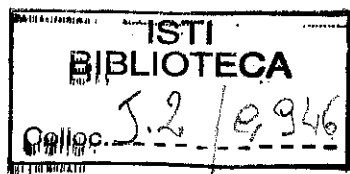
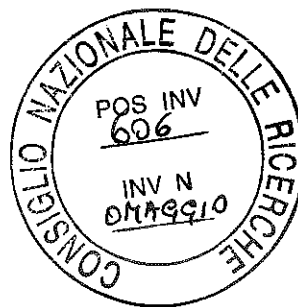


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(Eds)

# **Rational Continua, Classical and New**

A collection of papers  
dedicated to Gianfranco Capriz  
on the occasion  
of his 75th birthday



**Springer**

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Springer-Verlag Berlin Heidelberg New York  
a member of BertelmannSpringer Science+Business Media GmbH

© Springer-Verlag Italia, Milano 2003  
<http://www.springer.de>

ISBN 88-470-0157-9

Library of Congress Cataloging-in-Publication Data  
Rational continua, classical and new / P. Podio Guidugli, M. Brocato (eds.).  
p. cm.

Includes bibliographical references and index.

ISBN 8847001579 (alk. paper)

1. Thermodynamics. 2. Continuum mechanics. I. Podio-Guidugli, Paolo. II. Brocato, M., 1962-

QC311.2 .R38 2002  
536'.7--dc21

2002023679

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Cover design: Simona Colombo, Milan  
Typesetting: Bürosoft/Text- und DTP-Service, Berlin  
Printing and binding: Signum Srl, Bollate, Milan

Printed in Italy

SPIN: 10837718

## Foreword

Gianfranco Capriz was born in Gemona del Friuli on October 16, 1925. After graduating *summa cum laude* in mathematics at the Scuola Normale Superiore in Pisa (1948) and successfully attending a one-year doctoral course there (1949), he was appointed by Mauro Picone as a researcher at the Istituto Nazionale per le Applicazioni del Calcolo in Rome (1951–56). At the Institute, while working at his first research papers, he also served as a programmer in the staff operating the first general purpose computer ever installed in Italy.

In Rome he met Barbara, who was shortly to become his wife, and became acquainted with Ennio De Giorgi, Gaetano Fichera, Tristano Manacorda, Carlo Pucci, Michele Sce, and Edoardo Vesentini, with all of whom he was to maintain friendly and scientific relationships thereafter. In the same period he started his research activity in rational mechanics under the supervision of Antonio Signorini.

From Rome he moved to Stafford (UK) to work for the English Electric Company (1956–62) as a research mathematician and a programmer of DEUCE, the engineered version of the pilot machine ACE, originally designed by Alan Turing. This period of his life ended when Capriz was asked by Sandro Faedo to return to his country to contribute to the creation in Pisa of the largest concentration ever in Italy of research and development activities in computer science and information technology. As early as 1954, at the suggestion of Enrico Fermi, the construction of the first Italian scientific computer had been decided, and the task assigned to the Centro Studi Calcolatrice Elettronica (CSCE), based in Pisa. In 1961, the product of this effort, the Calcolatrice Elettronica Pisana (CEP), was inaugurated; one year later, CSCE became part of the Italian National Research Council. For two decades, from 1963 to 1983, Capriz was to serve as the Director of CSCE (later to be transformed into the Istituto di Elaborazione della Informazione) and then of CNUCE (Centro Nazionale Universitario di Calcolo Elettronico).

In those busy years, Capriz, who had been given the chair of rational mechanics at the University of Pisa in 1966, had also a central role in the creation of a school in continuum physics, which was one of the outcomes of another inspired initiative of Faedo, namely, the revival at the highest levels of mathematical activities in Pisa, with the appointments of A. Andreotti, J. Barsotti, E. Bombieri, S. Campanato, G. Prodi, G. Stampacchia, and Vesentini at the University, and of De Giorgi at the Scuola Normale.

