

# Book Reviews

## Computational Modelling and Simulation of Aircraft and the Environment Vol.1: Platform Kinematics and Synthetic Environment

**D. J. Diston**

*John Wiley and Sons, The Atrium, Southern Gate, Chichester, West Sussex, PO19 8SQ, UK. 2009. 356pp. Illustrated. £65. ISBN 978-0-470-01840-8.*

At the beginning of my career in aircraft and space vehicle data fusion there were several well-worn textbooks on the various domains of knowledge that were required. Within this set the Earth gravitational/magnetic modelling, standard geodetic models, reference frames and similar subjects were covered comprehensively in just one book. This book by Dr K.R. Britting – *Inertial Navigation Systems Analysis* (Wiley-Interscience, 1972) – is now long out-of-print and copies are becoming very rare.

That is why I am surprised and pleased to see such a *tour-de-force* in this new book. The book begins in Chapter 1 with an overview of systems design methods and the motivation for modelling. In Chapters 2 and 3 there is a very clear explanation of axis systems, transformations, projections and dynamics, including great circle navigation on an ellipsoidal Earth, for example. Chapter 4 covers positional astronomy, including all of the major time and spatial reference systems as well as orbital mechanics of the planets, satellites in general and GPS satellites in particular. Chapter 5 explains and gives data on the Earth's gravitational and geomagnetic fields. The final chapter provides an overview of standard atmosphere models and an introduction to some of the complexities in this area. Approximately one sixth of the book is devoted to two appendices that introduce and examine MATLAB®. This seems a little out of place but no doubt some readers will find it useful.

Overall this is an excellent book which leads the reader through a clear description of the subject and is easily navigated so that it also makes a good reference. I would not hesitate to recommend this book to novice and experienced practitioners of Earth modelling, inertial navigation, GPS systems and the like.

**Dr Geoff Henderson, CEng, MIET**

## Mechanics of Flight – Second edition

**W. F. Phillips**

*John Wiley and Sons, The Atrium, Southern Gate, Chichester, West Sussex, PO19 8SQ, UK. 2010. 1138pp. Illustrated. £100. ISBN 978-0-470-53975-0.*

## Flight Mechanics Modeling and Analysis

**J. R. Raol and J. Singh**

*CRC Press, 2 Park Square, Milton Park; Abingdon, Oxon, OX14 4RN, UK. 2009. 416pp. Illustrated. £95. ISBN 978-1-4200-6753-8.*

*Mechanics of Flight* is a very weighty tome (1.65kg) of some 1,138 pages. It is written by an American university professor for American university students at postgraduate or 'upper-division' undergraduate level. The author unashamedly expects his student to have a good grounding in university maths especially differential and matrix equations plus have completed an introductory course in aerodynamics.

Most pages of this tome contain numerous equations and the teaching is through equations with the author expecting the equations to 'speak' to the reader and imparting an underlying understanding of the issue being explained. Topics that have been taught to me without complicated maths (such as damped motions) are presented from the mathematical viewpoint rather than an engineering viewpoint. Yet a nice touch for the British reader is the author uses any opportunity in his pictures and diagrams to feature a Spitfire Mk XVIII, although he also includes four-engined passenger jets, Predator and Global Hawk UAVs (to demonstrate tail dihedral), ultralights (to explain pitch instability) and fast jet material contributed by a F-14 Tomcat test pilot. This variety is a relief since at one point the author says he would concentrate on general aviation aircraft since the student would be more able to hire one to try out concepts. (Has he tried living on a student's loan?)

Without a doubt this is a most comprehensive book covering aerodynamics, propulsion systems and their airflow characteristics, performance characteristics and handling qualities, static and dynamic stability and equations of motion with every form of nonlinearity added including spherical-earth approximations.

Make no mistake, nothing is simplified in this book and every effect of mathematical limitations/assumptions, nonlinear equations or things going wrong are covered, such as aileron reversals and airflow in a turn (to name but a couple of issues).

The book is also intended for practitioners even though it is written to students, and would not be out of place in the reference bookshelf in a number of aerodynamics, design office and avionics departments.

*Flight Mechanics Modeling and Analysis* is also intended for the advanced student and many of its tutorial examples are based on using PC MATLAB® which could be considered as a prerequisite for the serious student. At least this is cheaper than hiring a GA aircraft. The authors' approach is presented through system theory which leads to a more discursive and readable text, but nevertheless the student must still be very comfortable with the same maths as *Mechanics of Flight*. In addition the student should be familiar with the maths to support the later part of the book which presents analysis and control techniques. Thus the reader should be comfortable with Kalman Filtering and its extended versions, adaptive fuzzy systems, maximum likelihood and others.

The book covers much of the topics as *Mechanics of Flight* but not in the same detail. In fact aerodynamics (The first chapter of the other book) is relegated to an appendix. The equations of motion, static and dynamic stability as well as performance and handling qualities are all covered as per *Mechanics of Flight*, but then the book discusses the approach to flight testing and flight test data analysis necessary to identify the parameter for the models. I suspect that this chapter is pitched at the work done in the university. The chapter on fuzzy control analysis worried me as it did not mention safety issues and the approach to flight certification, but this might not matter for a student when you are pushing the boundaries of knowledge for them to develop in their careers. At least the second book introduces alternative design methods for flight stabilisation not covered in the first book. However it does not go into any detail.

In summary both books are serious and useful textbooks. *Mechanics of Flight* could be considered as a reference manual that would follow a student throughout his career, while *Flight Mechanics Modelling and Analysis* (which is about the same price but less than half the size) is pitched a bit lower, but is more readable for this and could probably be more helpful as an earlier primer.

**Eur Ing Mike Stanberry, MRAeS**