Book Reviews

The Aerodynamic Design of Aircraft

D. Kuchemann

American Institute of Aeronautics and Astronautics, 1801 Alexander Bell Drive, Suite 500, Reston, VA 20191-4344, USA. 2012. Distributed by Transatlantic Publishers Group, 97 Greenham Road London N10 1LN (Tel: 020-8815 5994; e-mail: mark.chaloner@tpgltd.co.uk). 564pp. Illustrated. £55. (20% discount available to RAeS members on request). ISBN 978-1-60086-922-8.

This is a new facsimile edition, in a slightly smaller format, of the classic textbook published by Pergamon Press in 1978, after the death of Dr Kuchemann in February 1976. He had been engaged in delivering a course of lectures to students at Imperial College, Aeronautical Engineering Dept., and this book is an expanded version of the notes for the course. Dr Kuchemann was in the final editing of the proofs when he died, and this process was completed by several of his colleagues.

For those not familiar with this classic text, the Author, sometimes referred to as the greatest aerodynamicist of his generation, has assembled a mass of detailed research material published up to the late 1970s – there are over 1,900 references to published reports and papers. More than this, the theme of the text is to place aerodynamics – with its associated fluid dynamics – at the forefront of aircraft design, asking 'What shape should an aircraft have to give certain desirable properties?'.

Throughout the author seeks to impart to the reader the idea of 'healthy flow' leading to sound and reliable design solutions which can be passed on to the designer who then produces the detailed design of the aircraft. Not only 'theoretical' but good experimental evidence is presented to this end and the arrangement of the chapters is logical and straightforward:

Chapter 1: 'Prolegomena'. The place of aircraft in the transport world and a general discussion of the need for research into theoretical and experimental methods, but always bearing in mind the physical realities of the flow.

Chapter 2: 'The Treatment of Airflows'. This deals with the Navier-Stokes equations and the simplifications that are needed to get meaningful results. Several types of flow are recognised and their applications to aircraft design are considered.

Chapter 3: 'Means for Generating Lift and Propulsive Forces'. Starting with the application of the momentum theorem, expressions for lift and drag are derived for practical cases of interest. These include aerofoils, wings of high aspect ratio with trailing vortex sheets, slender wings with non-planar vortex wakes and lifting bodies with shock waves.

The second part of this chapter deals with the generation of thrust forces for propulsion, in particular for air-breathing systems. Particular reference is made to the intake and nozzle for jet engines and fundamental concepts are introduced to be expanded later.

Chapter 4: 'Properties of Classical and Swept Aircraft'. Using the results for lift and drag derived from earlier chapters, it is found that a high aspect ratio is called for, an important result, reflected in the shapes of aircraft we see at subsonic speeds and typical values for maximum lift/drag ratio. These are combined with simple, statistically based estimates of weight of airframe and engines to show how the weight breakdown varies with range. The results of this simplified analysis are shown to give a good comparison with actual aircraft designs.

An extension to swept wings and the flows they generate occupies much of this chapter, and many experimental results are quoted to illustrate various effects. A further section is devoted to high lift effects and the effects of deflecting flaps and a discussion of swept wings in transonic and supersonic flow. There is a particularly interesting discussion of the effect of planform at supersonic speeds, covering swept wing plus body, integrated slender wings and 'oblique' or 'slewed' wings, such as were proposed by G. H. Lee and R. T. Jones in the 1960s.

Chapter 5: 'The Design of Classical and Swept Aircraft'. This is a detailed discussion of the above, starting with the design of aerofoils, then wings, then fuselages, going on to consider their combination, interference effects and so on. There is a brief treatment of non-uniform flows and the chapter concludes with a look at some propulsion problems. The speed range considered here is subsonic to moderate supersonic, but no hypersonic, which is treated later.

Chapter 6: 'The Design of Supersonic Slender Aircraft'. The aerodynamic design of this aircraft is radically different from that of the 'classical' layout, The reader is taken step by step through the aerodynamics of vortex flows and data are presented for the lift, drag and aerodynamic centre of slender wings, at low and high speed. At one time some data from the USA appeared to show that such wings were unstable in roll at quite low angles of attack; Kuchemann gives full credit to W. E. Gray, whose simple but compelling model experiments showed that this was very pessimistic and so cleared the path for the continuation of slender wing research. Again there is reference to propulsion and a brief comment on sonic bangs.

Chapter 7: 'Slender Aircraft for Flight at Subsonic Speeds over Short Ranges'. This starts with the concept propounded by S. B. Gates of 'Wraps for Air Travellers' in which cheap air transport is provided over short ranges for a mass of travellers. Subsequent studies had shown that comparable operating cost results could be found with aircraft differing from the classical wing plus body tail. One such was a low aspect ratio, thick wing aircraft with passengers seated within the wing, in a very compact layout. A case is made for a detailed study of the concept.

