Guided Wave Propagation In Single And Double Layer Hollow

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ABAQUS tutorial | Lamb Wave Propagation Analysis | Explicit | BWEngineering ABAQUS tutorial : Part 2. Lamb Wave Propagation Analysis

Guided waves propagation method6 An introduction to the dispersion of propagating waves

Ultrasonic Guided Waves Propagation Simulation in Abaqus

Introduction to Guided Wave Inspection Theory and TechnologyLamb Wave Propagation using Abaqus ǀLore Via Web Ultrasonic Guided Wave Propagation in isotropic flat

~~plate.~~ Guided wave propagation in thin plate Guided wave Guided wave propagation in honeycomb sandwich panel Ultrasonic guided waves propagation in pipe (with defect) What is Surface Wave Propagation? Long range ultrasonic testing using Teletest Focus ~~Dispersion of an A0 Lamb Wave~~ Ultrasonic testing simulation using COMSOL Calculating dispersion relation of Lamb waves using COMSOL EM Waves

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Non-destructive testing (NDT) at TWILec 12: Dispersion, Phase Velocity, Group Velocity | 8.03 Vibrations and Waves (Walter Lewin)

Waveguide intro

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how to generate wave in abaqus | Crack detection using Lamb waves in Abaqus CAE part 1~~PZFlex - NDT: Lamb wave~~

propagation in plates

Wave Propagation in Rectangular Waveguide - Guided Waves - Electromagnetic Theory #Bisection #algorithm to plot #dispersion #curves of #lamb #waves Guided waves Electromagnetic Waves Propagation Guided Wave Ultrasonic Inspection Propagation of lamb wave Mod-05 Lec-17 Wave Propagation Guided Wave Propagation In Single
Previous investigations of ultrasonic guided wave propagation in an elastic hollow cylinder and in an elastic hollow cylinder coated with a viscoelastic material have led to the development of inspection techniques for bare and coated pipes.

Guided wave propagation in single and double layer hollow ...

Guided wave propagation in single and double layer hollow cylinders embedded in infinite media The Journal of the Acoustical Society of America 129, 691 (2011 ... Most of the pipes are buried in soil, leading to the significance of the study on the subject of guided wave propagation in pipes with soil influence.

Guided wave propagation in single and double layer hollow ... Guided wave propagation in single and double layer hollow cylinders embedded in infinite media. Jia H(1), Jing M, Joseph LR. Author information: (1)Department of Engineering Science and Mechanics, The Pennsylvania State University, University Park, Pennsylvania 16802, USA.

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Guided Wave Propagation In Single And Double Layer Hollow

The rail is a highly directional structure and is extremely suitable for guided wave inspection. The guided wave-based method believes that rail damage can induce changes in propagation characteristics of the guided wave (reflected wave, transmitted wave, energy, etc.) [5–7]. The excitation sensors are arranged on one side of the rail with the receiving sensors on the same side or the other side.

Guided Wave Propagation for Monitoring the Rail Base
A very promising non-destructive approach is the guided wave propagation method. Long-range diagnostic capability of elastic waves makes them one of the most attractive tools for non-destructive evaluation (NDE) and structural health monitoring (SHM) systems.

Guided Wave Propagation in Detection of Partial ...
Guided wave propagation in metallic and resin plates loaded with water on single surface . By Takahiro Hayashi and

Daisuke Inoue. Cite . BibTex; Full citation; Publisher: AIP Publishing LLC. Year: 2016. DOI identifier: 10.1063/1.4940475. OAI identifier: Provided by: MUCC (Crossref) ...

Guided wave propagation in metallic and resin plates ...
Guided wave-based structural health monitoring (SHM) has been well studied in plate-like structures due to the ability of guided waves to propagate long distances with less energy loss and sensitivity to small defects in the structure. With guided wave SHM most of the methods used in conventional ultrasonics nondestructive evaluation including phased arrays can be implemented.

Guided Wave - an overview | ScienceDirect Topics
As the guided waves propagate through a heterogeneous zone the modal coefficients needed to describe the wavetrain vary with position, leading to interconversions between modes and reflection into backward travelling modes.

Guided wave propagation in laterally varying media - I ...
Guided wave testing is a non-destructive evaluation method. The method employs acoustic waves that propagate along an elongated structure while guided by its boundaries. This allows the waves to travel a long distance with little loss in energy. Nowadays, GWT is widely used to inspect and screen many engineering structures, particularly for the inspection of metallic pipelines around the world. In some

cases, hundreds of meters can be inspected from a single location. There are also some applica

Guided wave testing - Wikipedia

The most common UT inspection techniques involve the use of bulk waves in which the boundaries of the structure are just reflectors that do not fundamentally change the mode of propagation. Bulk waves only have two modes; longitudinal and shear, and are typically used to inspect areas near the transducer. Guided Wave (GW) testing on the other hand is a technique in which the ultrasonic waves propagate through the boundaries of a structure, and these boundaries actively affect the mode of ...

