## Review of:

## Rocket Propulsion Elements, Seventh Edition

George P. Sutton, Oscar Biblarz Wiley-Interscience [ISBN 0-471-32642-9] 2001

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The seventh edition continues the high standards of this long-running text. The analysis, although a little sparse, is clearly presented. As in the previous editions, there is an abundance of figures and tables. And there is much information on practical design and operation issues. These features make this book suitable for undergraduate and graduate instruction as well as highly useful for practicing engineers.

The book's twenty chapters form four substantial major groupings. Chapters 1 to 5 provide, in order, introductions to rocket propulsion methods, terminology, fluid mechanics, rocket flight performance and chemistry. The chapter on heat transfer that appeared in the introductory material of previous editions has been removed with some of its material merged into other sections of the book. Chapters 1 and 5 are particularly helpful in teaching rocket propulsion to undergraduates who have had basic thermodynamics and compressible flow.

The second portion of the book, Chapters 6 to 10, discusses liquid propellant engines. Chapter 6, concerning fundamentals, contains many rather different topics and, as such, does not flow as smoothly as other chapters. The information is quite useful, but disjointed. Chapter 7, in contrast, is a focused discussion of liquid propellants. A large number of propellants are described in a way such that even those of us who are not chemists can easily understand. Real world issues posed by propellants are well presented. Thrust chambers are the topic of Chapter 8. Much of the information on heat

transfer now appears in this chapter. There are nice worked examples and some particularly good problems at the end of this chapter. Chapter 9 presents a brief, mostly qualitative discussion of combustion where combustion instabilities receive a nice introduction. Chapter 10 covers turbo pumps and various design and operational issues. The discussion of turbopumps is perhaps overly brief. The design and operational issues are discussed in a qualitative, but quite practical and useful manner.

Solid propellant motors are the subject of the third major subdivision, Chapters 11 through 14. Chapter 11, fundamentals, concentrates on grain burning, structure and stress and is a very thorough presentation. The discussion of solid propellants, Chapter 12, mimics the earlier discussion of liquid propellants in its detail, clarity and practicality. Solid propellant combustion and motor design are treated in a well-illustrated, but mostly qualitative fashion in Chapters 13 and 14. Excellent examples of the illustrations are given by two figures in Chapter 14 showing throat components and erosion and temperature measurements for the Space Shuttle reusable solid rocket motor.

The final major grouping is formed by Chapters 15 to 20. This subdivision introduces two other propulsion methods (hybrid and electric) and four ancillary issues important to rockets. Chapter 15 (supported by two appendices) provides a very nice introduction to hybrids. Working equations for performance estimation are developed and then demonstrated in a thorough example. Combustion instability is given extended consideration. Chapters 16 to 18 discuss, in order, thrust vectoring, systems selection, and exhaust plumes. These are primarily qualitative, but well supported with figures, tables and practical information. Chapter 19 introduces electric propulsion. Like the earlier discussions of propellants, the presentation is lucid and well illustrated, so that those of us who are also not physicists can easily understand. Chapter 20 concludes the text with a brief look at the issues involved in rocket testing, with special emphasis on safety.

The only disappointing feature of this text is the appendix. It would be very helpful for the book to include thermochemical data to support Chapters 5, 7, 11 and 12.

Overall, this book provides a wealth of information in a very readable format. It is a text that anyone concerned with or interested in rocket propulsion should have.