Piezoelectricity – a direct conversion of mechanical stress to the electrical charge and vice versa – has been discovered about 130 years ago. Since that time it attracted a lot of interest from the application point of view as well as from the fundamental research as you can see in the comprehensive, although not exhaustive, list of books published during the last three decades. Piezoelectric substances are commercially produced in single-crystal form as well as in ceramics and they belong to the second biggest application of dielectric materials, just after semiconductors. Piezoelectric phenomena and their precise description require interdisciplinary theoretical knowledge of crystallography, tensor analysis, continuum mechanics, thermodynamics, non-linear phenomena as well as experimental experience with the electrical and mechanical measurements and necessary equipment. Piezoelectricity and piezoelectric materials study is a lifelong job for a researcher, like it is for authors of this book. It requires cooperation between physicists and engineers – specialists in the field. Despite of more than a hundred years of ongoing research as well as piezoelectricity application, new horizons open ahead of piezoelectricity researchers, today.

This book should be used as a theoretical foundation for the knowledge on piezoelectric sensors, excellently described by Gustav Gautschi in the book G. Gautschi: *Piezoelectric sensorics*, published by Springer Verlag in 2002. Publication of this book has been inspired by Prof. Jan Tichý about 10 years ago, who is one of the authors of the original edition of the book J. Tichý, G. Gautschi: *Piezoelektrische Messtechnik*, Springer Verlag, published together with G. Gautschi in German in 1980. The new edition of the book is extended in some chapters, translated to English and divided into two separate volumes – the first one with the physical foundations of piezoelectric sensorics, the second one mostly application-oriented piezoelectric sensorics instrumentation. The new international authors team includes Prof. Jan Tichý and his colleagues from the Technical University of Liberec, Czech Republic – namely, Prof. Jana Přívratská and Dr. Jiří Erhart – and Prof. Erwin Kittinger from the Leopold-Franzens Universität Innsbruck, Austria. Authors completed the manuscript according to his/her own specialization and interests in the field – i.e. J. Tichý prepared Chap. 1 and participated on most remaining chapters directly or through the original German text partly translated for the new edition, E. Kittinger prepared Chaps. 3, 4 and 6, J. Přívratská made Chap. 2 ready for publication and J. Erhart completed Chaps. 5, 7, Appendix and prepared the final edition of the whole manuscript.
Book content is organized in seven chapters and one Appendix. Chapter 1 is devoted to the fundamental principles of piezoelectricity and its application including related history of phenomenon discovery. A brief description of crystallography and tensor analysis needed for the piezoelectricity forms the content of Chap. 2. Covariant and contravariant formulation of tensor analysis is omitted in the new edition with respect to the old one. Chapter 3 is focused on the definition and basic properties of linear elastic properties of solids. Necessary thermodynamic description of piezoelectricity, definition of coupled field material coefficients and linear constitutive equations are discussed in Chap. 4. Piezoelectricity and its properties, tensor coefficients and their different possibilities, ferroelectricity, ferroics and physical models of it are given in Chap. 5. Chapter 6 is substantially enlarged in this new edition and it is focused especially on non-linear phenomena in electroelasticity. Chapter 7 has been also enlarged due to many new materials and their properties which appeared since the last book edition in 1980. This chapter includes lot of helpful tables with the material data for the most today’s applied materials. Finally, Appendix contains material tensor tables for the electromechanical coefficients listed in matrix form for reader’s easy use and convenience.

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