Chapter 8: 'Waverider Aircraft'. Starting with the premise that long ranges are to be flown in a relatively short time, this inevitably leads to the conclusion that hypersonic speeds of the order of Mach 4 and above are needed. Starting with simple cases of lifting bodies, the chapter discusses the possibilities for combining lifting and propulsive effects and some of the difficulties that may have to be tackled. One is left with the impression that there is a possibility here for fruitful investigation.

Chapter 9: 'Conclusions and Outlook'. In a final short chapter some of the basic precepts are reiterated – that for a successful design the physical flows must be stable and controllable. The requirement for reasonably short flight times leads to increasing speeds for longer ranges, which in turn implies different types of aircraft. As put down in this chapter… 'A whole spectrum of aircraft appears before us'. These remain to be explored, with aviation offering means for providing great technical and social prospects.

One might reasonably ask if a book written over 30 years ago could have any relevance today. Surely the science has moved on and different conclusions could be drawn. New methods have certainly been developed to increase the efficiency of aircraft and to reduce the cost of operating them, but physics has not changed and most of the basic premises in the book remain true. A copy should be on the shelf of every professional aerodynamicist, to be dipped into frequently, in order to perceive the wider picture. It is much more than just a textbook for students. When socio-economic conditions permit, further progress will be made and perhaps the idealistic forecasts in the final chapter of Kuchemann's book may start to appear.

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Spacecraft Charging

Edited by S. T. Lai

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Plasma, the fourth state of matter beyond solid, liquid and gas, provides a key component of the environment of spacecraft. It becomes important above 100km from the Earth's surface, and dominates the particle number density beyond ~500km. All orbiting, interplanetary and planetary spacecraft are thus immersed in plasma, but with quite different characteristics depending on both region and time, as related 'space weather' effects and the related low and high energy particle fluxes are highly variable.

Spacecraft charging can occur, driven by the balance of currents from the ambient plasma itself, from photoelectrons produced in sunlight and from secondary particles produced at the surface. The effects, which may drive the spacecraft positive or negative with respect to the surrounding plasma, depend critically on the spacecraft design and the region of space visited, and such charging has resulted in operational anomalies and some losses.

A sunlit spacecraft in low density and low temperature (a few eV) plasmas will float to a few volts positive, the precise level dependent on the ambient electron temperature; the major components in the current balance are ambient (more mobile) electrons and photoelectrons. The same spacecraft may be slightly negative in an ionosphere or several kV negative in eclipse with a keV auroral electron beam present. Clearly, this is a critical feature in scientific and commercial spacecraft design. For scientific spacecraft, charging will affect plasma measurements, and for all spacecraft, anomalies are possible. In our own work with Cassini, Venus Express, Cluster and others this requires important corrections to the particle data.

Another cause of anomalies and loss is penetrating radiation. This 'internal' or 'deep dielectric' charging may occur while a spacecraft is located in terrestrial or planetary radiation belt regions, or during solar particle events where MeV electrons can bathe spacecraft for up to a few days. Penetrating radiation can cause charge build-up, for example in coaxial cables, sometimes ultimately leading to a discharge, or may cause false counts in imagers and instruments. Clearly, these 'space weather' induced effects are an important part of spacecraft design, and something of a specialist area.

This book is an interesting collection of articles on spacecraft charging. The aim is to provide an introduction to spacecraft charging processes and to mitigation techniques. It starts with an overview and historical perspective chapter, then summarises the electron component of the currents arriving and leaving the spacecraft, moving to a chapter on charging and arcs in low Earth orbit, then surface charging and electrostatic discharges. This is followed by a chapter on simulations and another on charging in the auroral region; the last chapter is on internal (deep dielectric) charging. Each chapter is written by some of the experts in the field, so the information is accurate, useful and detailed. All of the chapters have a list of references for further reference.

Overall, the book is comprehensive and quite well presented although some of the illustrations are not reproduced very well in black and white or in the best resolution. The content is generally authoritative and will certainly be of use to spacecraft designers and engineers. I would have liked to see another chapter – an overview-style introduction to the space environment, including the ionosphere, Earth's magnetosphere, solar wind, space weather and planetary plasma interactions – to give some further context and background information. Nevertheless, as it stands this is a useful volume, containing many of the lessons learned on charging effects during the space age and the principles behind them.

