

1. Record Nr.	UNINA9911026076403321
Autore	Lissenden Cliff J
Titolo	Nonlinear Ultrasonic Guided Waves
Pubbl/distr/stampa	Bristol [England] (Temple Circus, Temple Way, Bristol BS1 6HG, UK) : , : IOP Publishing, , [2024]
ISBN	9780750349116 0750349115 9780750349130 0750349131 9780750349109 0750349107
Edizione	[1st ed.]
Descrizione fisica	1 online resource (335 pages)
Collana	IOP Ebooks Series
Disciplina	530.12/4
Soggetti	Wave-motion, Theory of Nonlinear waves Optical wave guides Ultrasonic testing Electrical engineering TECHNOLOGY & ENGINEERING / Electrical
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Note generali	"Version: 20240601"--Title page verso.
Nota di bibliografia	Includes bibliographical references.
Nota di contenuto	Intro -- Acknowledgments -- Author biography -- Cliff J Lissenden -- Chapter Introduction -- 1.1 Motivation -- 1.2 Brief perspective on nonlinear ultrasonic guided waves -- 1.3 Approach -- 1.4 Content -- 1.5 Closure -- References -- Chapter Preliminaries -- 2.1 Notation -- 2.2 Continuum mechanics -- 2.2.1 Kinematics -- Example 2.2. Normal strains -- Example 2.3. Shear strain -- 2.2.2 Balance laws -- 2.2.3 Stress -- 2.2.4 Constitutive relations -- Example 2.4. Stress components decomposed into linear and nonlinear parts -- Example 2.5. Strain energy function for transversely isotropic material -- 2.3 Elastodynamics -- 2.3.1 Wave equation -- 2.3.2 Wave equation for isotropic materials -- 2.3.3 Attenuation -- 2.4 Closure -- References -- Chapter Nonlinear elastic waves -- 3.1 Bulk longitudinal waves --

Example 3.1. Longitudinal wave nonlinearity -- Example 3.2. Regular perturbation approach to the nonlinear longitudinal wave problem -- Example 3.3. Nonlinear longitudinal wave solution using the method of multiple scales -- Example 3.4. Determine in terms of Landau-Lifshitz TOECs for an isotropic material -- 3.2 Bulk shear waves -- Example 3.5. Shear wave third harmonic generation -- 3.3 Attenuation -- 3.4 Measurements of nonlinearity -- 3.4.1 Acoustoelasticity -- 3.4.2 Second harmonic generation -- 3.4.3 Wave mixing -- 3.4.4 Nonlinear resonant ultrasound spectroscopy (NRUS) -- 3.4.5 Vibro-acoustics -- 3.4.6 Dynamic acoustoelastic testing -- 3.5 Closure -- References -- Chapter Boundary value problem formulation -- 4.1 Linear BVPs -- 4.1.1 Free surfaces -- 4.1.2 Plates -- 4.1.3 Hollow cylinders -- 4.1.4 Arbitrary cross-sections -- 4.2 Nonlinear BVPs -- 4.2.1 Regular perturbation method -- 4.2.2 Wave interactions -- Example 4.1. Third order interactions -- 4.3 Closure -- References -- Chapter Ultrasonic guided waves-linear features. 5.1 Physical characteristics of waves -- 5.1.1 Phase velocity -- 5.1.2 Wavestructure -- 5.1.3 Group velocity -- Example 5.1. Group velocity calculation -- 5.1.4 Attenuation -- 5.2 Rayleigh waves -- 5.3 Waves in plates -- 5.3.1 Shear-horizontal (SH) waves -- 5.3.2 Lamb waves -- 5.3.3 Anisotropic plates -- 5.3.4 Finite-width plates -- 5.4 Hollow cylinder waves -- 5.5 Other types of guided waves -- 5.6 Closure -- References -- Chapter Nonlinear analysis of plates -- 6.1 Reciprocity -- 6.2 Orthogonality -- Example 6.1. Auld's real reciprocity relation -- Example 6.2. Orthogonality of SH waves -- Example 6.3. Orthogonality of Lamb waves -- 6.3 Completeness -- 6.4 Normal mode expansion -- 6.5 Perturbation approach -- 6.6 Internal resonance -- Example 6.4. Second harmonic generation of Lamb waves -- 6.7 Wave mixing -- 6.8 Closure -- References -- Chapter Internal resonance in plates -- 7.1 Power flow for self-interaction -- 7.1.1 Second order -- 7.1.2 Third order -- 7.2 Power flow for mutual interaction -- 7.2.1 Second order co-directional -- Example 7.1. Parity analysis of mutual interaction between SRL and ASH wavefields -- 7.2.2 Third order co-directional -- 7.3 Effect of directionality -- 7.4 Synchronism -- 7.4.1 Second order self-interaction -- 7.4.2 Third order self-interaction -- 7.5 Group velocity matching -- 7.5.1 Co-directional wave mixing -- 7.5.2 Counter-propagating wave mixing -- 7.5.3 Non-collinear wave mixing -- 7.6 Comments on hollow cylinders -- 7.7 Closure -- References -- Chapter Selecting primary waves -- 8.1 Self-interaction in plates -- 8.1.1 Second harmonic generation -- 8.1.2 Third harmonic generation -- 8.1.3 Method of multiple scales -- 8.2 Mutual interaction in plates -- 8.2.1 Co-directional, $=0^\circ$ -- 8.2.2 Counter-propagating, $=180^\circ$ -- 8.2.3 Non-collinear, 0° and 180° -- 8.3 Hollow cylinders -- 8.4 Arbitrary cross-section. 8.5 Half-space -- 8.6 Closure -- References -- Chapter Finite amplitude pulse loading -- 9.1 Descriptors of nonlinearity -- 9.2 Experimental results from laser generation -- Example 9.1 Relationship between Rayleigh wave components -- 9.3 Modeling waveform evolution -- 9.4 Closure -- References -- Chapter Numerical simulations -- 10.1 Methods -- 10.2 Software tools -- 10.3 Sample problems -- 10.3.1 Reported in the literature -- 10.3.2 Lamb wave analyses using commercial software -- 10.4 Closure -- References -- Chapter Making measurements -- 11.1 Instrumentation -- 11.2 Generation -- 11.2.1 Transmitting transducers -- 11.2.2 Transmitting methods -- 11.3 Reception -- 11.3.1 Receiving transducers -- 11.3.2 Receiving methods -- 11.4 Signal processing -- 11.5 Closure -- References -- Chapter Highlights of experimental testing -- 12.1 Self-interaction -- 12.2 Mutual interaction -- 12.3 Quasi-Rayleigh waves --

12.4 Closure -- References -- Chapter Perspective -- 13.1 Separation of material nonlinearity from measurement system nonlinearity -- 13.2 Link with the structural design that identifies hot spots to be monitored and a plan for inclusion of nonlinear ultrasonic guided waves in the operations management and maintenance planning -- 13.3 Standards for test methods that are broad enough to be applicable to the emerging needs for offline inspection and in-service monitoring -- 13.4 Define specifications needed to build monitoring systems into self-aware smart structures -- 13.5 Solid connection between nonlinear wave propagation characteristics and the material microstructure that dictates its strength and fracture properties -- References.

Sommario/riassunto

The book sets the stage for nonlinear guided waves by introducing nonlinear wave propagation in 1D and expanding the mathematical treatment to guided waves. It considers self-interaction for harmonic generation and mutual interactions for wave mixing. It demonstrates the characteristics of nonlinear guided waves numerically and experimentally.
