Preface

Why such a book?

The important thing is not to stop questioning.
A. Einstein

There are many ways of telling the story of any field of science, or even more broadly, of any field of human activity. This book is an attempt to tell the story of wave motion, mostly in deformable solids but not exclusively. Wave motion is not restricted to solids, but waves also occur in other media. So, research into wave motion is an interdisciplinary field of science, and the experience from solids can be transferred to fluids and vice versa, although sometimes it may not be straightforward.

In this book, a step-by-step approach is used. If we take the notion of genealogy as it was coined (Greek: *genea* + *logos*, i.e. generation + knowledge), we could call every analysis that uses a step-by-step approach for developing ideas a "genealogy of thought". So genealogy can be used as a metaphor, not as a sequence of parallels and explanations as it is done in history. Certain ideas are lined up in a logical sequence, although initially they may have been introduced at a different time and for a different purpose. Questions were asked and answers were found not with the intention to build up something larger, it just happened so. And then summing up all answers, the whole seems to be built in a logical, well-constructed manner.

The questions which form the backbone of this book are in the style "what" and "why". I have undertaken my journey into wave dynamics by incorporating my studies into a general framework of mechanics and physics. One cannot stop questioning—this is probably the most essential driving force in research. An answered question usually generates more questions, which once answered will prepare the ground for next questions, etc. "The art of asking the right questions is more important than the art of solving them", said Georg Cantor. I agree with that. However, some questions remain unanswered not because we do not care about the art of looking for them but because we are not able to find an answer even if the question was asked correctly. Sometimes it takes time to find an answer, for example

to find the Higgs boson or to prove Fermat's last theorem. My teacher N. Alumäe used to say: "if you cannot answer a question in your research, then you are a happy person because you have something to think about". Following this thought, it seems like researchers are a happy lot because there are always unanswered questions around.

Much has been written about waves. It is difficult to pick up the most important treatises; they are referred to in the respective chapters. I myself have also added a couple of books into this huge depository of knowledge. The following book is a description of basic ideas on wave motion in the form of questions and answers. Such a route is retrospective, aiming to take the reader into the building of waves in a systemized walk in order to show him/her the whole as it stands now. Tomorrow we might find more answers and change something. On the one hand, there is a solid basis in the form of fundamental laws in mechanics established long time ago. On the other hand, however, the depth of these laws keeps opening up many new gates and avenues for further research—that is why one can safely expect many future questions and answers. This book assumes that a reader is familiar with the basic principles of mechanics. It provides an easy approach for understanding wave motion in solids, and up to rather complicated cases which are open to further generalizations.

No man is an iland intire of it'selfe.
J. Donne

On my way, I have met many colleagues asking questions and answering them. Some of them have crossed Hades but their ideas stayed with us and we stand on their shoulders. I value very much the following people who have influenced me in the past: G. Batchelor, P. Germain, D. Crighton, A. Jeffrey, N. Zvolinski, R. Chivers and others. I am pleased to continue discussions with G.A. Maugin, F. Pastrone, M. Braun, A. Szekeres, J. Plešek, H.-H. Dai and many others in this invisible college of companions around the world. I was privileged to work with many great colleagues in the IUTAM and the Euromech Society, and this practice has enriched me enormously. And certainly my home Institute and my close fellows are extremely important—I am very much indebted to them because without them I would have been much slower in answering some of the questions. This book could not have been written without the support of the Institute of Cybernetics at Tallinn University of Technology and CENS—the Centre for Nonlinear Studies (http://cens.ioc.ee). CENS has been a catalyst with its many facets—waves in solids, waves in fluids, optics, biophysics, soft matter physics, many national and international programs, and last but not least the influx of young people who have been eager to study interesting phenomena. The collegial cooperation in CENS is remarkable, and I owe much to everybody in it.

Concerning this text, thanks goes to Tanja Kosmatchova who created a readable text with formulae from my sometimes unreadable notes. Arkadi Berezovski answered questions on internal variables and critically read the manuscript. Andrus

Salupere, Kert Tamm, Tanel Peets, Galina Varlamova and Tanja Kosmatchova helped with figures—many thanks to all of them.

In this complicated world, one should always indicate the funding organisations—this research was supported by the EU through the European Regional Development Fund and by the Estonian Ministry of Education and Research through various funding schemes.

I appreciate very much the invaluable assistance of Martin Peters and Ruth Allewelt from Springer-Verlag for producing the book, and I acknowledge the excellent help from Tobias Schwaibold on style and English grammar of the manuscript.

My most sincere thanks go to my wife Kaja, my perpetual supporter, for her understanding and love. It is not easy to understand somebody who always asks questions and there are no immediate answers. She does.

Tallinn, Estonia Jüri Engelbrecht
May 2014

http://www.springer.com/978-3-319-14790-1

Questions About Elastic Waves

Engelbrecht, J.

2015, XIV, 196 p. 74 illus., 10 illus. in color., Hardcover
ISBN: 978-3-319-14790-1