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Volume 1

Progress in
Propulsion Physics

Edited by

Luigi T. DeLuca
Politecnico di Milano, SPLab
Milan, Italy

Christophe Bonnal
Centre National d'Etudes Spatiales
Evry, France

Oskar Haidn
Institute of Space Propulsion, DLR
Hardthausen, Germany

Sergey M. Frolov
N. N. Semenov Institute of Chemical Physics
Moscow, Russia



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PREFACE

This first volume of the EUCASS Book Series on Advances in Aerospace Sciences is dedicated to Propulsion Physics and includes a collection of the best papers presented at the 2nd European Conference for Aerospace Sciences held in Brussels, Belgium, July 01–06, 2007. About 1/3 of the total number of papers accepted for presentation at the conference was later selected by the volume editors and successively edited by an international body of peer reviewers. The current book is the product of this long review process.

Efforts were accomplished to make the EUCASS conference results readily and easily available to a wide range of international readers. Yet, all technical facts, from paper presentations to written diffusion of results, are carried out under highly professional standards. The attendance of worldwide renowned speakers and timeliness of the session topics prove the effectiveness and success of the EUCASS initiatives.

The final selection of the topics as well as the contributions to this book are based on the philosophy that important issues of aerospace science and technology have to be covered and that both timeliness and originality of each individual contribution are guaranteed. A rigorous review process involving renowned experts in the different fields assured the high standard of each chapter.

The volume includes eight chapters covering most of the traditional aspects in aerospace propulsion as well as several innovative ones:

- Chapter One: Solid Rocket Propulsion;
- Chapter Two: Liquid and Gelled Rocket Propulsion;
- Chapter Three: Fluid/Structure Interactions in Space/Launch Vehicles;
- Chapter Four: Pulsed/Continuous Detonation Propulsion;
- Chapter Five: Electric Propulsion for Spacecraft;
- Chapter Six: Airbreathing, Turbomachinery, and LAPCAT;
- Chapter Seven: Ceramic Matrix Composites for Aerospace Applications;
- Chapter Eight: Engine Health Monitoring.

The large number of contributions in the solid propulsion chapter clearly indicates the dynamic in this field which stems from launcher, in-space, and missile propulsion applications. While the majority of the contributions deal with metal burning, in particular, nanoaluminum, and environmentally friendly formulations, the fundamental aspects of composite propellant modeling and radiant ignition were also treated.

In liquid propulsion, all typical phenomena such as injection, ignition, combustion, heat transfer, and combustion stability are covered, with reference mainly to cryogenic bipropellants. However, two contributions which discuss various effects of gelled propulsion demonstrate the new interest such propellants have seen recently.

Rising interest in exploration and propulsion system being capable of multiple ignition is represented with contributions discussing fluid/structure interaction and, particularly, the behavior of a liquid propellant in a tank.

Contributions which present the most recent results from research into pulsed and continuous detonation propulsion systems demonstrate that this exciting new technology has made great progress and will see flight applications soon.

Conventional Hall thrusters but also novel propulsion concepts such as microdischarge, hybrid, and microwave thrusters are discussed in the electric propulsion chapter.

In the air-breathing chapter, supersonic propulsion dominates with an overview of the EU-LAPCAT program on supersonic civil transport research efforts. However, aspects of reusable launch vehicles, combined cycle concepts, micro gas turbines and turbomachinery are discussed as well.

While ceramic matrix composites have until recently only been thought applicable in aeronautic applications, the contributions report results towards attempts to realize the advantages of reduced weight and increased thermal resistance also in liquid propellant rocket engine applications.

The importance of system and component reliability is stressed by the contributions in the engine health monitoring chapter looking, in particular, into a novel algorithm of engine condition monitoring and nonintrusive diagnostics of components exposed to high temperatures.

To easily identify the material of interest, the reader is invited to consult the brief paper summaries compiled at the start of each of the eight chapters. At the end of the book, an author index is provided for the sake of reader's convenience.

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members of the Organizing Committee;
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 all conference participants including speakers, observers, and session chairs.

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The present book would not have been possible without the support and careful work of the international college of reviewers purposely nominated for this task. The quality of any scientific book is largely due to the will of reviewers to share their expertise and knowledge with colleagues from all over the world. As a minor token of the editors appreciation for their diligence and work, the names of all contributing reviewers are listed hereafter: William Anderson (USA), Dana Andrews (USA), Alice I. Atwood (USA), Valery A. Babuk (Russia), André Beaurain (France), Ivan Bekey (USA), Nicolas Bérend (France), Luca Boccaletto (France), Thom Boggs (USA), Alan Bond (UK), Christophe Bonhomme (France), Claudio Bruno (Italy), Michel Buchwalter (Germany), Anne Cadiou (France), Max Calabro (France), Osvaldo Campanella (USA), Nicolas Carrère (France), Leonard H. Caveny (USA), Nathalie Cesco (France), Elisa Cliquet (France), Bernard Desmet (France), Michel Dudeck (France), Peter Erichsen (Sweden), Debra Facktor-Lepore (USA), François Falempin (France), Pascal Fortunier (France), Octavia Frota (Portugal), Oleg Glotov (Russia), Nick Glumac (USA), Josef Görgen (Germany), Oleg Gorshkov (Russia), Alexander Gromov (Russia), Michel Gruslin (Belgium), Mohammed Habiballah (France), Stephen Heister (USA), Patrick Hendrick (Belgium), Alessandra Iannetti (France), Charles Kappenstein (France), Vladimir Kim (Russia), Paul Kuentzmann (France), Renaud Lecourt (France), Peter Lee (UK), David Lempert (Russia), José Longo (Germany), Agnes Luc (France), George Manelis (Russia), Stéphane Mazoufre (France), Hugh McSpadden (USA), Chuck Merkle (USA), Claude Merrill (USA), Philippe Novelli (France), Michael Oswald (Germany), Bryan A. Palaszewski (USA), Gary Popov (Russia), Benoît Pouffary (France), Geoff Searby (France), Valery Sinditskii (Russia), Martin Sippel (Germany), Nadezdha

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This volume is the outcome of hard work of the staff of TORUS PRESS Publishers (www.torus-press.ru) and their valuable contribution is appreciated.

We sincerely wish that this joint international effort will help all readers to gain a better understanding of aerospace propulsion, and to further appreciate and widen the fascinating horizons of the aerospace world.

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