenschaftskolleg zu Berlin (Institute for Advanced Studies), Germany, where he worked together with e.g. I. Müller (TU Berlin, Germany),
R. Rivlin (Lehigh, USA) and J. Kestin (Brown, USA), on martensitic phase transformations (SMA), non-newtonian fluids and acoustic waves in continua,
- the Technical University of Hamburg-Harburg, Germany, where he did research on crystal plasticity and the evolution of textures,
- the University of Essen, Germany, where he worked on thermodynamic models of porous materials,
- the Weierstrass Institute for Applied Analysis and Stochastics, Berlin, Germany, where he was the head of the Research Group Continuum Mechanics, and where he continued his work on thermodynamic models of porous materials and
- the University of Zielona Góra (Poland) where he taught many courses in mechanics, physics of structures, thermodynamics and so on.

In all of these institutions and in many others all over the world, Professor Wilmański taught numerous courses. He is a brilliant teacher which he not only showed during the interesting courses but also in competent and patient answers to many questions of his students. From my own experience I can state that even attending more than once the same course was not boring as it has never been the same course. In every presentation there were new elements and ideas as well as improved approaches to the subject with a reference to newest developments. The same concerns his attendance of numerous scientific conferences and seminars where he was always a lively participant making comments on various subjects in which he used his extensive knowledge. For some years he was the secretary treasurer of the International Society for the Interaction of Mathematics and Mechanics (ISIMM).

The contributions to the book concern various aspects of extension of classical continuum models. These extensions are related to the appearance of microstructures both natural as well as these created by processes. To the first class belong various thermodynamic models of multicomponent systems such as porous materials, composites, materials with microscopic heterogeneities (e.g. functionally graded materials). To the second class belong primarily microstructures created by phase transformations. Invited authors cover both fields of thermodynamic modeling and mathematical analysis of such continua with microstructure. In particular the following subjects are covered:

- thermodynamic modeling of saturated and unsaturated porous and granular media,
- linear and nonlinear waves in such materials,
- extensions of constitutive laws by internal variables, higher gradients and nonequilibrium fields,
- stochastic processes in porous and fractal materials,
- thermodynamic modeling of composite materials,
- mathematical analysis of multicomponent systems,
- phase transformations in solids.
I would like to thank all contributors for their willingness to write together this book. Thanks also to the editor in engineering of Springer Heidelberg, Dr. Christoph Baumann, who accepted with alacrity to publish this book. All of us wish Professor Wilmański the very best for his 70th birthday and many healthy, happy years to come! It has been a pleasure for all of us to work and to enjoy the leisure time with you.

Berlin, November 2009

Bettina Albers
Prof. Dr. Krzysztof Wilmański
Invited Contributors to the Present Book
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Part I

SCIENTIFIC LIFE OF
PROF. DR. KRZYSZTOF WILMAŃSKI
Curriculum Vitae of Prof. Dr. K. Wilmański

1940 March 1; born in Lodz, Poland.
1957 Matura at T. Kosciuszko Gymnasium, Lodz, Poland.
1959 married to Anna Sosin; two sons: Pawel (1959), Jan (1962).
1962 MSc at Civil Engineering Department, Technical University of Lodz, Poland; diplom work on Elastic-plastic thermal stresses in a thin ring.
1962-66 reader at the Technical University of Lodz (Poland).
1969-70 Postgraduate at the Johns Hopkins University, Baltimore (USA). Works on axiomatic and kinetic foundations of continuum thermodynamics with Prof. J. Ericksen and Prof. C. Truesdell (both Johns Hopkins University).
1971 M. T. Huber Prize of the Polish Academy of Science for the work on axiomatic foundations of thermodynamics.
1972-74 Visiting Professor at the College of Engineering, University of Baghdad, Iraq.
1979 Nomination to the Professor (title) by the State Counsil of Poland.
1979-80 Alexander von Humboldt Stipend at the University of Paderborn and the Technical University Berlin.
1984 Fellow at “Wissenschaftskolleg zu Berlin”, Institute for Advanced Studies. Works on martensitic phase transformations (SMA), non-newtonian fluids, acoustic waves in continua with Prof. Ingo Müller (TU Berlin, Germany), Prof. Ronald Rivlin (Lehigh, USA), Prof. Joseph Kestin (Brown, USA).
1985-86 Contract Professor at the Technical University of Berlin, Hermann-Föttinger-Institut. Work on a model of crystallizing polymers with Prof. Ingo Müller (TU Berlin).

1986-87 Visiting Professor at the University of Paderborn, Germany. Work on a nonlocal thermodynamic model of plasmas and electrolytes with Prof. J. Schröter.

1987-90 Contract Professor at the Technical University of Hamburg-Harburg, Germany. Work on crystal plasticity and the evolution of textures with Prof. O. Mahrenholtz.

1990-92 Contract Professor at the Technical University of Berlin, Germany. Work on the martensitic phase transformations with Prof. Ingo Müller.

