

Preface

The use of electromagnetic ultrasonic waves has several distinct advantages, including operation without a coupling fluid, non-contact operation, higher temperature operation and flexibility to generate the shear horizontal waves. Since the 1970s, a number of researchers have carried out electromagnetic ultrasonic testing with increasing concern. The use of ultrasonic guided waves has received a great deal of attention for nondestructive testing for the advantages of guided wave techniques such as high testing speed and the detection sensitivity on both inner and outer surfaces. Many industrial problems in special conditions can be solved by a combination of the electromagnetic ultrasonic approach and the guided wave technique, such as the online detection of stress corrosion cracks in natural gas pipelines. However, the electromagnetic ultrasonic technique is involved with the coupling and conversion among electromagnetics and mechanics as well as the vibration and propagation of ultrasonic waves, which can make it more difficult to do quantitative research. The multi-modes nature and dispersive characteristics of ultrasonic guided waves, and the mode conversion of the interactions between guided waves and defects, make it the most complicated of uses of guided waves. Consequently, it can be very difficult to combine the electromagnetic ultrasonics with ultrasonic guided-waves for application. In recent years, tremendous progress has been made in the theory and application of electromagnetic ultrasonic guided waves.

This book illustrates the theory and the practical applications of the electromagnetic ultrasonic guided waves. The main parts of the book include: the energy transfer mechanism of electromagnetic ultrasonics as well as the design methods; the calculations and simulations of the electromagnetic ultrasonics based on Lorentz force and magnetostrictive mechanism; the propagation characteristics of ultrasonic guided waves; the mechanism of detection of defects by guided waves; the quantification and location of defects; and the applications of electromagnetic ultrasonic guided wave techniques.

The contents of this book are the summaries of the authors' latest eight years of investigations and practical application in the field of electromagnetic ultrasonic

guided waves. Most of them are involved in the dissertations of the graduate and Ph.D. students supervised by the authors, including Shen Wang, Kuansheng Hao, Yongsheng Zhang, Chaofeng Ye, Peng Li, Junjun Xin, Yun Tong et al. In the practical applications of related technology, significant support was provided by colleagues and engineers from related companies and institutes of Petrochina Co. and Sinopec. We express our sincere gratitude to them for helping to improve the technology in real practice.

Chapters 1 and 6 were written by Weibin Li, Chaps. 2 and 3 were written by Qing Wang, Chaps. 4 and 5 were written by Shen Wang, and Chap. 7 was written by Songling Huang.

Considering the rapid growth of online detection and the great advantages of the electromagnetic guided wave technique, we hope that this book will be used as a reference in electromagnetic guided wave nondestructive evaluation and testing by individuals at any level and by graduate students. It is also hoped that this book will expand and promote the use of electromagnetic guided waves at both the national and international levels.

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