Shock Wave Science And Technology Reference Library Vol 1 Multiphase Flows I

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Advanced Science and Technology of Sintering

The Handbook of Shock Waves contains a comprehensive, structured coverage of research topics related to shock wave phenomena including shock waves in gases, liquids, solids, and space. Shock waves represent an extremely important physical phenomena which appears to be of special practical importance in three major fields: compressible flow (aerodynamics), materials science, and astrophysics. Shock waves comprise a phenomenon that occurs when pressure builds to force a reaction, i.e. sonic boom that occurs when a jet breaks the speed of sound. This Handbook contains experimental, theoretical, and numerical results which never before appeared under one cover; the first handbook of its kind. The Handbook of Shock Waves is intended for researchers and engineers active in shock wave related fields. Additionally, R&D establishments, applied science & research laboratories and scientific and engineering libraries both in universities and government institutions. As well as, undergraduate and graduate students in fluid mechanics, gas dynamics, and physics. Key Features * Ben-Dor is known as one of the founders of the field of shock waves * Covers a broad spectrum of shock wave research topics * Provides a comprehensive description of various shock wave related subjects * First handbook ever to include under one separate cover: experimental, theoretical, and numerical results

Bubble Dynamics and Shock Waves

This book presents a history of shock compression science, including development of experimental, material modeling, and hydrodynamics code technologies over the past six decades at Sandia National Laboratories. The book is organized into a discussion of major accomplishments by decade with over 900 references, followed by a unique collection of 45 personal recollections detailing the trials, tribulations, and successes of building a world-class organization in the field. It explains some of the challenges researchers faced and the gratification they experienced when a discovery was made. Several visionary researchers made pioneering advances that integrated these three technologies into a cohesive capability to solve complex scientific and engineering problems. What approaches worked, which ones did not, and the applications of the research are described. Notable applications include the turret explosion aboard the USS Iowa and the Shoemaker-Levy comet impact on Jupiter. The personal anecdotes and recollections make for a fascinating account of building a world-renowned capability from meager beginnings. This book will be inspiring to the expert, the non expert, and the early-career scientist. Undergraduate and graduate students in science and engineering who are contemplating different fields of study should find it especially compelling.

Fundamentals of Shock Wave Propagation in Solids

The phenomenon of shock wave reflection was first reported by the distinguished philosopher Ernst Mach in 1878. Its study was then abandoned for a period of about 60 years until its investigation was initiated in the early 1940s by Professor John von Neumann and Professor Bleakney. Under their supervision, 15 years of intensive research related to various aspects of the reflection of shock waves in pseudo-steady flows were carried out. It was during this period that the four basic shock wave reflection configurations were discovered. Then, for a period of about 10 years from the mid 1950s until the mid 1960s, investigation of the reflection phenomenon of shock waves was kept on a low flame all over the world (e. g. Australia, Japan, Canada, U. S. A. , U. S. S. R. , etc.) until Professor Bazhenova from the U. S. S. R. , Professor Irvine Glass from Canada, and Professor Roy Henderson from Australia re initiated the study of this and related phenomena. Under their scientific supervision and leadership, numerous findings related to this phenomenon were reported. Probably the most productive research group in the mid 1970s was that led by Professor Irvine Glass in the Institute of Aerospace Studies of the University of Toronto. In 1978, exactly 100 years after Ernst Mach first reported his discovery of the reflection phenomenon, I published my Ph. D. thesis in which, for the first time, analytical transition criteria between the various shock wave reflection configurations were established.

Shock Waves for Industrial Applications

This volume entitled Advanced Science and Technology of Sintering, contains the edited Proceedings of the Ninth World Round Table Conference on Sintering (IX WRTCS), held in Belgrade, Yugoslavia, September 1-4 1998. The gathering was one in a series of World Round Table Conferences on Sintering organised every four years by the Serbian Academy of Sciences and Arts (SASA) and the International

Institute for the Science of Sintering (IISS). The World Round Table Conferences on Sintering have been traditionally held in Yugoslavia. The first meeting was organised in Herceg Novi in 1969 and since then they have regularly gathered the scientific elite in the science of sintering. It is not by chance that, at these conferences, G. C. Kuczynski, G. V. Samsonov, R. Coble, Ya. E. Geguzin and other great names in this branch of science presented their latest results making great qualitative leaps in the its development. Belgrade hosted this conference for the first time. It was chosen as a reminder that 30 years ago it was the place where the International Team for Sintering was formed, further growing into the International Institute for the Science of Sintering. The IX WRTCS lasted four days. It included 156 participants from 17 countries who presented the results of their theoretical and experimental research in 130 papers in the form of plenary lectures, oral presentations and poster sections.