Guided Waves: Innerspec's UT Inspection Techniques
Characteristics of the guided wave propagation in the train axle are systematically investigated in this study, so as to explore guided wavebased structural health monitoring (SHM) method for this kind of structure. Piezoelectric patches are used as actuator to excite waves in the axle.

Guided wave propagation in highspeed train axle and ...
Meantime p, q are depending on refractive index and free-space wave number p 2 = n 1 2 k 0 2   2, q 2 = 2 n 2 2 k 0 2, is a propagation constant. For certain values of parameters k 0, a, n we can find propagation constant n m for a given n and m. Every n m corresponds to one possible propagation mode.

What is mode propagation in optical fiber?
Abstract Guided stress waves are considered one of the most efficient and reliable techniques that provide sufficient quantitative and qualitative assessment. In this study, we focused on scrutinizing the propagation behavior of guided waves in western white pine timber poles, experimentally, and numerically using COMSOL Multiphysics.

Understanding the guided waves propagation behavior in ...
Our previous papers reported dispersion curves for leaky Lamb waves in a water-loaded plate and wave structures for several typical modes including quasi-Scholte waves [1,2]. The calculations were carried out with a semi-analytical finite

element (SAFE) method developed for leaky Lamb waves. This study presents SAFE calculations for transient guided waves including time-domain waveforms and ...

Guided wave propagation in metallic and resin plates ...
The previous equations provide a general formalism for studying wave propagation in optical fibers. In practice, it is convenient to use a single field variable E. By taking the curl of the first equation and using the others, we obtain. where the velocity of light c is defined as c = (0 0) -1/2.

Wave Propagation in Step-Index Fibers Fosco Connect
Guided wave propagation in buried pipe is quite challenging since the soil layer is basically a semi-infinite space

compared with a pipe wall. A hybrid Semi-Analytical Finite Element method is applied to the buried pipe in this study.

The Pennsylvania State University GUIDED WAVE PROPAGATION ...

A waveguide is a structure that guides waves, such as electromagnetic waves or sound, with minimal loss of energy by restricting the transmission of energy to one direction. Without the physical constraint of a waveguide, wave amplitudes decrease according to the inverse square law as they expand into three dimensional space. There are different types of waveguides for different types of waves. The original and most common meaning is a hollow conductive metal pipe used to carry high frequency ra

Waveguide - Wikipedia

To ensure that the wave propagation can be simulated by the finite element method correctly, the mesh number within a wavelength is typically set to 20, i.e., Lmax = min /20, where Lmax is the maximum element length, and min is the shortest wavelength.

This book has grown out of a need for a beginning graduate level text which emphasizes the unifying concepts of the field of guided wave optics. Over the past twenty years, progress in this field has been so rapid, and therefore so helter-skelter, that it is hard, even for the fully involved practitioner no less the aspiring student, to see the unifying concepts. As will be discussed more fully below, there are at present quite a number of texts in the guided wave area. These texts vary in nature from the popular treatise to the voluminous scholarly work. I know of none, however, that treats the waveguide, semi conductor laser, fiber and fiber component, and integrated optic component all on equal footing using the forms of Maxwell's equations in polarizable media and coupled forms of Maxwell's equations as unifying tools. This book emphasizes basic concepts, yet is quantitative in nature and contains numerous applications. The book is designed to be used by the beginning graduate student or the professional who needs to review or catch up on the basics. Here at the University of Colorado, this text is generally used for a follow-up course to one in Physical Optics. The Physical Optics text employed, also written by the present author, primarily includes material which should be familiar to students with a strong background in optics or practitioners of guided waves.