Professor Andrew Coates, Mullard Space Science Laboratory, UCL

Welding and Joining of Aerospace Materials

Edited by M. C. Chaturvedi

Woodhead Publishing, 80 High Street, Sawston, Cambridge, CB22 3HJ, UK. 2012. 430pp. Illustrated. £155. ISBN 978-1-84569-532-3.

This collection of papers contains over 750 references and enough metallurgical information to impress and inspire the specialist researcher, while engineers, designers and mature students will learn much about the practicalities of joining materials.

Ten relatively new welding processes are reviewed in Chapter 1, 'New Welding Techniques for Aerospace Engineering'. Laser Beam Welding (as used by Airbus) and Blown Powder Direct Laser Deposition (as used to repair turbine seal segments) number among them. Chapter 2, 'Inertia Friction Welding for Aerospace Applications' – contains some mathematics relating to: heat generation, thermochemical modelling, micro structures and properties etc. In Chapter 3, 'Laser Welding of Metals for Aerospace and other Applications' is described as a high-power-density, low heat input, fusion process, which yields high aspect ratio welds with minimal distortion. State-of-the-art light amplification stimulated emission radiation (Laser) processes and sources are fully described.

Three integrated Laser/Arc/Plasma processes are discussed in Chapter 4, 'Hybrid Laser-Arc Welding of Aerospace and other Materials' – where it is said they offer: greater arc stability, deeper penetration and significant speed advantages over conventional methods. The authors report that although widely used for joining thick sections of plain carbon steel, these processes are not yet commercially viable for joining high strength aerospace materials. Heat Affected Zone (HAZ) Cracking in Welded Nickel Super Alloys is the subject of Chapter 5. The effect of carbon, sulphur, phosphorous, magnesium, zirconium and rare earth elements on HAZ is assessed.

The switch from welding to other joining techniques begins with Chapter 6 'Assessing the Riveting Process and Quality of Riveted Joints in Aerospace and other Applications'. The study investigates how variations in initial hole clearance/final interference, squeeze force and frictional force affect residual stresses. The laboratory processes described are high-tech, but only two piece lap joints, which transmit off-set loads through three in line countersunk rivets, are studied.

Chapter 7, 'Quality Control and Non-Destructive Testing of Self-Piercing (SP) Rivets in Aerospace and other Applications' – reveals more about NDT than it does about SP rivets per se. All who have used SP rivets will acknowledge their usefulness but no cost on performance figures is given here, the sole justification for their use being: a decline in the skilled workshop labour force. Hence higher NDT skills are now required. How to set up: digital cameras, Laser real-time computer vision positioning systems, ultrasound spectroscopy apparatus is important text. But a need for bespoke transducers tops the author's wish-list.

Chapter 8, 'Improvements in Bonding Metals for Aerospace and other Applications' offers a proven alternative to riveting, which does not reduce cross-sectional area but is weak in peel. Natural Bitumen (used 36,000 years ago) is cited as the first adhesive, but after that contemporary adhesives Redux, Epoxy and Methacrylate are considered. The importance of surface preparation is emphasised. Cold v Hot Curing; Presses v Autoclaves; Design, Stressing and Testing are issues debated. Fibre Metal Laminates, Honeycomb Structures, Bonded Repairs, Optical Digital Video microscopy and Numerical Tools are other section headings.

The twin demons of mismatched coefficients of expansion and the need for different surface treatments are tackled in Chapter 9, 'Composite to Metal Bonding in Aerospace and other Applications'. A wide range of adhesives are considered and much knowhow dispensed. Epoxy resins, for example, are preferred to Redux on the grounds that the latter releases moisture during cure and requires expensive pressurised jigs and tooling. Structural laminates studied include: Arall (aramid), Carall (carbon) and Glare (glass).

In Chapter 10, 'Diffusion Bonding of Metal Alloys in Aerospace and other Applications' is described as a solid state, heat and pressure process based on creep. The author explains that (certain materials excluded) atoms migrate across the interface of two or more flat surfaces to produce homogenous metallurgical bonds of strength similar to the parent metal. Microstructures, Processing principles, bonding, blow moulding and super plastic forming of titanium alloys, steels and copper are considered. Some useful temperature and temperature/strain rate guidance is given.

In Chapter 11 gas turbine components, honeycomb structures and fuel transfer pipes are presented as proven uses of high temperature brazing. The entire chapter is devoted to filler materials – now available as foils, pastes, sheet, powder, wire and rod, in many compositions. One interesting fact is that because temperature depressants (phosphorous, boron and silicon) diffuse into the parent metal, they do not prevent brazed turbine components from running at temperatures in excess of those needed to make the joint.

The ten step Appendix on Linear Friction Welding is excellent and worthy of full chapter status.

Although not all chapters are of equal merit the bulk of text is first rate. The book is, however, expensive and one has to assume the price has been pitched correctly.