Future Shock

The fourth of several volumes on solids in this series, the six extensive chapters here are more specifically concerned with detonation and shock compression waves in reactive heterogeneous media, including mixtures of solid, liquid and gas phases.

Shock Wave Science and Technology Reference Library, Vol.4

The theory of waves is generalized on cases when waves change medium in which they appear and propagate. A reaction of structural elements and space objects to the dynamic actions of the different nature, durations, and intensities is studied. It considers the effects of transitions in the state and phase equations of media on the formation and propagation of extreme waves as a result of power, thermal, or laser pulsed action. The influence of cavitation and cool boiling of liquids, geometric and physical nonlinearity of walls on containers' strength, and the formation of extreme waves is studied. The theory can be also used to optimize impulse technology, in particular, in the optimization of explosive processing of sheet metal by explosion in a liquid. This book was written for researchers and engineers, as well as graduate students in the fields of thermal fluids, aerospace, nuclear engineering, and nonlinear waves.

Fundamental Issues and Applications of Shock-Wave and High-Strain-Rate Phenomena

Methods and the latest results of experimental studies of the strength properties, polymorphism and metastable states of materials and substances with extremely short durations of shock-wave action are presented. The author provides a comprehensive and theoretical description of specific features of the dynamics of elastoplastic shock compression waves in relaxing media. The presentation is preceded by a detailed description of the theoretical foundations of the method and a brief discussion of the basic methods of generating and diagnosing shock waves in solids. Key Selling Features: Addresses dynamic elastic-plastic response, spallation, and shock-induced phase transformation. Provides a centralized presentation of topics of interest to the shock physics community Presents new

data on the mechanism and basic patterns of sub-microsecond polymorphic transformations and phase transitions. Investigates destruction waves in shock-compressed glasses. Analyzes the behavior of highly hard brittle materials under shock-wave loading and ways to diagnose fracture.

High-Pressure Shock Compression of Solids

"This book provides a comprehensive overview of the principles and industrial applications of shock waves to materials fabrication and manufacturing processes. It covers metals and alloys, ceramics, and polymers either as powders or composites. It is aimed at the industrialist, managers of technology, manufacturers, and those involved in a host of manufacturing processes where shock wave fabrication may provide some novel approaches and new process insights."--Knovel.

Bubble Dynamics and Shock Waves

Los Alamos National Laboratory is an incredible place. It was conceived and born amidst the most desperate of circumstances. It attracted some of the most brilliant minds, the most innovative entrepreneurs, and the most c- ative tinkerers of that generation. Out of that milieu emerged physics and engineering that beforehand was either unimagined, or thought to be f- tasy. One of the ?elds essentially invented during those years was the science of precision high explosives. Before 1942, explosives were used in munitions and commercial pursuits that demanded proper chemistry and con?nement for the necessary e?ect, but little else. The needs and requirements of the Manhattan project were of a much more precise and speci?c nature. Spatial and temporal speci?cations were reduced from centimeters and milliseconds to micrometers and nanoseconds. New theory and computational tools were required along with a raft of new experimental techniques and novel ways of interpreting the results. Over the next 40 years, the emphasis was on higher energy in smaller packages, more precise initiation schemes, better and safer formulations, and greater accuracy in forecasting performance. Researchers from many institutions began working in the emerging and expanding ?eld. In the midst of all of the work and progress in precision initiation and scienti?c study, in the early 1960s, papers began to appear detailing the ?rst quantitative studies of the transition from de?agration to detonation (DDT), ?rst in cast, then in pressed explosives, and ?nally in propellants.

