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Book Reviews

Dynamics of Exothermicity

Edited by J. Ray Bowen, Gordon and Breach, Amsterdam, The Netherlands, 1996, 376 pp., $110.00

This book contains a collection of papers written by colleagues, former students, and friends of Tony Oppenheim. The papers have been prepared in celebration of his 80th birthday and of the 50th anniversary of his being awarded the degrees D.I.C. from Imperial College and Ph.D. from the University of London. The book starts with a biography of Tony Oppenheim. It describes his professional career, starting as a reader at the City and Guilds College and climbing to the rank of Professor at the University of California, Berkeley. It also gives an account of the organization and launching of ICDERS (the International Colloquium on Dynamics of Explosions and Reacting Systems), which was started following an informal gathering at the site of Tony's detonation laboratory at Berkeley in 1966. Tony was an executive cochairman of the colloquia for its first 20 years. Also recorded are the various awards given to Dr. Oppenheim, a brief description of his professional activities, and a list of the M.S. and Ph.D. students that he has supervised over the years. The book ends with his bibliography, which through 1995, includes 215 archival publications.

The book is divided into two parts that reflect the two main research areas of Oppenheim. It contains a total of 14 articles written by 23 authors in addition to the introductory remarks by R. Bowen, who received his Ph.D. degree working with Oppenheim. The Introduction highlights Tony's contributions in the gasdynamics of combustion, detonations, and turbulent combustion and gives a brief account of the various contributions to this volume.

Part One, Dynamics of Reactive Systems, contains 11 articles. P. S. Barsanti, K. N. C. Bray, and R. S. Cant discuss the development of obstructed explosions in a confined environment. The evolution of the turbulent flame is followed based on a numerical simulation that uses a Reynolds stress second-order moment closure. The article by R. W. Bilger points out the difficulties associated with second-order closure of the Reynolds averaged equations for chemically reacting flows. Bilger then describes the conditional moment closure method, which effectively decouples the reaction kinetics from the flow and mixing processes, thus taking advantage of the knowledge and understanding of mixing processes in nonreacting flows. The use of asymptotic methods with reduced chemistry for predicting pollutant production in turbulent combustion is described by F. A. Williams. The article centers on pollutant production in the reaction-sheet regime of turbulent combustion, so that the emphasis is on the structures of the flamelets and how the pollutants are produced in these laminar flamelets. Numerical simulations of spatially developing mixing layers are presented by M. S. Soteriou, O. M. Knio, and A. F. Ghoniem based on a transport element method. The article describes the numerical scheme, which is an extension of the vortex element method that incorporates density variations and scalar transport, and presents results that illustrate the consequence of these effects. Remarks on the various methods used for modeling turbulent flows are made by A. Chorin, who also identifies the shortcomings of the different methods. A series of experiments is presented by P. Wolanski, showing the advantage of pulsed jet ignition, suggested by Oppenheim, over conventional spark ignition systems. The author discusses the potential application of the method to internal combustion engines. K. H. Homan and H. G. Wagner review recent results on soot formation. The article provides an overview of the processes that lead to soot and identifies the influence of pressure on its formation. S. S. Penner identifies the advantage of incineration over other disposal techniques of waste management. He outlines some of the combustion research opportunities related to waste incineration. The application of an arc discharge device for injecting a controllable oscillation into a combustion system is discussed by N. Kidin, J. P. Roberts, and M. L. Vuillermoz. The method is used to determine stability characteristics of the system. The article also summarizes recent work on the mechanisms that cause acoustic oscillations within the combustion process. The nonlinear distortion of an inviscid planar liquid sheet injected into a gas of negligible density is presented by W. A. Sirignano and C. Mehring. The analysis is based on a long-wave theory and focuses on traveling wave solutions.

Part Two, Dynamics of Explosions, contains four articles. E. S. Oran reviews the work performed at the U.S. Naval Research Laboratory on numerical simulation of the structure of detonation waves. The article provides an overview of the numerical techniques that have been used in the laboratory and illustrates through a series of simulations the ignition, propagation, and quenching of detonations. A. L. Kuhl describes the turbulent mixing that occurs in the fireball created by the detonation of a spherical HE charge. He uses a convective mixing model to simulate numerically the compressible turbulent flow at high Mach numbers. The article by J. H. Lee describes the physical phenomenon of the critical tube diameter problem for gaseous explosives and reviews existing theories on the subject. Explanations of

the possible mechanisms responsible for the existence or breakdown of the empirical relation between the critical tube diameter and the cell size, known as the 13λ correlation, are given. The last article, by J. C. Broda and E. K. Dabora, describes some recent experimental results on oblique detonations. The article describes the technique used to generate the oblique wave and reports on the observations of the transverse wave structure behind the detonation.

Some of the articles in this book provide an overview of the subject matter and will therefore be useful to graduate students and researchers in combustion as an entry into the latest developments in the field. Other articles are much narrower in scope, and the reader will need to search the literature for a more complete account of the subject. Nevertheless, the book as a whole provides an up-to-date look at some of the topics that have been Oppenheim's lifelong research interest.

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Advances in Turbulence VI

Edited by S. Gavrilakis, L. Machiels, and P. A. Monkewitz, Kluwer Academic Publishers, Dordrecht, The Netherlands, 1996, 627 pp., $257.00

This volume is, like its immediate predecessors, attractively and densely bound and provides an important "1996 snapshot" of turbulence work in Europe (inclusive of the United Kingdom). The European designation is based on the authors list in which the 178 contributions are derived from a European affiliation except for those from the United States (8%), Israel (3%), Japan (2%), Australia (2%), and New Zealand (1%). The 178 contributions are represented as brief communications (invited, eight pages; contributed, four pages; and poster, two pages). The bound volume was made available before the July 1996 sessions; hence, there is no reporting of the discussions that would have accompanied the presentations. The papers are arranged into the broad categories of Numerical Simulation and Modeling of Turbulence (25), Coherent Structures and Vorticity (18), Industrial and Environmental Applications (11), High Reynolds Number Turbulence and Intermittency (26), Compressible Turbulence (6), Transitional and Dynamical Systems (31), Experiments and Novel Experimental Techniques (36), Turbulence in Multi-Phase Flows (10), and Turbulent Mixing (15).

The editors observe that a primary contribution of this volume is its communication of the interests and current activities of the collected authors. This reviewer strongly agrees. It was a pleasure to sample the work of so many research groups and to be made aware of the sources for more information than can be communicated in the noted page limits.

The invited contributions were well selected. Their coverage and information content will be of interest to those in the turbulence community. This reviewer found many of the other papers to be of quality and interest similar to those that were in the invited category.

The European turbulence conferences continue to be a vital part of the international turbulence community's communication of its leading-edge efforts.

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