Peter C. Gasson, CEng, MIMechE, FRAeS

Tactical and Strategic Missile Guidance – Sixth edition

Progress in Aeronautics and Astronautics – Vol 239

P. Zarchan

American Institute of Aeronautics and Astronautics, 1801 Alexander Bell Drive, Suite 500, Reston, VA 20191-4344, USA. 2012. Distributed by Transatlantic Publishers Group, 97 Greenham Road, London, N10 1LN (Tel: 020-8815 5994; e-mail: mark.chaloner@tpgltd.co.uk). 1027pp. Illustrated. £107.50 (20% discount available to RAeS members on request). ISBN 978-1-60086-894-8.

Advances in Missile Guidance, Control and Estimation

Edited by S. N. Balakrishnan *et al*

CRC Press, Taylor & Francis Group, 6000 Broken Sound Parkway NW, Suite 300, Boca Raton, FL, 33487-2742, USA. 2012. Distributed by Taylor & Francis Group, 2 Park Square, Milton Park, Abingdon, OX14 4RN. 682pp. Illustrated. £99. ISBN 978-1-4200-8313-2.

These two books are physically large with a total of some 1,800 pages and nearly 11cms of shelf space – their contents match up to this imposing presence.

AIAA books are generally edited collections of papers by experts in the field, but *Tactical and Strategic Missile Guidance* breaks this format and is the work of one author, Paul Zarchan. It retains the basic format of earlier editions of this work. The second book *Advances in Missile Guidance, Control and Estimation* is an edited collection of chapters each written by experts in the field, which seems to reverse the normal format of CRC technical publications, which I usually associate with works by individual authors.

Paul Zarchan's book *Tactical and Strategic Missile Guidance* covers some 34 chapters together with an appendix of examples. The first five chapters form an introduction to the techniques of missile guidance covering firstly integral transforms, numerical methods and Runge Kutta integration algorithms. The fundamental guidance law – proportional navigation – is then derived and discussed before a detailed examination of the use of adjoints for analysis. Adjoint methods are favoured by the author and are based on the impulse or transient response of the system, thereby simplifying subsequent mathematical analysis without loss of fidelity. Used widely throughout the book, this technique is later used in noise analysis and for advanced filter analysis. The impact of noise on the system and co-variance analysis techniques, round off the introductory chapters.

The next four chapters explore proportional navigation guidance systems in more detail before using mathematical methods to extend proportional navigation into more complex guidance laws. Interleaved with this are two chapters on filtering techniques, the first looking at fading memory filters and the second covering Kalman filters. Chapter 10 draws together the tactical guidance aspects covering operational zones of tactical interceptors.

Chapters 11 to 18 cover aspects relevant to strategic weapon guidance and interception. Classical intercontinental ballistic guidance is covered before considerations of the guidance aspects of interception of strategic vehicles are given. Filtering and estimation techniques for the evaluation of target ballistic coefficients are given – although not mentioned, this forms the basis for differentiating lightweight decoys from genuine re-entry bodies. (It is relatively easy to match radar signatures in lightweight decoys, but not the re-entry dynamics)

Multiple targets and weaving targets are considered in Chapters 19 and 20. The next chapter derives the transfer function of a missile airframe with the following three chapters covering flight control design, the three-loop autopilot and trajectory shaping guidance.

Chapter 25 sees a return to the weaving target problem and introduces Kalman filtering as a means of reducing miss distance, and this is followed by a chapter entitled 'Alternative Approaches to Guidance Law Development' before a return to the weaving target problem with a filter bank approach in Chapter 27. The use of a filter bank would seem to have great utility in many other areas of missile control and guidance where estimates of parameters are required.

Engagement simulations in three dimensions are examined in Chapter 28, finishing the general content seen in the previous edition of this work. From here six new chapters have been added as follows: – 'Advanced Adjoint Applications', 'Miscellaneous Tactical Missile Guidance Topics', 'Comparison of Differential Game Guidance with Optimal Guidance', 'Kinematics of Intercepting a Ballistic Target', 'Boost-Phase Filtering Options', 'Kill Vehicle Guidance and Control Sizing for Boost-Phase Intercept'.

The six new chapters have been added to, and not interleaved with, the existing chapters and these chapters themselves are not optimally organised due to additions during earlier editions. This is a minor criticism about the arrangement of the contents, but such an important book could benefit from a revised layout in future editions of which I am sure there will be many. A fifty-two page appendix, containing additional worked examples, completes the book.