Extracorporeal Shock Waves in Orthopaedics

My intent in writing this book is to present an introduction to the thermo- chanical theory required to conduct research and pursue applications of shock physics in solid materials. Emphasis is on the range of moderate compression that can be produced by high-velocity impact or detonation of chemical exp- sives and in which elastoplastic responses are observed and simple equations of state are applicable. In the interest of simplicity, the presentation is restricted to plane waves producing uniaxial deformation. Although applications often - volve complex multidimensional deformation fields it is necessary to begin with the simpler case. This is also the most important case because it is the usual setting of experimental research. The

presentation is also restricted to theories of material response that are simple enough to permit illustrative problems to be solved with minimal recourse to numerical analysis. The discussions are set in the context of established continuum-mechanical principles. I have endeavored to define the quantities encountered with some care and to provide equations in several convenient forms and in a way that lends itself to easy reference. Thermodynamic analysis plays an important role in continuum mechanics, and I have included a presentation of aspects of this subject that are particularly relevant to shock physics. The notation adopted is that conventional in expositions of modern continuum mechanics, insofar as possible, and variables are explained as they are encountered. Those experienced in shock physics may find some of the notation unconventional.

Explosion, Shock Wave and High-Strain-Rate Phenomena V

Predicts the pace of environmental change during the next thirty years and the ways in which the individual must face and learn to cope with personal and social change

Shock Wave Science and Technology Reference Library, Vol. 1

The high temperatures generated in gases by shock waves give rise to physical and chemical phenomena such as molecular vibrational excitation, dissociation, ionization, chemical reactions and inherently related radiation. In continuum regime, these processes start from the wave front, so that generally the gaseous media behind shock waves may be in a thermodynamic and chemical non-equilibrium state. This book presents the state of knowledge of these phenomena. Thus, the thermodynamic properties of high temperature gases, including the plasma state are described, as well as the kinetics of the various chemical phenomena cited above. Numerous results of measurement and computation of vibrational relaxation times, dissociation and reaction rate constants are given, and various ionization and radiative mechanisms and processes are presented. The coupling between these different phenomena is taken into account as well as their interaction with the flow-field. Particular points such as the case of rarefied flows and the inside of the shock wave itself are also examined. Examples of specific non-equilibrium flows are given, generally corresponding to those encountered during spatial missions or in shock tube experiments.

Extreme Waves and Shock-Excited Processes in Structures and Space Objects

This book provides current, comprehensive, and clear explanations of the physics behind medical and biomedical applications of shock waves. Extracorporeal shock wave lithotripsy is one of the greatest medical advances of our time, and its techniques and clinical devices are continuously evolving. Further research continues to improve the understanding of calculi fragmentation and tissue-damaging mechanisms. Shock waves are also used in orthopedics and traumatology. Possible applications in oncology, cardiology, dentistry, gene therapy, cell transfection, transformation of fungi and bacteria, as well as the inactivation of microorganisms are promising approaches for clinical treatment,

industrial applications and research. Medical and Biomedical Applications of Shock Waves is useful as a guide for students, technicians and researchers working in universities and laboratories. Chemists, biologists, physicians and veterinarians, involved in research or clinical practice will find useful advice, but also engineers and physicists may benefit from the overview of current research endeavors and future directions. Furthermore, it may also serve to direct manufacturers towards the design of more efficient and safer clinical, industrial and laboratory equipment.

Shock Wave Reflection Phenomena

Transonic Aerodynamics

This book offers a timely reference on shock waves in multiphase flows, including new viewpoints and burgeoning developments. This volume treats shock and expansion waves in complex, bubbly liquids and cryogenic liquids. It also examines the relationship of shock waves with phase transitions and induced phase transitions as well as their interaction with solid foams, textiles, porous and granular media.

Hypervelocity Launchers

This book contains the proceedings of EXPLOMETTM 2000, International Conference on Fundamental Issues and Applications of Shock-Wave and High-Strain-Rate Phenomena, held in Albuquerque, New Mexico, 2000; the fifth in the EXPLOMETTM quinquennial series which began in Albuquerque in 1980. The book is divided into five major sections with a total of 85 chapters. Section I deals with materials issues in shock and high strain rates while Section II covers shock consolidation, reactions, and synthesis. Materials aspects of ballistic and hypervelocity impact are covered in Section III followed by modeling and simulation in Section IV and a range of novel applications of shock and high-strain-rate phenomena in Section V. Like previous conference volumes published in 1980, 1985, and 1995, the current volume includes contributions from fourteen countries outside the United States. As a consequence, it is hoped that this book will serve as a global summary of current issues involving shock and high-strain-rate phenomena as well as a general reference and teaching componant for specializd curricula dealing with these features in a contemporary way. Over the past twenty years, the EXPLOMETTM Conferences have created a family of participants who not only converse every five years but who have developed long-standing interactions and professional relationships which continue to stimulate new concepts and applications particularly rooted in basic materials behavior.

