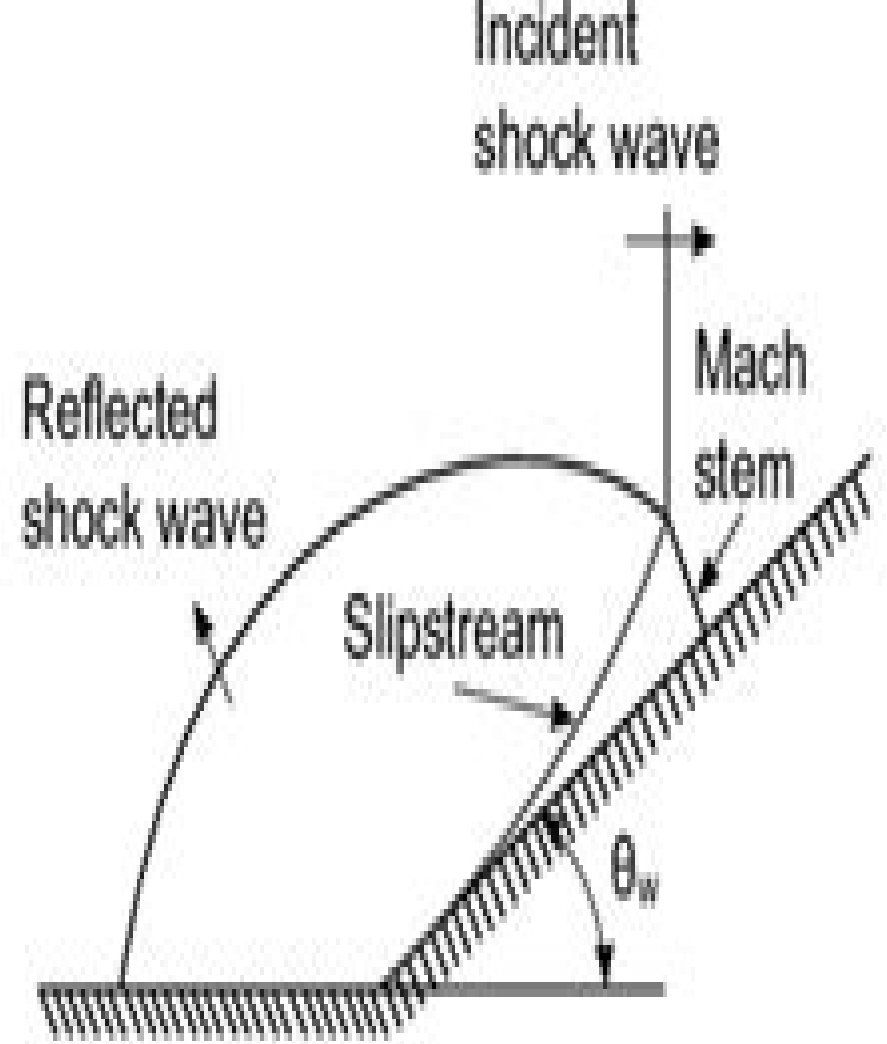


(a) Regular shock wave reflection



(b) Irregular shock wave reflection

# Shock Wave Reflection Phenomena

**Thomas Lechat, Sébastien  
Ollivier, Didier Dagna, Maria Karzova**



## **Shock Wave Reflection Phenomena:**

**Shock Wave Reflection Phenomena** Gabi Ben-Dor, 2007-08-28 This book is a comprehensive state of the knowledge summation of shock wave reflection phenomena from a phenomenological point of view It includes a thorough introduction to oblique shock wave reflections dealing with both regular and Mach types It also covers in detail the corresponding two and three shock theories The book moves on to describe reflection phenomena in a variety of flow types as well as providing the resolution of the Neumann paradox *Impact of Roughness on Shock Wave Reflection Phenomena* Thomas Lechat, Sébastien Ollivier, Didier Dagna, Maria Karzova, 2019 Mathematical Analysis of Shock Wave Reflection Shuxing Chen, 2020-09-04 This book is aimed to make careful analysis to various mathematical problems derived from shock reflection by using the theory of partial differential equations The occurrence propagation and reflection of shock waves are important phenomena in fluid dynamics Comparing the plenty of studies of physical experiments and numerical simulations on this subject this book makes main efforts to develop the related theory of mathematical analysis which is rather incomplete so far The book first introduces some basic knowledge on the system of compressible flow and shock waves then presents the concept of shock polar and its properties particularly the properties of the shock polar for potential flow equation which are first systematically presented and proved in this book Mathematical analysis of regular reflection and Mach reflection in steady and unsteady flow are the most essential parts of this book To give challenges in future research some long standing open problems are listed in the end This book is attractive to researchers in the fields of partial differential equations system of conservation laws fluid dynamics and shock theory *Shock Waves - Proceedings Of The 20th International Symposium (In 2 Volumes)* Hans G Hornung, Joseph E Shepherd, Bradford Sturtevant, 1997-01-22 The symposia take place every two years They are the forum at which scientists concerned with shock waves present their research They USE shock waves for chemical kinetics studies for materials studies and smashing kidney stones they STUDY the phenomena associated with flows involving shock waves such as supersonic flow explosions detonations volcanic eruptions and in this symposium even such with it topics as impact of Shoemaker Levy on Jupiter and blast waves in the World Trade Center They also discover new bigger and better ways of generating flows at hypervelocity speeds and develop their technological tools further The international exchange of information is documented in the proceedings volumes which have become a storehouse of information on the subject documenting the history of this peculiar branch of science that involves chemists physicists engineers geophysicists material scientists and biologists **Shock Waves** Klaus Hannemann, Friedrich Seiler, 2009-04-05 The 26th International Symposium on Shock Waves in G ttingen Germany was jointly organised by the German Aerospace Centre DLR and the French German Research Institute of Saint Louis ISL The year 2007 marked the 50th anniversary of the Symposium which first took place in 1957 in Boston and has since become an internationally acclaimed series of meetings for the wider Shock Wave Community The ISSW26 focused on the following areas Shock Propagation and Reflection Detonation

