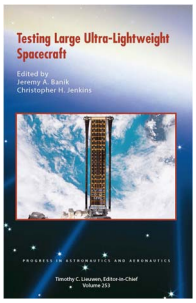
The reviewer now has two points to make: The reader should note the Principle of Virtual Work enables the Smiths lazy tongs, Example 17.7, to be solved in two lines. This statement of fact prompts the reviewer to suggest that the reader draw a free body diagram (see Section 2.4) and verifies the result obtained by the author. But more important the reader should ask the question: can the Smiths purchase be further enhanced by addition of further stages? This is the type of question the authors should be asking.

Although this book presents over 300 worked examples, which a few students may find useful, there are far too many inaccurate line diagrams (which should have been spotted and corrected prior to publication) to make this text a serious contender for widespread use. The general level of text is narrow, repetitive and barely stretches the mind beyond A Level applied maths. There are in fact so many examples relating to incline planes, ladders and hypothetical pulley block configurations that a cynic might conclude the authors are more interested in calculating forces relating to apparatus dating back to the pyramid/cathedral building age, than in addressing basic engineering problems of contemporary relevance and interest.

The authors' early thoughts on how best to teach the subject have not been fulfilled.

Peter C. Gasson, CEng, MIMechE, FRAeS



Testing Large Ultra-Lightweight Spacecraft. Progress in Aeronautics and Astronautics series – Vol 253

Edited by J. A. Banik and C. H. Jenkins

American Institute of Aeronautics and Astronautics, Reston, VA, USA 2017. Distributed by Transatlantic Publishers Group, 97 Greenham Road, London, N10 1LN, UK. £116. (20% discount available to RAeS members on request; email: mark.chaloner@tpgltd.co.uk). ISBN 978-1-62410-464-0.

Testing Large Ultra-Lightweight Spacecraft is the third book from the co-editor C.H.M. Jenkins in the AIAA Progress in Aeronautics and Astronautics series on the topic of large ultra-lightweight spacecraft (LULS) structures, otherwise known as gossamer structures. It follows *Gossamer Spacecraft: Membrane and Inflatable Structures Technology for*

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Space Applications (2001) and *Recent Advances in Gossamer Spacecraft* (2006). The characteristics of the LULS family are difficult to define precisely, but Jenkins suggests that a typical member will have an areal density of less than $1kg/m^2$ when deployed and a high deployed to stowed volume packaging ratio. Typical members of the LULS family include inflatable structures, space sails, coilable or reliable booms and a large variety of deployable reflectors.

The current volume addresses one of the most challenging aspects of developing LULS structures – that of assessing structural characteristics and performance on the ground. The broad definition of the LULS family prohibits a precise step-by-step approach to be captured in a single volume. The book does not attempt to provide a standard for testing large deployable structures on Earth, but rather seeks to document the various, and sometimes unique, techniques that have been employed to date, providing 'rules of thumb' where appropriate. The book's authors use a large number of examples from current and historic missions, drawn mostly from American and a small number of Japanese and European programmes.

Thoroughly researched with well-organised chapters, the book will be of real use to researchers and engineers in the spacecraft structures industry, as well as to students exploring the topic. The book starts with a chapter on structure classifications and test philosophy, followed by four chapters covering specific aspects of ground-based testing: gravity offloading, deployment motions and forces, deployment repeatability and structural dynamics. The final chapter addresses spaceflight testing, drawing on the results of 22 major spaceflight tests since 1990 involving LULS structures. An unconventional feature of the book is a series of interviews with Dr Costas Cassapakis, Robert Freeland and Dr Martin Mikulas that appear as appendices.

The large number of practical examples given throughout the book makes it a particularly worthwhile read for anyone planning a lightweight space structure test campaign, as the reader is very likely to benefit from the many inventive approaches to testing documented within.

Dr Andrew Viquerat

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