
PREFACE

Research on advanced propulsion has got several new focuses during the past several decades. One of them is the use of pulse detonations for producing enhanced thrust at both static and dynamic conditions. Thermodynamically, there are no doubts that detonation provides the best thermal efficiency of combustion in terms of minimal entropy of the exhaust jet. Based on this, a number of diligent efforts have been undertaken to show that proper utilization of the operation cycle does result in improved performance, in particular, for highly detonable gaseous fuel–oxygen mixtures. Transition to more realistic fuel–air mixtures poses, as expected, many problems. Some of the arising problems are akin to those typical of chemical propulsion. However, there are several issues that represent new scientific and technological challenges. The success in resolving these problems will determine the implementation of pulse detonation propulsion.

The recent interest in air-breathing and rocket pulse detonation engines (PDEs) has added new dimensions to the studies of detonation physics. Numerous new investigations on gas-phase and spray detonations have been started all over the world, in particular pertaining to detonation control and the effects of confinement. This is evident from the formation of collaborative teams by industry both in the U.S. and in Europe and sponsored research worldwide. Dedicated technical meetings and sessions on PDEs in combustion-related conferences are becoming very popular.

The U.S. Office of Naval Research (ONR)* and the Russian Foundation for Basic Research (RFBR) are among the principal sponsors in fundamental research on detonation. The International Colloquia on Advances in Experimentation and Computation of Detonations, held in 1998 at St. Petersburg, Russia, jointly sponsored by these organizations in association with ONR International Field Office — Europe, European Research Office of the U.S. Army, and Enas — Research & Education Co., and on Control of Detonation Processes, held in 2000 at Moscow, Russia, jointly sponsored by these organizations in association with ONR International Field Office — Europe, European Research Office of the U.S. Army, and the Scientific Council on Combustion and Explosion of the Presidium of the Russian Academy of Sciences, have further strengthened the awareness of this forefront in science and technology, and provided a forum for dialogue among specialists.

*The content of the information does not necessarily reflect the position or the policy of the United States Government and no official endorsement should be inferred.

In the current concepts of practical PDEs, confinement plays a very significant role. To concentrate on this issue, an International Colloquium on Advances in Confined Detonations has been organized. This Colloquium was sponsored by the U.S. ONR, ONR International Field Office — Europe, RFBR, and the Scientific Council on Combustion and Explosion of the Presidium of the Russian Academy of Sciences. The international scientific community responded overwhelmingly with over 50 papers from 9 countries. The extended abstracts of all presentations have been published earlier*.

This volume contains full manuscripts of selected contributions presented at the Colloquium. The articles were selected based on these criteria: their direct relevance to the topic, their significance, and international representation. The articles were thoroughly edited and organized in a uniform and easily readable manner with three parts: (1) Confined Deflagrations and Detonations; (2) Pulse Detonation Engines; and (3) Avenues of Future Research. In addition to new results and findings, the book includes critical analyses of previous studies and controversial aspects of confined detonations and numerous references to archival publications worldwide. The volume is prepared as a reference for practicing engineers and research scientists working in the field of combustion and propulsion.

This volume is the outcome of hard work of a number of people who have rendered their best, and we appreciate their contribution. The editors acknowledge the concern and diligence of the Torus Press staff. We thank all authors for preparing their papers and spending their time and efforts with the editors on improving the text, figures, and scope of their contributions to fit with the overall goals of the book.

Many thanks are due to Academician A.G. Merzhanov, Academician V.A. Kabanov, and Prof. A.A. Berlin for their valuable contribution to the organization of the Colloquium. We do hope that this book will contribute to transitioning the knowledge on detonations science to technology and applications.

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*Roy, G., S. Frolov, R. Santoro, and S. Tsyganov, eds. 2002. *Advances in confined detonations*. Moscow, Russia: Torus Press.