1992-96 Lecturer at the University of Essen, Department of Civil Engineering. Work on thermodynamic models of porous materials.

1995 Habilitation (Venia legendi) at the University of Essen, Germany.


1998 Habilitation (Venia legendi) at the Technical University of Berlin, Germany.

1999 Conferment of the German citizenship.

2005 Professor of Mechanics at the Institute of Structural Engineering, University of Zielona Gora (Poland).

**Teaching activities**

1962-65 Undergraduate courses (lectures and tutorials) in Strength of Materials, Mechanics of Structures, Theory of Elasticity at the Technical University of Lodz (Poland) and its division in Plock (Poland).

1967-1984 Undergraduate courses (lectures, tutorials and some laboratory demonstrations) at the Technical University of Kielce (Poland) and College of Engineering, University of Baghdad (Iraq, 1972-1974). Subjects: Strength of Materials, Engineering Analysis.

1967-1992 Graduate courses at Polish Academy of Sciences (IPPT, Warsaw, Poland), Warsaw University (Poland), Technical University of Pozen (Poland), Technical University of Opeln (Poland), Technical University of Kielce (Poland), University of Paderborn (Germany), Technical University of Hamburg-Harburg (Germany). Subjects: linear and nonlinear mechanics of continua, phenomenological thermodynamics, theory of propagation of linear and nonlinear waves in continua, theory of mixtures and of multicomponent systems, magnetohydrodynamics and macroscopic theory of electrolytes, extended thermodynamics, kinetic theory of gases.
1992-2005 Undergraduate courses at the University of Essen and the Technical University of Berlin. Subjects: as above.


**Supervision of Ph.D. Theses**

B. Uziemblo (Polish Academy of Sciences, Warsaw, Poland), M. Elzanowski (Polish Academy of Sciences, Warsaw, Poland), J. Frankowski (Technical University of Kielce, Poland), B. Albers (Technical University of Berlin, Germany).

Supervision of some 30 MSc Theses (Diplomworks) at various universities.

**Some chosen lectures and courses**

- 3 courses (two of them self-organized; 6 monographic lectures in each course with notes published by Springer Vienna) at CISM (International Centre for Mechanical Sciences) in Udine (Italy) in the years 1978, 1998, 2004.
- Graduate course of phenomenological thermodynamics (30 hours) at the Weierstrass Institute for Applied Analysis and Stochastics (Berlin, Germany), 1996-1997.
- General lecture at the 33rd Conference of Solid Mechanics in Zakopane (Poland), 2000 on: *Extended thermodynamics of porous and granular materials.*
- Graduate courses (6 hours) for architects within the European Program ”Structural Health Monitoring System,” Universita di Pisa (Italy), 2000 on: *Waves and nondestructive testing of porous materials.*
- Graduate course of thermodynamics at the XXVth Summerschool on Mathematical Physics, Ravello (Italy), 2000.
- Ph.D. Course (app. 15 hours) at the joint school of the Technical Universities of Turin, Milan and Rome, Turin (Italy), 2001 on: *Thermodynamics of multicomponent systems.*
- General lecture at the conference GEOMATH3 in Horton (Greece), 2002 on: *Microworld and macroworld – multiscaling problems of geophysics.*
- General lecture at the conference STAMM 2002, Maiori (Italy), 2002 on: *Acoustic waves and nondestructive testing of granular materials.*
- Lecture at ROSE School (European School for Advanced Studies in Reduction of Seismic Risk), Universita di Pavia (Italy), 2003 on: *Bulk and surface waves in saturated poroelastic materials – low frequency approximation.*
- General lecture (key-note lecture) and the conference CANCAM 2003 in Calgary (Canada), 2003 on: *Macroscopic modeling of porous and granular materials – microstructure, thermodynamics and some boundary-initial value problems.*
• Graduate Course (45 hours) at the Technion, Haifa (Israel), 2006 on: *Continuum Thermodynamics*.

• Graduate Course (15 hours) at the Technical University of Graz, 2007 on: *Continuum Thermodynamics*.

**Some activities in corporations and organization of science**

During the last 30 years organization and participation in the organization of numerous international scientific conferences. Some more important examples:


• Euromech Colloquium: *Mean field theory of shape memory alloys*, Jablonna (Poland), 1981.

• Euromech Colloquium: *Porous media – theories and experiments*, Essen (Germany), 1997.


• Chair of the Prenominated Session at 21st ICTAM – IUTAM Congress in Warsaw (Poland), 2004: *Impact and wave propagation* (with Prof. Andrew Norris, Rutgers University, USA).

• Organization of the CISM course in Udine (Italy): *Surface waves in geomechanics: direct and inverse modeling for soils and rocks* (with Prof. Carlo Lai, Universita di Pavia, Italy).

• Conference: *Continuous and Discrete Modelling in Mechanics* (CDMM2005), Warszawa (Poland), September 5-9, 2005.

Publications of Prof. Dr. K. Wilmański