Capriz never ceased to do research, not even while he was the President of TECSIEL (1983–92), a company of the IRI group, where computer networks were studied and, in particular, the OSI standards first effected and installed (OSIRIDE network, 1984). In addition, he repeatedly served as visiting professor abroad (at the Johns Hopkins University, the University of Minnesota and the Carnegie Mellon University in the US; at the University of Manitoba, in Canada; and as Erskine Professor at the University of Canterbury, in New Zealand). He was Vice-President of UMI, the Unione Matematica Italiana (1976–82), President of ISIMM, the International

Society for the Interactions of Mechanics and Mathematics (1997–99), and President of AIMETA, the Associazione Italiana di Meccanica Teorica ed Applicata (1999–2001). He is presently a corresponding member of the Accademia dei Lincei and a *professor emeritus* at the University of Pisa.

When he first met Clifford A. Truesdell in the middle sixties, Capriz had already worked on such diverse subjects as computational mechanics, lubrication, creep, vibrations and stability of rotating shafts, stability and numerical computations in hydrodynamics, viscoelasticity, and the manufacture of ceramics. After meeting Truesdell, his scientific interests were more and more directed toward the analysis of fundamental and innovative problems in continuum mechanics, especially, materials with memory, problems with live loads, non-linear vibrations of strings, mixtures, and a host of problems involving the continuum descriptions of microstructures: continua with voids; liquids with bubbles; granular materials; continua with vectorial, affine, or spherical structure; bodies with continuous distribution of dislocations; Cosserat continua; and liquid crystals. The book on *Continua with Microstructure* edited by C. Truesdell for Springer in the series Tracts in Natural Philosophy, summarizes about fifteen years of his scientific achievements in the field of the title, and contains innumerable suggestions for further research.

Both Capriz' broad scientific production and the variety of themes he dealt with during his career bear witness to the agility and sharpness of his mind, ready to capture weaknesses and pitfalls, as well as his ability to spot promising possibilities, sometimes deeply hidden in continuous models, no matter whether classical or just proposed, and to convert them into new challenging research tasks: whence the title of this tribute volume.

A mathematician and an engineer, a philosopher and a manager, a leader and a friend: all this Gianfranco Capriz is to those who have the good fortune, honor and pleasure to work with him.

## Preface

A selected number of prominent researchers, all in close personal and scientific contact with Gianfranco Capriz, have been invited to contribute to this volume, on a subject of their choice. They are, in alphabetical order: *P. Biscari, G. Cimatti, S.C. Cowin, C. Davini, R.L. Fosdick, P. Giovine, J.T. Jenkins, R.J. Knops, I. Müller, D.R. Owen, M. Šilhavý, G. Vergara Caffarelli, E.G. Virga, K. Wilmanski, and H. Zorski*. It is because of the outstanding quality of their effort, and that of their coauthors, that this book not only meets to the full its purpose as homage but also offers—so we believe—a rather unique and variegated collection of papers in modern continuum mechanics.

Many contributions are in research areas in which Gianfranco Capriz has been active, but not all. Among the latter papers, those by Biscari and Zorski, the first and last in the list, exemplify well how useful concepts from continuum mechanics can be in modeling and analyzing bioaggregates. The papers by Cimatti and Davini are also rather remote by theme from Gianfranco's own research; yet, they will certainly appeal to his taste for mathematical analysis, when applied to concrete problems of continuum physics and structural mechanics. Gianfranco has displayed such taste all along in his scientific life, first of all in dealing with questions from the theory of elasticity, linear or non-linear. It is not by mere coincidence that papers in elasticity comprise a relatively large subgroup in this book, a group including the works by Cowin, Fosdick (coauthored with Dunn and Zhang), Knops, Šilhavý, and Vergara Caffarelli (with Carillo and Podio-Guidugli). In particular, the paper by Cowin is devoted to find which response symmetries of a linearly elastic material are compatible with the presence of a geometrically organized distributed microstructure; for this reason, this paper may serve as a bridge from elasticity to one of Gianfranco's favorite subjects, continua with microstructure. Three papers in the book deal with this subject, those by Giovine, Jenkins and LaRagione, and Virga; a fourth paper, by Owen, discusses the nonstandard type of microstructure due to nonsmooth submacroscopic *disarrangements*. Finally, the paper by Wilmanski, which is about porous media, another class of microstructured continua, focuses on an issue especially dear to Gianfranco's heart as a rational mechanist, namely, the role of inertial interactions in the governing equations of a thermomechanical theory; although the occasion is a study of heat conduction within the framework of extended thermodynamics, the theme of Müller's contribution with Barbera is the same.

Rome–Paris, September 2002

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