The CRC book *Advances in Missile Guidance, Control and Estimation* starts with an introduction before going on to the numbered chapters each from an author or authors who are experts in the content of their chapter. The introduction develops the missile equations of motion and homing engagement dynamics before introducing autopilot and guidance algorithm development; it then poses some challenges and finishes by summarising the contents of the book.

The first four chapters cover the design and analysis of autopilots and controllers over a typical missile flight envelope. Chapter 5 explores the integration of homing guidance with the autopilot.

Chapters 6 to 11 cover diverse techniques applied to the homing guidance problem. These techniques include the use of sliding mode control, differential geometry and differential game theory. Impact angle control, waypoint guidance and the integration of an estimator filter with an autopilot are considered.

Chapter 12 introduces particle filters as an estimation technique applicable to the guidance problem, although the more conventional Kalman filter estimator together with the particle filter, have been noted in sub sections of the previous chapter.

The final three chapters cover the practical implementation issues of missile autopilot and guidance law design. Initially this is explained by looking at the practicalities of the design of multirate digital guidance laws and autopilots, followed by the design of a CLOS (Command to Line of Sight) guidance system in Chapter 14. Chapter 15 completes the book with an examination of the practicalities of robust control of missiles.

The two books contain extensive references at the end of each chapter although *Advances in Missile Guidance, Control and Estimation* has the greater number with greatest variety including references to earlier editions of Paul Zarchan's book. Also MATLAB is an application used in both books with *Tactical and Strategic Missile Guidance – Sixth edition* offering a Fortran alternative via the AIAA web site whilst the CRC book extends its use of MATLAB to include SIMULINK.

The introductions of both books could be usefully extended as this would make them much more accessible to the novice and greatly increase their usefulness as textbooks. Both books concentrate on pursuit/homing guidance and the derivation of the proportional navigation law – both could benefit from an introductory section outlining estimation/filtering as applied to missile pursuit guidance and possibly an introduction to waypoint navigation guidance.

These books have considerable technical depth also matched by great breadth, yet neither book is a complete exposition on missile guidance – *Advances in Missile Guidance, Control and Estimation* has limited coverage of ballistic strategic weapon guidance whilst *Tactical and Strategic Missile Guidance – Sixth edition* does not cover way point/GOLIS (Go to a Location in Space) navigation guidance, applicable to both strategic and tactical weapons.

These are minor criticisms of two excellent books on missile guidance and control, both of which should be in the library of every weapon guidance technologist.

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Aerodynamic Principles of Flight Vehicles

A. G. Panaras

American Institute of Aeronautics and Astronautics, 1801 Alexander Bell Drive, Suite 500, Reston, VA, 20191-4344, USA. 2012. Distributed by Transatlantic Publishers Group, 97 Greenham Road London N10 1LN (Tel: 020-8815 5994; e-mail: mark.chaloner@tpgltd.co.uk). 319pp. Illustrated. £34.50 (20% discount available to RAeS members on request). ISBN 978-1-60086-916-7.

This book is part of the AIAA '*Library of Flight*' series. A strong emphasis is placed on vortex dynamics (including vortex particle CFD methods) and shock/shock and shock/boundary-layer interactions; a particular research interest of the author. Chapter 1 gives an account of the historical development of aircraft, with references to bird and insect flight and a review of aerodynamic phenomena and prediction methods, including CFD methods. Chapter 2 reviews the role of vortices in aerodynamics, including flow control, wing-tip devices and trailing-vortex decay and alleviation. The remaining chapters deal with transonic and supersonic flow, transonic aircraft configurations and high supersonic and hypersonic flow. The heading for Chapter 4 'Transonic Aircraft Configurations' is somewhat misleading as it contains, for example, discussions on supersonic transport and supersonic business jet configurations.

The book contains reviews of many detailed topics not usually encountered in standard text books, e.g. the Edney shock-wave interaction classifications and analysis of high-speed corner-flows. In some 300 pages it is not possible to treat these topics in great depth but many references are given enabling the interested reader to pursue them further.

An early jarring note is struck in the author's preface (and repeated in Chapter 1) where the production of lift is attributed to the trailing vortices, 'that attract the surrounding air and eject it downward between them, causing a reaction force that keeps the airplane airborne' (page ix). Hope that this is an isolated aberration is dashed in Chapter 2 by an unconvincing Trefftz-plane momentum analysis. Much is made of the 'action-reaction principle' but the careful accounting needed in a control-volume analysis is absent and the reader is led to regard the wing as analogous to a vertical-lift engine; suppressing the important fact that lift produced by an aerofoil is, per se, non-dissipative. To confuse an uninitiated reader further, Fig 1.12 (page 18) attributes lift, not to the trailing vortices, but to downward deflection of air at the wing trailing edge. Upwash, equally apparent at the leading edge, is ignored, although this accounts for half the momentum change at the wing boundary.