Handbook of Shock Waves, Three Volume Set

Ending poverty and stabilizing climate change will be two unprecedented global achievements and two major steps toward sustainable development. But the two objectives cannot be considered in isolation: they need to be jointly tackled through an integrated strategy. This report brings together those two objectives and explores how they can more easily be achieved if considered together. It

examines the potential impact of climate change and climate policies on poverty reduction. It also provides guidance on how to create a “win-win†? situation so that climate change policies contribute to poverty reduction and poverty-reduction policies contribute to climate change mitigation and resilience building. The key finding of the report is that climate change represents a significant obstacle to the sustained eradication of poverty, but future impacts on poverty are determined by policy choices: rapid, inclusive, and climate-informed development can prevent most short-term impacts whereas immediate pro-poor, emissions-reduction policies can drastically limit long-term ones.

Medical and Biomedical Applications of Shock Waves

This book is the second volume of Solids Volumes in theShockWaveScience and Technology Reference Library. These volumes are primarily concerned with high-pressure shock waves in solid media, including detonation and hi- velocity impact and penetration events. This volume contains four articles. The ?rst two describe the reactive behavior of condensed-phase explosives, and the remaining two discuss the inert, mechanical response of solid materials. The articles are each se-contained, and can be read independently of each other. They o?er a timely reference, for beginners as well as professional scientists and engineers, cov- ing the foundations and the latest progress, and include burgeoning devel- ment as well as challenging unsolved problems. The ?rst chapter, by S. She?eld and R. Engelke, discusses the shock initiation and detonation phenomena of solids explosives. The article is an outgrowth of two previous review articles: “Explosives” in vol. 6 of En- clopedia of Applied Physics (VCH, 1993) and “Initiation and Propagation of Detonation in Condensed-Phase High Explosives” in High-Pressure Shock Compression of Solids III (Springer, 1998). This article is not only an - dated review, but also o?ers a concise heuristic introduction to shock waves and condensed-phase detonation. The authors emphasize the point that d- onation is not an uncontrollable, chaotic event, but that it is an orderly event that is governed by and is describable in terms of the conservation of mass, momentum, energy and certain material-speci?c properties of the explosive.

Shock Waves Science and Technology Library, Vol. 6

This book presents, in a concise and comprehensive manner, the essential techniques by which shock wave physicists probe the boundaries of material response to impulsive loads. The author is a well-known figure in shock wave physics, having worked for over forty years with many of the outstanding researchers in the field.The book acquaints readers both with modern instrumentation techniques including interferometers such as the DISAR and the VISAR — and with methods that have been established by previous generations of experimentalists — including acoustic measurement techniques and low to moderate strain rate machines.Besides an exposition of the theoretical aspects of shock wave phenomena, it contains large amounts of data on equations of state, spallation thresholds, shock wave attenuation from very high pressures, and elastic constants. Much of this information has been previously unavailable in open publications.The text documents the transition from testing performed with explosives to the use of modern compressed gas guns, which permit much more detailed diagnostics and controlled conditions. In particular, the author pioneered

the use of two-stage light gas guns which launch high-density plates against specimens located at the muzzle. The high launch velocity of these guns produced data that represents the highest pressures obtained in the free world at that time./a

Explosive Effects and Applications

This book, as a volume of the Shock Wave Science and Technology Reference Library, is primarily concerned with the fundamental theory of detonation physics in gaseous and condensed phase reactive media. The detonation process involves complex chemical reaction and fluid dynamics, accompanied by intricate effects of heat, light, electricity and magnetism - a contemporary research field that has found wide applications in propulsion and power, hazard prevention as well as military engineering. The seven extensive chapters contained in this volume are: - Chemical Equilibrium Detonation (S Bastea and LE Fried) - Steady One-Dimensional Detonations (A Higgins) - Detonation Instability (HD Ng and F Zhang) - Dynamic Parameters of Detonation (AA Vasiliev) - Multi-Scaled Cellular Detonation (D Desbordes and HN Presles) - Condensed Matter Detonation: Theory and Practice (C Tarver) - Theory of Detonation Shock Dynamics (JB Bdzil and DS Stewart) The chapters are thematically interrelated in a systematic descriptive approach, though, each chapter is self-contained and can be read independently from the others. It offers a timely reference of theoretical detonation physics for graduate students as well as professional scientists and engineers.

