

# *Contents*

---

CONTRIBUTORS	ix
PREFACE	xi
INTRODUCTION	xiii

## **1**

### **Radiated Fields of Ultrasonic Transducers**

**D. A. HUTCHINS AND G. HAYWARD**

1. INTRODUCTION	1
2. FIELDS OF CONTINUOUS-WAVE (CW) TRANSDUCERS	5
3. TRANSIENT FIELD CHARACTERISTICS	21
4. CONTROL OF TRANSDUCER SPATIAL FIELD CHARACTERISTICS	60
REFERENCES	79

## **2**

### **The Measurement of Ultrasonic Velocity**

**EMMANUEL P. PAPADAKIS**

1. INTRODUCTION	81
2. FUNDAMENTALS OF THE PULSE-ECHO-OVERLAP MEASUREMENT	83
3. VERSATILE CONFIGURATIONS	94
4. MODERN EQUIPMENT	100
5. DIFFRACTION CORRECTIONS	101
6. ABSOLUTE ACCURACY	103
7. SUMMARY	105
REFERENCES	105

**3****The Measurement of Ultrasonic Attenuation**

EMMANUEL P. PAPADAKIS

1. INTRODUCTION	108
2. FUNDAMENTALS OF MEASUREMENT	110
3. EXPERIMENTAL SITUATIONS TO BE AVOIDED	123
4. DIFFRACTION CORRECTIONS TO TRANSFORM RAW DATA INTO ABSOLUTE MEASUREMENTS	129
5. BUFFER ROD METHOD	134
6. BEYOND THE FUNDAMENTALS	148
7. SUMMARY	154
REFERENCES	154

**4****Physical Principles of Measurements with EMAT Transducers**

R. B. THOMPSON

1. INTRODUCTION	157
2. GENERAL FORMALISM FOR DISCUSSION OF MEASUREMENT PRINCIPLES	159
3. RADIATION INTO HALF-SPACES	164
4. COUPLING TO GUIDED MODES	184
5. OPERATION IN MAGNETIC MATERIALS	191
6. SUMMARY AND CONCLUSIONS	197
REFERENCES	199

**5****Optical Detection of Ultrasound**

JAMES W. WAGNER

1. INTRODUCTION	201
2. ENCODING AND DECODING ULTRASONIC INFORMATION ON AN OPTICAL BEAM	212
3. DETECTION SENSITIVITY	248
4. SUMMARY	263
ACKNOWLEDGEMENT	264
REFERENCES	264

**6**

Measuring the Electrical Characteristics of Piezoelectric  
Devices

WARREN L. SMITH

1. GENERAL REMARKS	267
2. STANDARD METHODS FOR DEVICE MEASUREMENT	272
3. RECOMMENDED SCATTERING PARAMETER METHODS	275
4. ESTIMATION OF EQUIVALENT CIRCUIT PARAMETERS	284
5. SUMMARY OF RESONATOR MEASUREMENT CONSIDERATIONS	289
REFERENCES	290

**7**

Photoelastic Visualization and Theoretical Analyses of  
Scatterings of Ultrasonic Pulses in Solids

C. F. YING

1. INTRODUCTION	291
2. THE DYNAMIC PHOTOELASTIC VISUALIZATION TECHNIQUE	292
3. REFLECTION OF BULK WAVES FROM THE PLANE BOUNDARY SURFACE OF A SEMI-INFINITE SOLID MEDIUM	300
4. SCATTERING OF BULK WAVES BY A TWO-DIMENSIONAL PLANE CRACK	308
5. SCATTERING OF BULK WAVES BY A CYLINDRICAL CAVITY	327
6. SCATTERING OF BULK WAVES AND RALEIGH WAVES BY FREE CORNERS	332
7. VISUALIZATION OF LAMB WAVES AND STUDY OF THEIR REFLECTION FROM A PLATE-FREE EDGE	337
8. CONCLUSION	342
ACKNOWLEDGEMENT	342
REFERENCES	342
 AUTHOR INDEX	 345
SUBJECT INDEX	349
CONTENTS OF PREVIOUS VOLUMES	355