This is certainly not a conventional textbook and such questionable analyses suggest that it is best directed at a critical reader having a sound background in aerodynamics, rather than the 'introductory understanding' suggested by the publisher.

The book treats a wide range of topics but their selection and variable level of treatment does not justify the publisher's claim that it is encyclopaedic. The Appendix, too, contains a disparate collection of relationships, from the implementation of vortex-particle methods to the very simple first-order integration of pressure distributions around two-dimensional bodies.

In spite of many reservations, I enjoyed this book. The style is very readable and I found the detailed 'review' material interesting and, if approached critically, useful.

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Aircraft Noise: Assessment, prediction and control

O. Zaporozhets *et al*

Spon Press, Taylor & Francis Group, 2 Park Square, Milton Park, Abingdon, OX14 4RN, UK. 2011. 414pp. Illustrated. £80. ISBN 978-0-415-24066-6.

Aircraft noise has adverse impacts on passengers, airport staff and people living near airports. It limits the capacity of regional and international airports throughout the world. This book aims to illustrate how accurate and reliable information about aircraft noise levels can be obtained by calculations using appropriate generation and propagation models, or by measurements with effective monitoring systems.

The first chapter introduces the various aircraft noise sources, some of the basic concepts and equations, regulations and abatement techniques. Chapter 2 considers the main sources of aircraft noise and some simple approaches to prediction. The propagation of sound is considered in Chapter 3, including atmospheric absorption, refraction by wind and temperature gradients and the impact of turbulence and propagation over flat ground, barriers and trees. Chapter 4 looks at methods for prediction of the impact of aircraft noise around airfields from both flights and ground operations.

Chapter 5 illustrates how these methods can be used to investigate the influence of operational factors (e.g. meteorological conditions, glide slope or rolling starts) on noise. Methods for aircraft noise reduction at source and along the propagation path are reviewed in Chapter 6, including optimisation of flight trajectories, optimum scheduling and acoustic screens. Finally Chapter 7 considers noise monitoring not just in terms of physical measurement but also in the wider context of establishing historical and future trends in order to inform and prove management strategies.

The book would have benefited from tighter editing. Perhaps most problematic is that figures which were clearly intended for reproduction in colour or at larger scale have not been reformatted, making them hard to interpret.

The approaches and examples used throughout the text draw heavily on the Ukrainian noise prediction tool set ISOBELL'a and BELTRA. Although some consideration is given to other noise tools, particularly INM and ANOPP, it would have been interesting to compare and contrast these in more detail. As a consequence the book will be less useful to those who are required to work with other tools such as INM, or ANCON in the UK.

Overall the book provides a useful overview of the tools needed for managing and monitoring aircraft noise impact. An index is included and there is a long list of sources, but the addition of lists of symbols and abbreviations would have made it more useful as a reference. It assumes a level of background knowledge which makes it perhaps less suitable for students. For those already familiar with the field the non-Western perspective is interesting and the conclusions drawn in the later chapters are independent of the methods used to derive them.

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Basic Helicopter Aerodynamics – Third edition

J. Seddon and S. Newman

John Wiley and Sons, The Atrium, Southern Gate, Chichester, West Sussex, PO19 8SQ, UK. 2011. 255pp. Illustrated. £55. ISBN 978-0-470-66501-5.

The subject matter of helicopter engineering is full of very good books, some of which are extraordinary in both scope and achievement. Seddon's book on basic aerodynamics, in its first edition, was a dwarf in a crowd of giants running to over 1,000 pages of intricate mathematics and academic citations. The First edition (Oxford: BSP Professional Books, 1990) ran to about 100 pages, and any self-proclaimed expert would not have given it a serious look. But if we want to start understanding the modern helicopter, some of those books are nothing short of intimidating.

Developing this book through its current Third edition, Simon Newman has made it by considerably more appealing; the book now contains enough material for a complete undergraduate (beginners) course in helicopter engineering, including modern terminology, graphs, images, layout, equations, etc.

The first chapter, inevitably, deals with the history of the development of the helicopter as we know it today, including less-conventional configurations (tilt-rotors, intermeshing rotors). References are more sparse, but due credit is given to a number of well established textbooks. The core of the book consists of classical aerodynamic material, including rotor in vertical flight, forward flight (including ground resonance), aerodynamic design, tail rotor aerodynamics, wake analysis (Chapters 2-7). The problem of stability and control is dealt very briefly, without mathematics, in Chapter 8. This chapter, in fact, shows some key stability concepts, rather than attempting a solution of an inherently complex problem.