Blast Effects

This self-contained book begins with fundamental principles and proceeds to the latest developments in the field. Using a systematic mathematical approach, it covers linearized and transonic theories, simple flows, general theories of lift and drag, subsonic flows, sonic flows, shock waves, airfoils and three-dimensional wings. Also discussed are far fields and the transonic law of stabilization. Significant mathematical areas which enter the discussion are: Partial Differential Equations of Mixed Type, Weak Solutions (Shock Waves), Hodograph Transformations, Similarity Solutions and New Numerical Methods for Equations of Mixed Type.

Shock Waves in Materials Science

Recent investigations into blast-resistant properties of polyureas and other multi-phase polymeric elastomers indicate that they can dissipate broad bands of frequencies such as those encountered in blast events. In this unique book, Elastomeric Polymers with High Rate Sensitivity, Dr. Roshdy Barsoum and expert contributors bring together the cutting-edge testing methodologies, material properties, and critical design data for engineers seeking to deploy this technology. Where conventional methods of resisting blast, shockwave, and penetration are expensive, time-consuming and impractical, high-strain rate elastomeric polymers (HSREP) can be cheaper, quicker, and more easily applied to new and old materials alike. This book aids both military and civilian engineers in a range of applications, from buildings and tunnels to lightweight armor, ships, and aircraft. The book

features constitutive models for software developers designing with these advanced polymers, as well as a discussion of the mechanisms of interaction between high-strain rate polymers and other materials. It also thoroughly covers HSREP engineering methods to achieve other unique properties, such as fireproofing. Material properties and design data included to enable engineers to successfully deploy this technology Cheaper, quicker, and more easily implemented than traditional methods of increasing blast and ballistic performance A how-to guide to the engineering of high strain rate elastomeric polymers to achieve other useful properties, such as fireproofing

Shock Wave Science and Technology Reference Library, Vol. 3

Emphasizing metallurgical and materials applications of shock-wave and high-strain-rate phenomena, this superb volume presents the work of the leading international authorities who examine the state of the art of explosive and related technologies in the context of metallurgical and materials processing and fabrication.

Shock Wave Science and Technology Reference Library, Vol. 2

This book explores the interplay of bubble dynamics and shock waves, covering shock wave emission by laser generated bubbles, pulsating bubbles near boundaries, interaction of shock waves with bubble clouds, applications in shock wave lithotripsy, and more.

Shock Wave Science and Technology Reference Library

This unique and encyclopedic reference work describes the evolution of the physics of modern shock wave and detonation from the earlier and classical percussion. The history of this complex process is first reviewed in a general survey. Subsequently, the subject is treated in more detail and the book is richly illustrated in the form of a picture gallery. This book is ideal for everyone professionally interested in shock wave phenomena.

History of Shock Waves, Explosions and Impact

This book provides an elementary introduction to some one-dimensional fluid flow problems involving shock waves in air. The differential equations of fluid flow are approximated by finite difference equations and these in turn are numerically integrated in a stepwise manner. Artificial viscosity is introduced into the numerical calculations in order to deal with shocks. The presentation is restricted to the finite-difference approach to solve the coupled differential equations of fluid flow as distinct from finite-volume or finite-element methods. This text presents the results arising from the numerical solution using Mathcad programming. Both plane and spherical shock waves are discussed with particular emphasis on very strong explosive shocks in air. This text will appeal to students, researchers, and professionals in shock wave research and related fields. Students in particular will appreciate the benefits of numerical methods in fluid mechanics and the level of presentation.

Shock Wave Science and Technology Reference Library, Vol. 5

This book is the first of several volumes on solids in the Shock Wave Science and Technology Reference Library. This is a unique collection, and the library as a whole sets out to comprehensively and authoritatively cover and review at research level the subject matter with all its ramifications. All the chapters are self-contained and can be read independently of each other, though they are of course thematically interrelated.