Guided wave inspection of pipelines is an important and growing area of Non-Destructive Evaluation (NDE). This technique can be used for remote inspection or monitoring of buried pipelines, or pipelines with insulation. Guided waves are sensitive to flaws such as corrosion pits and cracks. They can be used to locate flaws existing on either the outer or the inner surface of a pipe. Guided wave energy focusing can be performed to concentrate guided wave energy at particular combinations of circumferential and axial locations in straight pipes. When it can be used, this practice enhances the circumferential resolution of defects. Elbows in a piping system are sufficiently disruptive to guided wave energy that the focusing methods used in practical inspections of straight pipe have not been extended to the region beyond an elbow. Counter-intuitively, elbows with a 45 degree bend are more harmful to guided waves than those with a 90 degree bend. A simple and elegant explanation for this phenomenon is provided in this dissertation. Theoretical advancements to guided wave physics propagating around an elbow have tended to be few and slow. This is at least partly due to the complexity of the mathematics involved in the conventional description of guided wave mechanics. Parametric focusing for pipes with bends has not been previously possible as it is for straight sections of pipes. While some techniques such as time-reversal mirrors and blind finite-element-method modeling have existed for focusing beyond elbows, these techniques have been limited and largely of academic value. Also, the understanding of wave behavior in a pipe elbow has in the past been generally unclear. Consequently, signal interpretation has also been very limited for guided waves initiating in, or returning from, the far side of an elbow. A new approach to understanding guided wave propagation is developed in this work. This understanding consists of the idea that the pathway a guided wave will take across a waveguide can be predicted from the geometric features of the waveguide and a set of initial conditions pertaining to the wave. One such feature is the geometric cross-section in which the wave is propagating. This cross-section refers to a plane that contains both the propagation direction of the wave and the coinciding surface normal of one of the boundaries guiding the wave. Thinking of guided waves from this perspective enables a clear answer to some important questions about wave propagation beyond an elbow that have not been effectively answered before. For example, before this work, it was not understood if and when full guided wave coverage exists in a pipe beyond an elbow. This new thinking also enables the calculation of the elbow transfer function--the mapping of guided wave energy impinging on an elbow to the configuration it will have on the other side of the elbow. Each of these examples separately represents significant practical advancements in the guided wave community. The new approach also introduces a forward focusing model for controlling and focusing guided wave energy in pipe sections in and beyond an elbow. It is believed that this is the first such forward-oriented apparatus for controlling guided wave energy beyond an elbow. It is expected that this will be of great practical consequence. In addition to these specific benefits, it is anticipated that this dissertation will serve as a foundation for a good deal of future work and contributions to guided wave understanding and non-destructive testing equipment.

Understanding and analysing the complex phenomena related to elastic wave propagation has been the subject of intense research for many years and has enabled application in numerous fields of technology, including structural health monitoring (SHM). In the course of the rapid advancement of diagnostic methods utilising elastic wave propagation, it has become clear that existing methods of elastic wave modeling and analysis are not always very useful; developing numerical methods aimed at modeling and analysing these phenomena has become a necessity. Furthermore, any methods developed need to be verified experimentally, which has become achievable with the advancement of measurement methods utilising laser vibrometry. Guided Waves in

Structures for SHM reports on the simulation, analysis and experimental investigation related propagation of elastic waves in isotropic or laminated structures. The full spectrum of theoretical and practical issues associated with propagation of elastic waves is presented and discussed in this one study. Key features: Covers both numerical and experimental aspects of modeling, analysis and measurement of elastic wave propagation in structural elements formed from isotropic or composite materials Comprehensively discusses the application of the Spectral Finite Element Method for modelling and analysing elastic wave propagation in diverse structural elements Presents results of experimental measurements employing advanced laser technologies, validating the quality and correctness of the developed numerical models Accompanying website (www.wiley.com/go/ostachowicz) contains demonstration versions of commercial software developed by the authors for modelling and analyzing elastic wave propagation using the Spectral Finite Element Method Guided Waves in Structures for SHM provides a state of the art resource for researchers and graduate students in structural health monitoring, signal processing and structural dynamics. This book should also provide a useful reference for practising engineers within structural health monitoring and non-destructive testing.

The propagation of ultrasonic guided waves in solids is an important area of scientific inquiry, primarily due to their practical applications for nondestructive characterization of materials, such as nondestructive inspection, quality assurance testing, structural health monitoring, and providing a material state awareness. This Special Issue of Applied Sciences covers all aspects of ultrasonic guided waves (e.g., phased array transducers, meta-materials to control wave propagation characteristics, scattering, attenuation, and signal processing techniques) from the perspective of modeling, simulation, laboratory experiments, or field testing. In order to fully utilize ultrasonic guided waves for these applications, it is necessary to have a firm grasp of their requisite characteristics, which include that they are multimodal, dispersive, and are comprised of unique displacement profiles through the thickness of the waveguide.

The propagation of acoustic and electromagnetic waves in stratified media is a subject that has profound implications in many areas of applied physics and in engineering, just to mention a few, in ocean acoustics, integrated optics, and wave guides. See for example Tolstoy and Clay 1966, Marcuse 1974, and Brekhovskikh 1980. As is well known, stratified media, that is to say media whose physical properties depend on a single coordinate, can produce guided waves that propagate in directions orthogonal to that of stratification, in addition to the free waves that propagate as in homogeneous media. When the stratified media are perturbed, that is to say when locally the physical properties of the media depend upon all of the coordinates, the free and guided waves are no longer solutions to the appropriate wave equations, and this leads to a rich pattern of wave propagation that involves the scattering of the free and guided waves among each other, and with the perturbation. These phenomena have many implications in applied physics and engineering, such as in the transmission and reflexion of guided waves by the perturbation, interference between guided waves, and energy losses in open wave guides due to radiation. The subject matter of this monograph is the study of these phenomena.

