

Preface

The book at hand covers parts of the emerging research area *Structural Health Monitoring* (SHM). It is based on the results which our research groups achieved in the course of a joint project in the field of SHM of layered fiber-reinforced composites on the basis of guided waves after their excitation by piezoelectric actuators.

Thus, the book compiles the developed approaches from the basics to engineering applications and covers important experimental as well as numerical aspects of this highly interdisciplinary research area. It is subdivided into six parts. After a short introduction, Part II covers analytical, numerical, and experimental foundations. Part III is concerned with efficient numerical methods and gives a detailed insight into various approaches for computational analysis of wave propagation in thin-walled wave guides. Part IV deals with physical effects which generate continuous mode conversion in composite plates, a phenomenon which is not widely recognized and hardly discussed in the current literature. Part V accounts for signal processing as an indispensable tool in SHM approaches. Part IV addresses various general aspects of SHM and, finally, focuses on a SHM system in its entirety.

We think that this book is suitable as a reference for engineers and scientists in industry and academia, since it includes foundational knowledge and the application of this knowledge to engineering structures. SHM with its various aspects might also be integrated into graduate courses on mechanics of composite materials, materials science, signal processing, actuator and sensor technology, and mathematics and that the book provides the necessary components.

We thank the members of our research groups for their dedicated work and active commitment during the term of the project. These researchers are named as chapter authors and without their effort this book would not have appeared. Among them we wish to thank, in particular, Bianca Hennings and Sascha Duczek, who interacted with the different coauthors during the completion of this book and were responsible for its editing. They spent a lot of time in this effort and we would like to express our sincere thanks.

This book grew out of the joint project *Integrierte Bauteilüberwachung in Faserverbunden durch Analyse von Lambwellen nach deren gezielter Anregung*

durch piezokeramische Flächenaktoren (Structural health monitoring of fiber-reinforced composites by means of piezoelectrically excited Lamb waves) on which our research groups from Helmut-Schmidt-Universität/Universität der Bundeswehr Hamburg, Otto-von-Guericke-Universität Magdeburg, Technische Universität Braunschweig, Universität des Saarlandes Saarbrücken and Deutsches Zentrum für Luft- und Raumfahrt Braunschweig were working for 6 years. The extensive financial support of the Deutsche Forschungsgemeinschaft (DFG) is gratefully acknowledged.

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