

Fundamentals Of Physical Acoustics Blackstock

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Warren P. Mason

an authoritative up to date introduction to physical acoustics easy to read and understand fundamentals of physical acoustics fills a long standing need for an acoustics text that challenges but does not overpower graduate students in engineering and physics mathematical results and physical explanations go hand in hand and a unique feature of the book is the balance it strikes between time domain and frequency domain presentations fundamentals of physical acoustics is intended for a two semester first year graduate course but is also suitable for advanced undergraduates emphasis on plane waves in the first part of the book keeps the mathematics simple yet accommodates a broad range of topics propagation reflection and transmission normal modes and simple waveguides for rectilinear geometries horns inhomogeneous media and sound absorption and dispersion the second part of the book is devoted to a more rigorous development of the wave equation spherical and cylindrical waves including the more advanced mathematics required advanced waveguides baffled piston radiation diffraction treated in the time domain and arrays applications and examples are drawn from atmospheric acoustics noise control underwater acoustics engineering acoustics acoustical measurements supplemented with more than 300 graphs and figures as well as copious end of chapter problems fundamentals of physical acoustics is also an excellent professional reference for engineers and scientists

physical acoustics principles and methods reviews the principles and methods of physical acoustics and covers topics ranging from third sound in superfluid helium films to the method of matched asymptotic expansions mae ultrasonic diffraction from single apertures and its application to pulse measurements and crystal physics are also discussed together with elastic surface wave devices acoustic emission and nonlinear effects in piezoelectric quartz crystals comprised of six chapters this volume begins

with a detailed treatment of the theory of third sound in superfluid helium films third sound resonators and many other properties the second chapter is devoted to the mae method with emphasis on its ability to produce results in acoustics and to provide insight into classical problems subsequent chapters deal with bulk and surface waves phase coded signals and their generation and detection by interdigital grid structures elastic surface wave devices such as pulse compression filters and nonlinear effects in quartz crystals the final chapter describes acoustic emission and the noise produced in materials when they are strained this book will be of interest to physicists

physical acoustics principles and methods volume x is a five chapter text that covers the principles and methods of generation of physical acoustics the first chapter provides the essential results obtained concerning acoustic surface waves on curved surfaces and relates them to the corresponding plane surface waves this chapter also presents a classification of surface and lateral waves on flat surfaces along with their properties the second chapter describes a group of acoustic wave problems that are particularly suitable for study by means of schlieren visualization the third chapter deals with the production of ultrasonic waves by direct electromagnetic generation while type ii superconductors which are useful for superconducting magnets with strong magnetic fields and with high current densities are investigated in the fourth chapter the fifth chapter discusses the principles of hologram and its application to very short length electromagnetic waves known as microwaves and to acoustic waves of various wavelengths

this corrected version of the landmark 1981 textbook introduces the physical principles and theoretical basis of acoustics with deep mathematical rigor concentrating on concepts and points of view that have proven useful in applications such as noise control underwater sound architectural acoustics audio engineering nondestructive testing remote sensing and medical ultrasonics since its publication this text has been

used as part of numerous acoustics related courses across the world and continues to be used widely today during its writing the book was fine tuned according to insights gleaned from a broad range of classroom settings its careful design supports students in their pursuit of a firm foundation while allowing flexibility in course structure the book can easily be used in single term or full year graduate courses and includes problems and answers this rigorous and essential text is a must have for any practicing or aspiring acoustician

physical acoustics principles and methods volume xv is a four chapter text that covers the history of ultrasonics interdigital transducers theory of resonance scattering and acoustic emission chapter 1 provides the history of ultrasonics and the developments of its application in crystal transducers oscillators selective wave filters underwater sound dentistry and medicine chapter 2 is a comprehensive account of the use of circuit model analysis to design interdigital transducers idts for surface acoustic wave saw devices this chapter also looks into the total filter design problem for the important case of saw filters composed solely of idts and matching circuits chapter 3 discusses the resonance scattering theory its application to acoustic and elastic wave scattering and the relevant experiments chapter 4 deals with the optical detection of acoustic emissions acoustic emissions during various transformations and dislocation effects researchers in the fields of electronics technology and applied and engineering mechanics will find this book invaluable

physical acoustics principles and methods volume xii covers the fundamental physical phenomena and important engineering applications of physical acoustics this volume is composed of five chapters and begins with the presentation of the theoretical concepts and experimental data concerning the role of long wavelength acoustic phonons in jahn teller phase transitions the second chapter highlights the use of superconducting tunneling junctions as phonon generators and detectors followed by a discussion on

ultrasonic wave propagation in glasses at low temperatures in the third chapter the fourth chapter explores various integral transform methods for describing the elastic response to acoustic pulsed these methods include spatial fourier and or bessel transforms the watson sommerfeld transformation or the poisson summation formula and the fourier or laplace transform for the time behavior the final chapter outlines the measurement methods for ultrasonic phase and group velocities and attenuation together with their industrial applications

physical acoustics principles and methods reviews the principles and methods of physical acoustics and covers topics ranging from relaxation processes in sound propagation in fluids to acoustic vibrational modes in quartz crystals along with electron and phonon drag on mobile dislocations in metals at low temperatures two pulse phonon echoes in solid state acoustics and memory echoes in powders are also discussed comprised of seven chapters this volume begins with a historical account of relaxation processes in sound propagation followed by an analysis of acoustic vibrational modes in quartz crystals the reader is then introduced to electron and phonon drag on mobile dislocations at low temperatures together with two pulse phonon echoes in solid state acoustics and dynamic polarization echoes in powdered materials the book also considers memory echoes in powders before concluding with an evaluation of acousto optic transduction mechanisms used in fiber optic acoustic sensors together with their practical implementation this book will be of interest to physicists