Wireless communications allow high-speed mobile access to a global Internet based on ultra-wideband backbone intercontinental and terrestrial networks. Both of these environments support the carrying of information via electromagnetic waves that are wireless (in free air) or guided through optical fibers. Wireless and Guided Wave Electromagnetics: Fundamentals and Applications explores the fundamental aspects of electromagnetic waves in wireless media and wired guided media. This is an essential subject for engineers and physicists working with communication technologies, mobile networks, and optical communications. This comprehensive book: Builds from the basics to modern topics in electromagnetics for wireless and optical fiber communication Examines wireless radiation and the guiding of optical waves, which are crucial for carrying high-speed information in long-reach optical networking scenarios Explains the physical phenomena and practical aspects of guiding optical waves that may not require detailed electromagnetic solutions Explores applications of electromagnetic waves in optical communication systems and networks based on frequency domain transfer functions in the linear regions, which simplifies the physical complexity of the waves but still allows them to be examined from a system engineering perspective Uses MATLAB® and Simulink® models to simulate and illustrate the electromagnetic fields Includes worked examples, laboratory exercises, and problem sets to test understanding The book's modular structure makes it suitable for a variety of courses, for self-study, or as a resource for research and development. Throughout, the author emphasizes issues commonly faced by engineers. Going a step beyond traditional electromagnetics textbooks, this book highlights specific uses of electromagnetic waves with a focus on the wireless and optical technologies that are increasingly important for high-speed transmission over very long distances.

Summary: This book presents necessary background knowledge on mechanics to understand and analyze elastic wave propagation in solids and fluids. This knowledge is necessary for elastic wave propagation modeling and for interpreting experimental data generated during ultrasonic nondestructive testing and evaluation (NDT&E). The book covers both linear and nonlinear analyses of ultrasonic NDT&E techniques. The materials presented here also include some exercise problems and solution manual. Therefore, this book can serve as a textbook or reference book for a graduate level course on elastic waves and/or ultrasonic nondestructive evaluation. It will be also useful for instructors who are interested in designing short courses on elastic wave propagation in solids or NDT&E. The materials covered in the first two chapters provide the fundamental knowledge on linear mechanics of deformable solids while Chapter 4 covers nonlinear mechanics. Thus, both linear and nonlinear ultrasonic techniques are covered here. Nonlinear ultrasonic techniques are becoming more popular in recent years for detecting very small defects and damages. However, this topic is hardly covered in currently available textbooks. Researchers mostly rely on published research papers and research monographs to learn about nonlinear ultrasonic techniques. Chapter 3 describes elastic wave propagation modeling techniques using DPSM. Chapter 5 is dedicated to an important and very active research field acoustic source localization that is essential for structural health monitoring and for localizing crack and other type of damage initiation regions. Features Introduces Linear and Nonlinear ultrasonic techniques in a single book. Commences with basic definitions of displacement, displacement gradient, traction and stress. Provides step by step derivations of fundamental equations of mechanics as well as linear and nonlinear wave propagation analysis. Discusses basic theory in addition to providing detailed NDE applications. Provides extensive example and exercise problems along with an extensive solutions manual.

Uniquely combines both the optical and electrical properties of guided-wave optoelectronic devices, providing key concepts and practical analytical techniques.

Ultrasonic waves are well-known for their broad range of applications. They can be employed in various fields of knowledge such as medicine, engineering, physics, biology, materials etc. A characteristic presented in all applications is the simplicity of the instrumentation involved, even knowing that the methods are mostly very complex, sometimes requiring analytical and numerical developments. This book presents a number of state-of-the-art applications of ultrasonic waves, developed by the main researchers in their scientific fields from all around the world. Phased array modelling, ultrasonic thrusters, positioning systems, tomography, projection, gas hydrate bearing sediments and Doppler Velocimetry are some of the topics discussed, which, together with materials characterization, mining, corrosion, and gas removal by ultrasonic techniques, form an exciting set of updated knowledge. Theoretical advances on ultrasonic waves analysis are presented in every chapter, especially in those about modelling the generation and propagation of waves, and the influence of Goldberg's number on approximation for finite amplitude acoustic waves. Readers will find this book ta valuable source of information where authors describe their works in a clear way, basing them on relevant bibliographic references and actual challenges of their field of study.