The book ends with an Appendix showing performance and mission calculations. This chapter has been adapted from one of the Authors's earlier books (*The Foundations of Helicopter Flight* (London: Edward Arnold (Publishers) Ltd. 1994). Perhaps this chapter could have been moved to the main body of the work, since it contains considerable fundamental material (rotor downwash, rotor power, engine limits), alongside a specific mission analysis.

In summary, this greatly improved edition is going to be of interest to all those young people wishing to embark on the understanding of the helicopter, without the fuss of too much detail and too much theory.

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Steady Aircraft Flight and Performance

N. Harris McClamroch

Princeton University Press. 6 Oxford Street, Woodstock, OX20 1TW, UK, 2011. 391pp. Illustrated. £55. ISBN 978-0-691-14719-2.

The main objective of the book is to give a scientifically rigorous treatment of aircraft steady flight, which in the author's opinion is lacking from many existing books on aircraft performance. A second objective is to provide the required background for future study of flight dynamics and control. The book sets out to achieve these objectives by using an approach more commonly adopted for flight dynamics analysis, namely the development of the equations of motion in three dimensions through consideration of translational kinematics, Newton's Laws of Motion and free body diagrams.

The book is clearly laid out in chapters that would be familiar to any student of aircraft performance with the addition of two chapters on flight planning and flight dynamics. A typical chapter develops the equations required for the phase of flight being considered and this is followed by use of the equations in two comprehensive case studies. One of these case studies is an executive jet whilst the other is a general aviation propeller aircraft. These case studies are clearly laid out and incorporate the listings of Matlab files used to do much of the analysis. Each of these case studies is treated in isolation from the other, and whilst it means that both studies are complete, it does sometimes give the impression of unnecessary repetition when a complete chapter is read in one sitting.

The use of the case studies allows the effects of constraints on the analysis to be identified and discussed. It is a pity that there is no attempt to compare and contrast the trends seen in the results for the two aircraft types considered. A comprehensive set of tutorial examples are included at the end of most chapters and these are based on the two case studies plus a UAV example.

Overall, the book achieves its objectives and would be a worthwhile addition to any library.

Dr Peter Render, CEng, MRAeS

Introduction to Structural Dynamics and Aeroelasticity – Second edition

D. H. Hodges and G. A. Pierce

Cambridge University Press, The Edinburgh Building, Cambridge, CB2 8RU, UK, 2011, 247pp. Illustrated. £50. ISBN 978-0-521-19590-4.

This book is the Second edition of a book first published in 2002, but based on course notes for students at Georgia Tech. from the early 1970s. This Second edition has been updated by Hodges following the death of Professor Pierce.

The book is still unashamedly aimed at final year undergraduates and postgraduates. The competition for textbooks on dynamics and aeroelasticity is intense: nearly a dozen on aeroelasticity alone, several by E. H. Dowell.

To satisfy undergraduate readers a book has to have two main features. Firstly the text has to be clear and well-illustrated with examples which do not use several pages of algebra. Secondly there has to be many set problems, with some solutions (for students and tutors alike). This book satisfies the second criterion well. There are many problems at the end of each chapter, with a few solutions.

The text is also pitched at the right fundamental level without being excessively long. The book has only 230 pages and this has been achieved by concentrating on simple structural examples with analytical solutions. For example, free vibrations, modal analysis, approximate methods (including simple finite elements) are developed for uniform strings in tension and uniform beams in bending or torsion.

The second half of the book continues this strategy by treating the aeroelastic behaviour of two-dimensional aerofoils supported by a torsional and extensional (plunging) spring. Divergence and (simple harmonic) flutter are captured by simple analysis. The simplicity of steady-state aerodynamics is later corrected by several extensions such as '*k*' and '*p-k*' methods, Theodorsen's unsteady theory and Peter's finite-state unsteady theory. This use of two-dimensional rigid aerofoils is justifiable for a teaching text, including mention of more sophisticated models for complete wings and aircraft. The text touches on the effect of three-dimensional structural and aerodynamic behaviour using such codes as NASTRAN and ASTROS.

This book will certainly appeal to mathematically inclined students, but would have benefited from a little more physics. For example in classical torsion/bending flutter the importance of phase can be emphasised in showing how energy per cycle can be extracted from the flow by lifting forces moving over rotational displacements. Mass-balancing of wings and controls has but a brief mention. Explicit solutions could also be cited, for example a flexible aircraft meeting gusts.