and Combustion Hypersonic Flow Shock Boundary Layer Interaction Numerical Methods Medical Biological and Industrial Applications Richtmyer Meshkov Instability Blast Waves Chemically Reacting Flows Diagnostics Facilities Flow Visualisation Ignition Impact and Compaction Multiphase Flow Nozzles Flows Plasmas and Propulsion The two Volumes contain the papers presented at the symposium and serve as a reference for the participants of the ISSW 26 and individuals interested in these fields

**Handbook of Shock Waves, Three Volume Set** Gabi Ben-Dor, Ozer Igra, Tov Elperin, 2000-10-18 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

History of Shock Waves, Explosions and Impact Peter O. K. Krehl, 2008-09-24 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

*Explosion Shock Waves and High Strain Rate Phenomena* K. Hokamoto, K. Raghukandan, 2019-08-20 The book presents the papers presented at the 6th international conference on Explosion Shock Wave and High Strain Rate Phenomena ESHP Topics covered include Advanced Manufacturing under Impact Shock Loading Detonation of High Pressure Flammable Gas in Closed Spaces High Strain Rate Behaviour of Auxetic Cellular Structures Underwater Shock Waves Generation Magnetic Pressure Welding of Aluminum Sheets Shock Synthesis of Zirconium Oxides Impact Joining of Dissimilar Metals High Speed Oblique Collision of Metals Dynamic Behavior of Dislocation Wall Structures Tensile Strength of Rock at High Strain Rates Fiber Reinforced Mortar Impact Analysis of Carbon Fiber Reinforced Polymer Explosive Welding Underwater Explosive Welding Making Ultrafine Explosives Aluminum Steel Explosive Cladding Explosively Cladded Aluminum Hybrid Composites Explosive Clads with Interlayers

Professor I. I. Glass: A Tribute and Memorial Kazuyoshi Takayama, Ozer Igra, 2012-10-16 The book provides personal memories along with

description of scientific works written by ex graduate students and research associates of the late Professor Glass The described research work covers a wide range of shock wave phenomena resulting from seeds planted by Professor Glass Professor Glass was born in Poland in 1918 He immigrated together with his parents to Canada at the age of 12 and received all his professional education at the University of Toronto Canada He became a world recognized expert in shock wave phenomena and during his 45 years of active research he supervised more than 125 master and doctoral students post doctoral fellows and visiting research associates In this book seven of his past students research associates describe their personal memories of Professor Glass and present some of their investigations in shock wave phenomena which sprung from their past work with Professor Glass Specifically these investigations include underwater shock waves shock bubble interaction medical applications of shock wave various types of shock tubes and shock tube techniques shock wave attenuation and different types of shock wave reflections

*Static Compression of Energetic Materials* Suhithi M. Peiris,Gasper J. Piermarini,2009-01-03 Developing and testing novel energetic materials is an expanding branch of the materials sciences Reaction detonation or explosion of such materials invariably produce extremely high pressures and temperatures To study the equations of state EOS of energetic materials in extreme regimes both shock and static high pressure studies are required The present volume is an introduction and review of theoretical experimental and numerical aspects of static compression of such materials Chapter 1 introduces the basic experimental tool the diamond anvil pressure cell and the observational techniques used with it such as optical microscopy infrared spectrometry and x ray diffraction Chapter 2 outlines the principles of high nitrogen energetic materials synthesis Chapters 3 and 4 examine and compare various EOS formalisms and data fitting for crystalline and non crystalline materials respectively Chapter 5 details the reaction kinetics of detonating energetic materials Chapter 6 investigates the interplay between static and dynamic shock studies Finally Chapters 7 and 8 introduce numerical simulations molecular dynamics of energetic materials under either hydrostatic or uni axial stress and ab initio treatments of defects in crystalline materials This timely volume meets the growing demand for a state of the art introduction and review of the most relevant aspects of static compression of energetic materials and will be a valuable reference to researchers and scientists working in academic industrial and governmental research laboratories

