

Book Reviews

The Space Environment and its Effects on Space Systems

V.L. Pisacane

American Institute of Aeronautics and Astronautics, 1801 Alexander Bell Drive, Suite 500, Reston, VA 20191-4344, USA. 2008. 421pp. \$64.95 (AIAA Members), \$94.95 (Non-Members). ISBN 978-1-56347-926-7.

I enjoyed looking at this book. It provides an excellent introduction to the many diverse elements that make up the space environment and that all need to be understood in order to successfully operate space missions. It addresses the needs of several audiences including both engineers who want to gain substantial knowledge of the physics behind space environment phenomena and scientists who want to understand how this physics helps us understand many practical problems of spacecraft design and operation.

The book starts by setting the context through a review of the problems posed by the space environment and the ways these risks are managed and through two chapters that outline the major features of the Solar System. This includes the Sun, which is the energy source that drives most space weather, and the solar wind, which conveys much of that energy to Earth.

We then move to the heart of the book: a series of chapters that discuss different aspects of the space environment. The coverage is comprehensive. It provides extensive discussion of the physical processes that take place in the space environment including (a) the fundamental forces (electromagnetism and gravity) that control the environment and (b) the interactions of plasma and radiation environments with space systems. These generic aspects of the environment are complemented by chapters that focus on specific regions/phenomena including magnetospheres (mainly focused on the Earth's magnetosphere but with some information on those of other planets), the neutral environment in the upper atmospheres of Earth and other planets, and the micro-particle environment due to meteoroids and space debris. The book also includes two chapters covering the problems of spacecraft contamination and thermal control. These are not often included in space environment studies and their inclusion here is to be welcomed. They add significantly to the breath of view that the book provides.

The level of presentation is well-pitched throughout the book. There is a strong emphasis on physical understanding under-

pinned by mathematical representation and manipulation. This book is an excellent source for information on the space environment. It will be useful at all levels from advanced students to experienced scientists and engineers. I recommend it to any space professional who wants to learn more about this aspect of space activities.

Dr Mike Hapgood

Analyses for Durability and System Design Lifetime: a Multidisciplinary Approach

J.H. Saleh.

Cambridge University Press, The Edinburgh Building, Shaftesbury Road, Cambridge, CB2 2RU. 2008. 201pp. £45. ISBN 978-0-521-86789-4.

The author addresses the durability and design life aspects of system design, considering the 'technicalities', marginal costs, and complex systems aspects in which external factors such as competition, other market factors and obsolescence might be involved. He discusses philosophical and qualitative aspects, as well as presenting methods for quantitative analysis.

There is a brief philosophical discussion on the generality of the term 'durability', but the discussion of 'technicalities' does not include any specific scientific or engineering treatment of actual processes that influence durability or life, such as wear, material fatigue, corrosion etc. The main chapters discuss optimal durability, the history of the economic study of the subject, cost analysis methods and methods for analysing complex systems.

Simple examples are provided to illustrate the ideas: razor blades and light bulbs. A space satellite system is used as the example for more detailed analysis, including features like battery life, solar panel life and propellant reserves.

The author includes a philosophical discussion of the concept of Oliver Wendell Holmes' 'One Hoss Shay', the imaginary design in which every component lasts exactly the same time before they all fail simultaneously. He gives one explanation why this is impossible, in practical terms. However, neither here, nor in the main parts of the book, does he discuss or take account of the inherent uncertainty of much engineering design for durability and life. Uncertainty, often very wide, is the reality of

much modern engineering, so any quantitative analyses should include the sources of these and their likely magnitudes.

Patrick O'Connor CEng, MRAeS

Composite Materials: Design and Applications – Second edition

D. Gay and S.V. Hoa

CRC Press, Taylor and Francis Group, 2 Park Square, Milton Park, Abingdon, Oxon, OX14 4RN UK. 2008. 548pp. Illustrated. £39.99. ISBN 1-4200-4519-9.

Undergraduate students, composite designers and engineers will find this book to be very appealing. The concepts governing Materials Science of composites have been effectively reduced to major concepts and keywords, thus allowing examples and composite design key questions to be answered in this comprehensive composite design manual. The book is visually rich, with abundance of excellent illustrations related to composite properties, concepts and applications. Composite materials in aerospace structures are given a particular attention, with examples covering a wide range of aerospace composites, including civil aircraft, military jets and future supersonic aircraft structures.

The book consists of four parts; the all-inclusive Part I connects the micro-world of composite constituents with their numerous applications and properties, by portraying the most important design principles. Part II covers the essential composite laminate theory, including failure criteria. Part III conveys the major strength of this book, by presenting detailed stress-analyses of composite beams under flexure and torsion and flexure of thick composite plates. Finally, Part IV presents composite materials design of no less than 43 engineering applications such as transmission shafts in trucks, space shuttle manipulator arm, wing spar, sailboat shell and many other similar engineering designs which can be effectively applied to projects in composite materials courses.

The information is readable, easily absorbed and can be immediately applied to specific engineering designs and problems without expanding one's attention to non-specific theory. Among the similar titles, this one stands out as a one-stop-shop for composite design instructions and applications.

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