This book brings together contributions from thirteen leading experts in the subject from all over the world and forms the second half of a pair of books, the first being *Bistatic Radar: Principles and Practice* published by Wiley in 2007. Dr Cherniakov, who leads a group at the University of Birmingham which has done pioneering work in this field, is well qualified to edit these books.

The book is organised in ten chapters. Emphasis is given to two principal aspects of the subject: bistatic synthetic aperture radar and passive bistatic radar. The first of these allows the formation of high-resolution radar images from aircraft-borne or satellite-borne platforms; the second exploits signals from broadcast, communications or radionavigation transmissions, giving in effect a passive, completely covert radar system, that is also able to use parts of the electromagnetic spectrum (such as VHF or UHF) not usually available for radar applications.

The style of the book is clear and authoritative, with an appropriate level of mathematical detail and excellent use of diagrams to explain complicated concepts. Since it contains a wealth of new information, new results from practical systems and a large number of up-to-date references, the book will be of great value to researchers in this subject in university and industrial laboratories.

Professor H.D. Griffiths, FREng, FIET, FIEEE

Atmospheric and Space Flight Dynamics: Modeling and Simulation with MATLAB and Simulink

A. Tewari

Birkhauser Verlag, Viaduktstrasse 42, CH-4051 Basel, Switzerland. 2007. 556pp. £60. ISBN 978-0-8176-4437-6.

This book is remarkable due to its coverage, both in topics and levels, of the many fields indicated by the title.

Chapter 1 is an introduction whilst Chapter 2 covers kinematics expressed in conventional vector and matrix forms. It also deals with the Gibbs vector and quaternions. Chapter 3 is a brief introduction to gravity and non-spherical planetary shapes. Chapter 4 deals with the basic Newtonian dynamics of particles, groups of particles and, in particular, two-body problems. Chapter 5 takes the reader into orbital mechanics and Chapter 6 deals with perturbed orbits. Chapter 7 covers the classical three body problem ending with the numerical solution of the restricted problem. Chapter 8 deals with rocket propulsion for multi-stage and optimal rockets.

The book now continues with discussion of the properties of the atmosphere and moves on to concepts of aerodynamics. The next topic is air-breathing propulsion from propeller driven to scramjets. This now leads on to trans-atmospheric trajectories, which is regarded as the heart of the book. Chapter 13 is devoted to rigid body dynamics and its application to attitude dynamics. The last two chapters cover attitude control systems followed by advanced numerical modelling.

There are many worked examples and applications of MATLAB and Simulink to help give practicality to the theory. It is not possible to verify all the equations, almost 400, but the final results appear to be accurate. However, there are just a few ambiguities in the use of symbols and terminology. Also the verbal description of the physics involved is not always as expected, especially in the field of aerodynamics.

Overall it is a book worth reading as it draws together most of the topics relevant to spaceflight.

Dr H. Ron Harrison, CEng, FRAeS

Materials and Process Selection for Engineering Design – Second edition

M.M. Farag

CRC Press, Taylor and Francis Group, 2 Park Square, Milton Park, Abingdon, Oxon, OX14 4RN, UK. 2008. 432pp. Illustrated. £34.99. ISBN 1-4200-6308-1.

Dr Farag introduces his subject by first describing the organisational aspects of product design and development – an activity he sees as a formal decision making process. Vertical and horizontal (lateral thinking) is implied throughout but the iterative nature of design is not apparent.

Having set the scene in Chapter 1, the main text is presented in four quite separate parts: I Performance of Materials in Service; II Relationship Between Design, Materials and Manufacturing Processes; III Selection and Substitution of Materials in Industry; IV Appendices A, B and C.

The author assumes that readers have completed a first course in Materials Science but a consistent academic level is not maintained. To take but one instance: How many teachers of this subject would attempt to kick-start an elementary text by quoting the Griffith plane stress equation for 'glass'? Quite apart from the fact that calculating the surface energy lies beyond the immediate scope of the likely reader, the introduction of stress intensity factors K1 and Kc, four chapters ahead of the most basic (P over A) stress calculations, (in Chapter 6), is surely premature.

Chapter 3 – headed 'Environmental Degradation' – is not about degradation of the external environment per se, but about the corrosion, oxidation and abrasive wear of metals. Had the ins and outs of the Waste Electronic and Electrical Equipment Directive (WEEE), the Restriction of Hazardous Substances Directive (RoHS), and the Energy using Products Directive (EuP) been considered, the Chapter would have been correctly titled, but this is not to say a knowledge of corrosion, oxidation and abrasive wear is unimportant.

Chapter 4 'Selection of Materials to Resist Failure' touches on topics normally studied at first year level. The chapter contains numerous data tables which relate to common materials and their uses. The use of Performance Indices forms an important part of this chapter, but these are presented without proof and many readers will not have a clue: why it's S (for strength) in tension, $S^{2/3}$ in torsion, $S^{1/2}$ for a flat plate in bending or why it's $\pi^{1/2}$ in one equation and $\pi^{1/3}$ in another.

It has to be said that Part II is simplistic, and for the reviewer, disappointing. The most worthy part of Chapter 5 – 'The Nature of Engineering Design' – is a flow chart and supporting comment which shows design to be an interactive process, but few very basic numerical examples do not explain the true nature and aims of design. Chapter 6 – 'Effect of Material Properties on Design' – contains some useful data tables and closely related guidelines. Chapter 7 – 'Effect of Manufacturing Processes on Design' – amounts to little more than what a junior craft apprentice would have known as basic workshop technology and practice, some 50 years ago. The Index does contain a single entry for CAD/CAM systems, but CNC machining, rapid profiling, robots, flow visualisation (used in casting, forging and extrusion), all important topics, are not mentioned here.