**Shock Waves** Tai-Ping Liu,2021-10-12 This book presents the fundamentals of the shock wave theory The first part of the book Chapters 1 through 5 covers the basic elements of the shock wave theory by analyzing the scalar conservation laws The main focus of the analysis is on the explicit solution behavior This first part of the book requires only a course in multi variable calculus and can be used as a text for an undergraduate topics course In the second part of the book Chapters 6 through 9 this general theory is used to study systems of hyperbolic conservation laws This is a most significant well posedness theory for weak solutions of quasilinear evolutionary partial differential equations The final part of the book Chapters 10 through 14 returns to the original subject of the shock wave theory by focusing on specific physical

models Potentially interesting questions and research directions are also raised in these chapters The book can serve as an introductory text for advanced undergraduate students and for graduate students in mathematics engineering and physical sciences Each chapter ends with suggestions for further reading and exercises for students      *Shock Wave Dynamics* George Emanuel, 2012-12-18 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      **Shock Wave Compression of Condensed Matter** Jerry W Forbes, 2013-02-01 This book introduces the core concepts of the shock wave physics of condensed matter taking a continuum mechanics approach to examine liquids and isotropic solids The text primarily focuses on one dimensional uniaxial compression in order to show the key features of condensed matter's response to shock wave loading The first four chapters are specifically designed to quickly familiarize physical scientists and engineers with how shock waves interact with other shock waves or material boundaries as well as to allow readers to better understand shock wave literature use basic data analysis techniques and design simple 1 D shock wave experiments This is achieved by first presenting the steady one dimensional strain conservation laws using shock wave impedance matching which insures conservation of mass momentum and energy Here the initial emphasis is on the meaning of shock wave and mass velocities in a laboratory coordinate system An overview of basic experimental techniques for measuring pressure shock velocity mass velocity compression and internal energy of steady 1 D shock waves is then presented In the second part of the book more advanced topics are progressively introduced thermodynamic surfaces are used to describe equilibrium flow behavior first order Maxwell solid models are used to describe time dependent flow behavior descriptions of detonation shock waves in ideal and non ideal explosives are provided and lastly a select group of current issues in shock wave physics are discussed in the final chapter      *Medical and Biomedical Applications of Shock Waves* Achim M. Loske, 2016-12-01 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 Waves Zonglin Jiang,2010-05-30 The 24th International Symposium on Shock Waves ISSW24 was held at the Beijing Friendship Hotel during July 11 16 2004 in Beijing It was a great pleasure for the Local Organizing Committee to organize the ISSW in China for the first time because forty seven years have passed since the First Shock Tube Symposium was held in 1957 at Albuquerque The ISSW24 had to be postponed for one year because of the SARS outbreak in Beijing shortly before the Symposium was scheduled to be held in 2003 but it has achieved success due to the continuous support and kind understanding from all the delegates It is very heart warming to have had such an experience and I am very happy to have served as chairman for the Symposium I would like to thank all for the contributions and help that they have given us over the past three years without which we would not have had the Symposium A total of 460 abstracts were submitted to the ISSW24 Each of the abstracts was evaluated by three members of the Scientific Review Committee and the decision on acceptance was made based on the reviewers reports 195 oral papers including 9 plenary lectures were accepted to be presented in three parallel sessions and 135 poster papers in three dedicated poster sessions Topics discussed in these papers cover all aspects of shock wave research      **30th**

**International Symposium on Shock Waves 1** Gabi Ben-Dor, Oren Sadot, Ozer Igra, 2017-08-09 These proceedings collect the papers presented at the 30th International Symposium on Shock Waves ISSW30 which was held in Tel Aviv Israel from July 19 to July 24 2015 The Symposium was organized by Ortra Ltd The ISSW30 focused on the state of knowledge of the following areas Nozzle Flow Supersonic and Hypersonic Flows with Shocks Supersonic Jets Chemical Kinetics Chemical Reacting Flows Detonation Combustion Ignition Shock Wave Reflection and Interaction Shock Wave Interaction with Obstacles Shock Wave Interaction with Porous Media Shock Wave Interaction with Granular Media Shock Wave Interaction with Dusty Media Plasma Magnetohydrodynamics Re entry to Earth Atmosphere Shock Waves in Rarefied Gases Shock Waves in Condensed Matter Solids and Liquids Shock Waves in Dense Gases Shock Wave Focusing Richtmyer Meshkov Instability Shock Boundary Layer Interaction Multiphase Flow Blast Waves Facilities Flow Visualization and Numerical Methods The two volumes serve as a reference for the participants of the ISSW30 and anyone interested in these fields

