

Preface

Combustion is present continuously in our lives. It is a major source of energy conversion for power generation, transportation, manufacturing, indoor heating and air conditioning, cooking, etc. It is also a source of destructive events such as explosions and building and wildland fires. Its uncontrolled use may have damaging health effects through contamination of air and water. While combustion has helped humanity to prosper greatly, particularly with the use of fossil fuels, its indiscriminate use is altering the current global ecological balance through contamination and global warming. Thus, it is natural that combustion concerns people of all education levels, and it is important that the subject of combustion is taught at several levels of technical depth in schools and colleges.

Combustion is an interdisciplinary field with the interaction of thermodynamics, chemistry, fluid mechanics, and heat transfer, and, consequently, difficult to describe in simple terms and in a balanced manner between the different basic sciences. Many of the books currently available in combustion are geared to researchers in the field or to students conducting graduate studies. There are few books that are planned for teaching students that are not advanced in their technical studies. It is for this reason we have written this book aiming at readers that have not been previously exposed to combustion science, and that is at the undergraduate college level. We have often traded accuracy in our description and explanation of combustion processes for simplicity and easiness of understanding. Our readers should have knowledge of basic sciences, but are not necessarily advanced in their studies.

The book is based on lectures given by the authors through the years in a senior elective undergraduate combustion class in the Department of Mechanical Engineering at the University of California, Berkeley. The organization of the book chapters follows more or less those of other combustion textbooks, starting with a review of thermodynamics, chemical kinetics and the transport conservation equations. This is followed with chapters on the basic concepts of ignition, premixed and non-premixed combustion, and a chapter on emissions from combustion. The application of these basic concepts in practical combustion systems is implemented in a chapter devoted to internal combustion engines. Examples of problem solutions of different combustion processes are given through the book to help the student understand the material. A few problems are also given at the end of the different chapters.

In addition to the traditional class lectures, the course has a weekly demonstration laboratory where the students are exposed to the actual combustion processes presented in class.¹ We feel that these demonstration laboratories are very valuable to the students since they help them visualize the somewhat abstract concepts presented in class. For this reason, we have included as an appendix a description of several of the laboratories used in the class together with videos of some of the lab experiments to help a potential user of the book implement the laboratories.²

Finally, we would like to thank the graduate students that through the years have helped us as Teaching Assistants of the course and have helped us refine our class notes, and the Mechanical Engineering technical staff for the invaluable help running the demonstration laboratories. Our special thanks goes to Anthony DeFilippo for his unconditional help in commenting about the content of the book and revising and editing each chapter.

¹Labs are located on Springer Extras at <http://extras.springer.com/2011/978-1-4419-7942-1>

²Links to laboratory video demonstrations are located in each lab. Readers can also find them at <http://www.youtube.com/user/FndmtlsofCombustion>

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Fundamentals of Combustion Processes

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2011, XXIV, 304 p. With online files/update., Hardcover

ISBN: 978-1-4419-7942-1