the interaction of sound waves with the medium through which they pass can be used to investigate the thermophysical properties of that medium with the advent of modern instrumentation it is now possible to determine the speed and absorption of sound with extremely high precision and through the dependence of those quantities on variables like temperature pressure and frequency to gain a sensitive measure of one or more

properties of fluid this has led to renewed interest in such measurements and in the extraction of thermophysical properties of gases and liquids there from physical acoustics and metrology of fluids describes both how to design experiments to achieve the highest possible accuracy and how to relate the quantities measured in those experiments to the thermophysical properties of the medium a thorough theoretical examination of the alternative experimental methods available is designed to guide the experimentalist toward better and more accurate methods this theoretical analysis is enhanced and complemented by an in depth discussion of practical experimental techniques and the problems inherent within them bringing together the fields of thermodynamics kinetic theory fluid mechanics and theoretical acoustics plus a wealth of information about practical instruments this book represents an essential reference on the design and execution of valuable experiments in fluid metrology and physical acoustics

physical acoustics principles and methods volume vi provides five chapters covering the whole of physical acoustics the first chapter extends the methods for studying high frequency sound waves in the hypersonic range by the technique of brillouin scattering the next chapter discusses the acoustic properties of materials of the perovskite structure these materials have soft modes which are transverse optic modes of the phonon spectrum that have unusually low and strongly temperature dependent frequencies this chapter expounds the influence of the soft modes with particular attention to potassium tantalate and strontium titanate the third chapter gives a theoretical treatment of the properties and possibilities of surface waves in crystals that are becoming of increasing interest for delay lines amplifiers of sound waves and other practical applications the fourth chapter discusses the experimental methods and results of the dynamic shear properties of solvents and polystyrene solutions from 20 to 300 mhz including a description of its materials and steady flow properties the final chapter deals with condensed helium which requires quantum reactions to account for

its properties while the experimental data on solid helium are still insufficient this chapter gives both a theoretical and an experimental account of sound propagation in solid helium including various liquid forms this book is recommended to both students and physicists conducting research on physical acoustics

this book contains 17 invited papers and 80 communicated papers presented at the international symposium on physical acoustics held at the university campus of kortrijk belgium from 19 22 june 1990 the twenty fifth anniversary of the campus was celebrated with special activities such as concerts exhibitions and scientific meetings this symposium was a part of the celebration the 120 participants came from 18 different countries among the largest groups we mention 32 french contributions and 19 contributions from the u s s r we especially thank prof v v proklov from moscow and prof s v kulakov from leningrad who helped us with the distribution of invitations in the u s s r we also thank prof g quentin and ir b poiree from paris who endeavored to inform all french acousticians we thank all the lecturers for their effort in producing the material for the book in time the invited lectures have been collected and retyped by prof m breazeale u s a while the contributed papers were collected by prof o leroy and retyped in belgium the first 200 pages of the book comprise the invited lectures not classified by topic but are in alphabetical order with reference to the first author the second part of the book contains the contributed papers and posters also classified in alphabetical order according to the first author

physical acoustics principles and methods reviews the principles and methods of physical acoustics with emphasis on applications of the thermal and acoustic response to light measurements in which a beam of light or electrons excites a system are presented and information is obtained from the resulting thermal or acoustic waves comprised of seven chapters this volume begins with a description of the use of number theory to design phase gratings and arrays with low directivity followed by a

comprehensive account of ultrasonic generation by pulsed lasers in gases vapors liquids and solids thermoelastic generation at a free surface is considered along with the effect of material ablation and the effect of surface modification by a thin liquid coating or constraining solid layer subsequent chapters focus on electron acoustic imaging of solids the theory of photothermal and photoacoustic effects in condensed matter the use of photoacoustics to study the vibrational relaxation of molecules and analytical applications of photoacoustic spectroscopy to condensed phase substances the final chapter describes imaging with optically generated thermal waves this book will be of interest to physicists

physical acoustics principles and methods volume iv part a applications to quantum and solid state physics provides an introduction for the various applications of quantum mechanics to acoustics by describing several processes for which such considerations are essential this book explores the magnetic fields applied to metals in the normal state which have the effect of localizing the interaction between the acoustic waves and the electrons to specific parts of the fermi surface organized into nine chapters this volume starts with an overview of the transmission of sound waves in semiconducting crystals that are piezoelectric this text then examines the reactions of nonpiezoelectric semiconductors with electrons through the deformation potential that changes the shape of the fermi surface other chapters consider the amplification of acoustic waves in semiconductors by the application of an electric field the final chapter examines how measurements can delineate the fermi surface of monovalent metals physicists and engineers will find this book useful

physical acoustics principles and methods volume v focuses on high frequency sound waves in liquids solids and gases which are powerful tools for analyzing the molecular domain wall defect and other types of motions that can take place in these media this book discusses the measurements and techniques used for studying the effects of

impurities on the anelastic properties of crystalline quartz comprised of six chapters this volume starts with an overview of the various effects that can take place when waves are propagated in solids subject to high magnetic fields this text then discusses the velocity changes and attenuation in solid and liquid metals other chapters consider the transmission of sound waves in superconductors and explore the giant quantum oscillations at high magnetic fields this book discusses as well the x ray diffraction topological method for investigating resonant vibrations the final chapter deals with the transmission of hypersonic sound waves this book is a valuable resource for physicists and engineers

physical acoustics principles and methods volume vii is a compilation of articles that deals with the various studies in the field of physical acoustics the book covers the ultrasonic attenuation in metals and superconductors ultrasonic investigations of phase transitions and critical points interaction of light with ultrasound and high frequency elastic surface waves physicists chemists and materials scientists will find the text a good reference material

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