

The Gas Dynamics of Explosions

Explosions, and the non-steady shock propagation associated with them, continue to interest researchers working in different fields of physics and engineering (e.g., astrophysics, fusion, etc.). Based on the author's course in shock dynamics, this book describes the various analytical methods developed to determine non-steady shock propagation. These methods offer a simple alternative to the direct numerical integration of the Euler equations and offer a better insight into the physics of the problem. Professor Lee presents the subject systematically and in a style that is accessible to graduate students and researchers working in shock dynamics, combustion, high-speed aerodynamics, propulsion, and related topics.

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32 Avenue of the Americas, New York NY 10013

Cambridge University Press is part of the University of Cambridge.

It furthers the University's mission by disseminating knowledge in the pursuit of education, learning and research at the highest international levels of excellence.

www.cambridge.org

Information on this title: www.cambridge.org/9781107106307

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First published 2016

A catalog record for this publication is available from the British Library

ISBN 978-1-107-10630-7 Hardback

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Preface

Gas dynamics of explosions is a subject that deals with the non-steady propagation of shock waves. The theoretical description of non-steady shock propagation requires, in general, the solution of the non-linear partial differential equations of compressible flow that govern the unsteady flow behind the shock. This requires the numerical integration of the conservation equations. However, there exist various analytical methods that can give approximate solutions and provide a useful alternative to the more involved numerical integration of the gas dynamics equations. Analytical methods can also render the physics of the problem more transparent.

The material in this book is largely based on a course on shock dynamics that the author gave periodically since the 1970s. The objective of that course is to discuss the fundamentals of the non-steady gas dynamics and shock waves, where relatively few books on the subject are available. The choice of topics is that of the author and emphasis is placed on presenting the basics of gas dynamics. Thus, relatively few practical problems and numerical results are given, and sample problems are only used to serve as illustrations of the method.

Although the works of numerous authors are reviewed and developed upon, the book neither gives a comprehensive review of the extensive literature on the subject nor provides a detailed bibliography. It is felt that references can readily be obtained via an internet search. The few references that are given are mostly limited to the few early studies where the method was developed.

The author is extremely grateful to Dr. K. Ramamurthi who made valuable contributions and carried a very thorough reading of the manuscript. Dr. P. Thibault and Mr. M. Gaug also carried out proof reading of the manuscript. Drs. Qin Hui and Li Jian carried out the difficult task of typing the manuscript from the author's handwritten draft.