Shock Waves

This comprehensive and carefully edited volume presents a variety of experimental methods used in Shock Waves research. In 14 self contained chapters this 9th volume of the “Shock Wave Science and Technology Reference Library” presents the experimental methods used in Shock Tubes, Shock Tunnels and Expansion Tubes facilities. Also described is their set-up and operation. The uses of an arc heated wind tunnel and a gun tunnel are also contained in this volume. Whenever possible, in addition to the technical description some typical scientific results obtained using such facilities are described. Additionally, this authoritative book includes techniques for measuring physical properties of blast waves and laser generated shock waves. Information about active shock wave laboratories at different locations around the world that are not described in the chapters herein is given in the Appendix, making this book useful for every researcher involved in shock/blast wave phenomena.

Shock Waves Science and Technology Library, Vol. 6

This book explores the interplay of bubble dynamics and shock waves, covering shock wave emission by laser generated bubbles, pulsating bubbles near boundaries, interaction of shock waves with bubble clouds, applications in shock wave lithotripsy, and more.

Shock Waves: Measuring The Dynamic Response Of Materials

In this volume, the shock compression technology of materials is described in parallel with the latest research results and their background. In the past, this type of technology was developed in connection with military techniques by certain particular research organizations. For this reason, researchers of materials in general have had less opportunity to make use of the technology. The conventional technology of shock compression has now been established, and is recognized as being remarkably useful as a means of materials science study. The feasibility of shock compression technology is dealt with in this book, as well as the latest research results for general material scientists. The shock synthesis of ceramics and intermetallic compounds, as well as shock compression behavior, are also described. In contrast to conventional works of this kind, this book describes shock compression studies performed by material scientists.

Sonic Thunder

In the present volume numerous descriptions of Ram accelerators are presented. These descriptions provide good overview on the progress made and the present state of the Ram accelerator technology worldwide. In addition, articles describing light gas gun, ballistic range including a chapter dealing with shock waves in solids are given. Along with the technical description of considered facilities, samples of obtained results are also included. Each chapter is written by an expert in the described topic providing a comprehensive description of the discussed phenomena.

Metallurgical Applications of Shock-Wave and High-Strain Rate Phenomena

5th ESHP Selected, peer reviewed papers from the Fifth International Symposium on Explosion, Shock Wave and High-Strain-Rate Phenomena (5th ESHP), September 25-28, 2016, Beijing, China

Elastomeric Polymers with High Rate Sensitivity

Since the earliest days of human existence, the clash of thunder and trembling of the hills has struck fear into the hearts of seasoned warriors and tribal villagers alike. Great gods, demi-gods, and heroes were created to explain the awesome, mysterious, and incomprehensibly powerful forces of Nature in a feeble attempt to make sense of the world around them. To our advanced scientific minds today, these explanations seem childish and ridiculous; however, the power to flatten thousands of square miles of ancient forest, create massive holes in the Earth itself, and cause mountains to tremble to their very roots are more than enough reason to believe. Indeed, perhaps our scientific advancement has caused us to not fully or completely appreciate the awesome scale and power that Nature can wield against us. The study of shock wave formation and dynamics begins with a study of waves themselves. Simple harmonic motion is used to analyze the physical mechanisms of wave generation and propagation, and the principle of superposition is used to mathematically generate constructive and destructive interference. Further development leads to the shock singularity where a single wave of immense magnitude propagates and decays through various media. Correlations with the fields of thermodynamics, meteorology, crater formation, and acoustics are made, as well as a few special applications. Direct correlation is made to events in Arizona, Siberia, and others. The mathematical requirement for this text includes trigonometry, differential equations, and large series summations, which should be accessible to most beginning and advanced university students. This text should serve well as supplementary material in a course covering discrete wave dynamics, applied thermodynamics, or extreme acoustics.

Impactful Times

This book compiles a variety of experimental data on blast waves. The book begins with an introductory chapter and proceeds to the topic of blast wave phenomenology, with a discussion Rankine-Hugoniot equations and the Friedlander equation, used to describe the pressure-time history of a blast wave. Additional

topics include arrival time measurement, the initiation of detonation by exploding wires, a discussion of TNT equivalency, and small scale experiments. Gaseous and high explosive detonations are covered as well. The topics and experiments covered were chosen based on the comparison of used scale sizes, from small to large. Each characteristic parameter of blast waves is analyzed and expressed versus scaled distance in terms of energy and mass. Finally, the appendix compiles a number of polynomial laws that will prove indispensable for engineers and researchers.