Professor G. A. O. Davies, CEng, FRAeS

Recent papers in Aerodynamic design of aircraft. Papers. People.Â The observed prototype design employs an interim supercruising and thrust vectoring engine, common to the production Su-35S Flanker. The configuration is intended to validate aerodynamic and systems performance, and is clearly not intended for full validation of low observables performance. A new 35 - 40 klbf class 3D TVC supercruising engine for the PAK-FA is currently being developed by NPO Saturn. Analysis of PAK-FA prototype airframe shaping shows a design which has forward fuselage, inlet, upper fuselage, wing and tail surface airframe Very Low Observable (VLO/stealth) shaping which is hi Keywords: transport aircraft, transonic wings, aerodynamic design. This paper gives brief description of the authorâ€™s experience in aerodynamic design of wings and other layout elements of subsonic transport aircraft.Â The aerodynamic design procedure used in TsAGI consists of four basic components [5]: geometry manipulation system, direct methods for the analysis of aerodynamic characteristics, inverse methods for construction of geometrical shapes with desired pressure distributions and optimization methods, allowing a designer to maximize the selected objective function (for example, lift-to-drag ratio) by a geometry variation at the imposed constructive. and aerodynamic restrictions. The key to success of the aerodynamic design process is a direct analysis method. Aircraft Aerodynamic Design. 265 Pages Â· 2014 Â· 8.7 MB Â· 302 Downloads Â·English. by AndrÃ¡s SÃ³bester.Â Propellor Aerodynamics The History, Aerodynamics & Operation of Aircraft Propellers. 203 PagesÂ·2015Â·8.63 MBÂ·358 DownloadsÂ·New! digital design digital design digital design principles & practices. 795 PagesÂ·2006Â·4.92 MBÂ·26,929 Downloads. , software tools are an essential part of digital design. Indeed, the c01.fm Jet Propulsion : A Simple Guide to the Aerodynamic and Thermodynamic Design and Performance of Jet. 322 PagesÂ·2003Â·3.7 MBÂ·853 DownloadsÂ·New! This second edition of Cumpsty's self-contained introduction to the aerodynamic and thermodynamic Fashion Design Essenti aircraft design - Which are some. Activities For Radio Hobbyists â€“ Radio Control. Why aeroplanes windows are round instead of square? Dragonfly Remote Control Helicopters and My Granddad's Story. Airfoil Designs - Pilot's Handbook of Aeronautical Knowledge - Chapter 3. See more.Â Vertical Takeoff And Landing Aircraft Patent - Airplane Blueprint Airplane Art Pilot Gift Aircraft Decor Airplane Poster VTOL by PatentsAsPrints. See more. Aviation Training Pilot Training Flight Lessons Flying Lessons Aviation Insurance Angel Flight Chapter 3 Ground School Fluid Dynamics. Typical Airfoil Section - Pilot's Handbook of Aeronautical Knowledge - Chapter 3. Wayne Jeffries. Aerodynamic Theory. AIAA Education Series, Virginia, 2012. XVII, 583 p. â€” ISBN 978-1-60086-922-8. Dietrich Kuchemann's The Aerodynamic Design of Aircraft is as relevant and as forward looking today as it was when it was first published in 1978. It comprises the philosophy and life's work of a unique and visionary intellect. Based upon material taught in a course at Imperial College London, the insight and intuition conveyed by this text are timeless. With its republication, Kuchemann's influence will extend to the next generation of aerospace industry students and practitioners and the vehicles the I became determined that The Aerodynamic Design of Aircraft must be reprinted and made available again to the aerospace community. Later that year, I received enthusiastic support for this project from the membership and leadership of the AIAA Aircraft Design Technical Committee. With their backing, I approached the publishing staff of the AIAA about pursuing this project.Â Aerodynamics is for him an applied science that is meaningful only when it has the practical design of aircraft as its aim. The best methods are those that work in this context; they contribute to a conceptual framework that the scientist is aiming to put into the hands of the aircraft designer.

AIAA Education Series, Virginia, 2012. XVII, 583 p. â€" ISBN 978-1-60086-922-8. Dietrich Kuchemann's The Aerodynamic Design of Aircraft is as relevant and as forward looking today as it was when it was first published in 1978. It comprises the philosophy and life's work of a unique and visionary intellect. Based upon material taught in a course at Imperial College London, the insight and intuition conveyed by this text are timeless. With its republication, Kuchemann's influence will extend to the next generation of aerospace industry students and practitioners and the vehicles the The Aerodynamic Design of Aircraft. Average rating:0out of5stars, based on0reviewsWrite a review. AIAA (American Institute of Aeronautics & Ast. This button opens a dialog that displays additional images for this product with the option to zoom in or out. Tell us if something is incorrect. The Aerodynamic Design of Aircraft. Average rating:0out of5stars, based on0reviewsWrite a review. AIAA (American Institute of Aeronautics & Ast. $58.31$58.31$58.31$58.31. Only 4 left!