Part III – 'Selection and Substitution of Materials in Industry' – begins at Chapter 8 and puts the author on firmer ground. The author's objective is to review ways of optimising priorities associated with what he calls custom made components. These, we are told, are components for which the cost distribution is approximately: 5% design, 50% materials, 15% labour, 30% overheads – a distribution which clearly excludes the manufacture of a watch and a military battle tank from the discussion. Material cost from ore preparation to final product is explained in detail. One graph

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shows (that although bauxite is far more plentiful than iron ore) processing aluminium to the ingot stage is ten times as expensive as processing steel. Economic influences such as supply and demand, order size, standardisation and inventory costs are covered, worked examples included. The economics of time saving devices, such as jigs and fixtures, are discussed in terms of dollar cost, but the cost benefits inherent in using capstan/turret lathes and CNC machining centres are again ignored. 'The Materials Selection Process' Chapter 9 – encourages the reader to initially scan candidate materials, processes and designs, by asking simple questions of the value analysis type. 'What is it?', 'What does it do?'. 'How does it do it?', 'How much should it be?'. After these simple questions have been asked and answered more formal procedures may be adopted. Procedures explained include: cost per unit property method, Ashby selection charts, Digital Logic, Analytic Hierarchy and Property Limits. The author explains and demonstrates the application of these methods using five fairly basic numerical examples.

How to make an existing product cheaper and hopefully better, by substituting one material for another is explained in Chapter 10. Older readers may recall how 40-50 years ago proven metal components, loaded in bending, were rashly replaced by geometrically identical parts, made from one or other of the latest plastics, without paying due regard for the ten-twenty fold higher flexibility of the new material.

The author rightly states that new materials have to be extensively tested before they are used for critical applications. The slow but successful inclusion of CFRP into aircraft structures is not directly mentioned but serves as a lesson to us all. In common with other chapters the text is well stocked with case studies – the most relevant to aeronautical readers being case study 10.4, pages 312-316. This study follows work by Shipp (1990) who analysed costs for aluminium alloy and CFRP spoilers for 737-200/300 aircraft at Boeing. Although material, labour and transition costs are dated the basic approach is valid and the conclusion drawn very much to the point.

The author uses more simple examples in Chapter 11, to illustrate how design and material selection processes interact. The first case study relates to a very basic turnbuckle design. The problem being to size the geometry in such a way that the best available material is used. Although practising designers might find the author's analysis laboured, the study serves to encourage the less well informed to do a few simple sums before committing dumb designs to the shops. Other examples include an interesting and informative study of a hip-joint prosthesis, a hydrodynamic journal bearing, a tennis racquet (second time round) and an automotive panel.

The author justly claims that Part IV, Appendices A, B and C provide reference information helpful to the reader. Appendix A contains 27 tables, which added to many lesser tables within the text provides a valuable and extensive source of useful technical data. Appendix B lists conversion factors for Imperial to SI units. Appendix C is a Glossary of over 300 technical terms. An Index of 300 column inches is provided.

Dr Farag is a recipient of the Egyptian State Award for promotion of science and the First Order of Merit in arts and sciences – he is clearly a highly respected teacher. The strength of his book lies in its many worked examples and review questions set at the close of every chapter. The material data provided is also excellent.

Peter C. Gasson CEng, MIMechE, FRAeS

Principles of Turbomachinery in Air-Breathing Engines

E. A. Baskharone

Cambridge University Press, The Edinburgh Building, Shaftesbury Road, Cambridge, CB2 2RU. 2006. 580pp. Illustrated. £70. ISBN 0-521-85810-0.

This book intended for students studying aerospace engineering and turbomachinery offers basic grounding in thermodynamics and fluid mechanics with a particular emphasis with the aerodynamic design of turbo-machines. The book's author Erian Baskharone has a substantial industrial and academic research background and this book benefits substantially from this combined competence. Of particular value to the reader, and especially to graduate students, are the very many examples and exercises offered supported by well documented solutions. The book also has a very large number of figures and diagrams clearly annotated and related to the text being addressed.

The author has a significant background in turbomachinery fluid induced vibrations, but this aspect is not addressed within this book which focuses on aerodynamic design. The author also has a substantial industrial background, particularly in small turboprop and turbofan engines gained from his time at Garrett Turbine Company (currently Honeywell Aerospace Co.) and this was clearly useful in the production of the book, even though it could be argued that more current, wider industrial examples may have added value to the nature of the text.

Besides fundamentals and principles of turbomachinery, there is a wealth of good advice on shaping and performance of components. Whilst there is much more information available within industry on axial-turbo machines, the information available on centrifugal machines is much more limited. Therefore, his very comprehensive treatment of centrifugal compressors and particularly radial inflow turbines will be of value to practising industrial engineers, providing them with one of the few, well documented, useful sources in this field. Regrettably, this reviewer is not entirely comfortable with the section on cooled radial inflow blading and would suggest that this information be used with some care.

For the graduate student, this well presented and structured book would be much more useful if read in conjunction with a good book on gas turbines and another on heat transfer which covered modern blade cooling techniques.

Professor Riti Singh CEng, FRAeS

Undergraduate research projects

A research project is often an important part of many university undergraduate courses. The Royal Aeronautical Society is occasionally approached regarding publication of papers from such projects in *The Aeronautical Journal*.

Our policy is that we welcome papers from any and every source, including papers resulting from undergraduate projects. In this case we would normally expect the papers to be submitted jointly with the supervisor and they would be exposed to exactly the same refereeing process as all the other papers received.

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