Introduction to Simple Shock Waves in Air

Working knowledge of the relations of various quantities and their derivatives across a shock wave is useful for any advanced research involving shock waves. Although these relations can be derived in principle by any diligent student of the subject, the derivations are often not trivial, and once derived, neither the approach nor the result can be

High Temperature Phenomena in Shock Waves

This book, as a volume of the Shock Wave Science and Technology Reference Library, is primarily concerned with the fundamental theory of detonation physics in gaseous and condensed phase reactive media. The detonation process involves complex chemical reaction and fluid dynamics, accompanied by intricate effects of heat, light, electricity and magnetism - a contemporary research field that has found wide applications in propulsion and power, hazard prevention as well as military engineering. The seven extensive chapters contained in this volume are: - Chemical Equilibrium Detonation (S Bastea and LE Fried) - Steady One-Dimensional Detonations (A Higgins) - Detonation Instability (HD Ng and F Zhang) - Dynamic Parameters of Detonation (AA Vasiliev) - Multi-Scaled Cellular Detonation (D Desbordes and HN Presles) - Condensed Matter Detonation: Theory and Practice (C Tarver) - Theory of Detonation Shock Dynamics (JB Bdzil and DS Stewart) The chapters are thematically interrelated in a systematic descriptive approach, though, each chapter is self-contained and can be read independently from the others. It offers a timely reference of theoretical detonation physics for graduate students as well as professional scientists and engineers.

Fluid Mechanics

This book presents a set of basic understandings of the behavior and response of solids to propagating shock waves. The propagation of shock waves in a solid body is accompanied by large compressions, decompression, and shear. Thus, the shear strength of solids and any inelastic response due to shock wave propagation is of the utmost importance. Furthermore, shock compres sion of solids is always accompanied by heating, and the rise of local tempera ture which may be due to both compression and dissipation. For many solids, under a certain range of impact pressures, a two-wave structure arises such that the first wave, called the elastic prescursor, travels with the speed of sound; and the second wave, called a plastic shock wave, travels at a slower speed. Shock-wave loading of solids is normally accomplished by either projectile impact, such as produced by guns or by

explosives. The shock heating and compression of solids covers a wide range of temperatures and densities. For example, the temperature may be as high as a few electron volts (1 eV = 11,500 K) for very strong shocks and the densification may be as high as four times the normal density.

Shock Wave Dynamics

The application of extracorporeal shock waves in the locomotor apparatus offers new therapeutic concepts. This book provides an up-to-date overview on the use of shock waves in orthopaedics. The main emphasis is laid on the basics of shock wave techniques and on the impact of shock waves on cells and organs. The reader is provided with a summary of experimental and clinical results of shock wave therapy applied to the bone and the epiphyseal growth plate. Authors from five clinical centres report on their experiences with shock wave therapy in tendinosis calcarea, epicondylopathy and calcar spur. Furthermore they report on first experiences with shock wave therapy in children with cerebral paresis.

Shock Waves in Solid State Physics

Fluid Mechanics, Second Edition deals with fluid mechanics, that is, the theory of the motion of liquids and gases. Topics covered range from ideal fluids and viscous fluids to turbulence, boundary layers, thermal conduction, and diffusion. Surface phenomena, sound, and shock waves are also discussed, along with gas flow, combustion, superfluids, and relativistic fluid dynamics. This book is comprised of 16 chapters and begins with an overview of the fundamental equations of fluid dynamics, including Euler's equation and Bernoulli's equation. The reader is then introduced to the equations of motion of a viscous fluid; energy dissipation in an incompressible fluid; damping of gravity waves; and the mechanism whereby turbulence occurs. The following chapters explore the laminar boundary layer; thermal conduction in fluids; dynamics of diffusion of a mixture of fluids; and the phenomena that occur near the surface separating two continuous media. The energy and momentum of sound waves; the direction of variation of quantities in a shock wave; one- and two-dimensional gas flow; and the intersection of surfaces of discontinuity are also also considered. This monograph will be of interest to theoretical physicists.

Experimental Methods of Shock Wave Research

This is a broad-based text on the fundamentals of explosive behavior and the application of explosives in civil engineering, industrial processes, aerospace applications, and military uses.