*Shock Wave Interactions* Konstantinos Kontis, 2018-03-28 This edited monograph contains the proceedings of the International Shock Interaction Symposium which emerged as an heir to both the Mach Reflection and Shock Vortex Interaction Symposia These scientific biannual meetings provide an ideal platform to expose new developments and discuss recent challenges in the field of shock wave interaction phenomena The goal of the symposia is to offer a forum for international interaction between young and established scientists in the field of shock and blast wave interaction phenomena The target audience of this book comprises primarily researchers and experts in the field of shock waves but the book may also be beneficial for young scientists and graduate students alike      *28th International Symposium on Shock Waves* Konstantinos Kontis, 2012-03-22 The University of Manchester hosted the 28th International Symposium on Shock

Waves between 17 and 22 July 2011 The International Symposium on Shock Waves first took place in 1957 in Boston and has since become an internationally acclaimed series of meetings for the wider Shock Wave Community The ISSW28 focused on the following areas Blast Waves Chemically Reacting Flows Dense Gases and Rarefied Flows Detonation and Combustion Diagnostics Facilities Flow Visualisation Hypersonic Flow Ignition Impact and Compaction Multiphase Flow Nozzle Flow Numerical Methods Propulsion Richtmyer Meshkov Shockwave Boundary Layer Interaction Shock Propagation and Reflection Shock Vortex Interaction Shockwave Phenomena and Applications as well as Medical and Biological Applications The two Volumes contain the papers presented at the symposium and serve as a reference for the participants of the ISSW 28 and individuals interested in these fields

*Porous Media: Theory and Experiments* Reint de Boer, 2012-12-06 The EUROMECH Colloquium 366 Porous Media Theory and Experiments was held at the Bildungszentrum für die Entsorgung und Wasserwirtschaft GmbH B E W Essen Germany from 23 to 27 June 1997 The goal of EUROMECH 366 was the presentation of recent findings in the macroscopic porous media theory mixture theory restricted by the volume fraction concept concerning general concepts and special investigations in the theoretical as well as the experimental field Herein numerical results requiring new solution strategies were also to be included Moreover foundations of fundamental statements in the macroscopic porous media theory e g the effective stress principle for incompressible and compressible constituents by micromechanic investigations were welcome Emphasis was placed upon the need to bring together scientists from various branches where porous media theories play a dominant role namely from theoretical mechanics agriculture biomechanics chemical engineering geophysics and soil mechanics as well as from petroleum energy and environmental engineering More than 80 people from 12 different countries expressed their interest in the Colloquium and finally 58 took part in the meeting presenting 42 papers Among the talks were seven principal lectures given by leading scientists in the a m fields invited by the organizers As Chairman of EUROMECH 366 I would like to thank the co chairmen and all of my co workers from the Institute of Mechanics FB 10 University of Essen for their help in organizing the Colloquium in particular Dr Ing W Walther Priv Doz

*Analytical Fluid Dynamics* George Emanuel, 2017-09-18 New Edition Now Covers Shock Wave Analysis An in depth presentation of analytical methods and physical foundations Analytical Fluid Dynamics Third Edition breaks down the how and why of fluid dynamics While continuing to cover the most fundamental topics in fluid mechanics this latest work emphasizes advanced analytical approaches to aid in the analytical process and corresponding physical interpretation It also addresses the need for a more flexible mathematical language utilizing vector and tensor analysis and transformation theory to cover the growing complexity of fluid dynamics Revised and updated the text centers on shock wave structure shock wave derivatives and shock produced vorticity supersonic diffusers thrust and lift from an asymmetric nozzle and outlines operator methods and laminar boundary layer theory In addition the discussion introduces pertinent assumptions reasons for studying a particular topic background discussion illustrative examples and numerous end of



chapter problems Utilizing a wide variety of topics on inviscid and viscous fluid dynamics the author covers material that includes Viscous dissipation The second law of thermodynamics Calorically imperfect gas flows Aerodynamic sweep Shock wave interference Unsteady one dimensional flow Internal ballistics Force and momentum balance The Substitution Principle Rarefaction shock waves A comprehensive treatment of flow property derivatives just downstream of an unsteady three dimensional shock Shock generated vorticity Triple points An extended version of the Navier Stokes equations Shock free supersonic diffusers Lift and thrust from an asymmetric nozzle Analytical Fluid Dynamics Third Edition outlines the basics of analytical fluid mechanics while emphasizing analytical approaches to fluid dynamics Covering the material in depth this book provides an authoritative interpretation of formulations and procedures in analytical fluid dynamics and offers analytical solutions to fluid dynamic problems

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