

# Book Review

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## **Introduction to Avionic Systems (2nd edition)**

R. P. G. Collinson, Kluwer Academic Publishers, Norwell, MA, 2003, 492 pp., \$125.00, ISBN 1-4020-7278-3

It is difficult to overemphasize the significance of avionics in present-day aerospace vehicles. Avionics is the brain behind the structure, aerodynamics, and propulsion of every modern flying system. Therefore, any new book on the subject, such as the second edition of *Introduction to Avionic Systems*, is very welcome.

The first edition of this book was published in 1996. The new edition, published in 2003, includes only minor changes. In particular, the order of the chapters entitled "Displays and man-machine interaction" and "Air data and air data systems" have been switched. In addition, a short, descriptive chapter on unattended air vehicles has been added. Other than these changes, there are not any substantial differences between the two editions.

The subject of automatic flight control is divided, quite logically, into two chapters. Aerodynamics and aircraft control are presented in Chapter 3 and fly by wire is presented in Chapter 4. The material on aircraft flight mechanics and control is adequate. The description of micro-machined vibrating mass gyroscopes, skewed axes sensor configurations, and the connection between the direction cosine matrix and the corresponding attitude quaternion have been added to Chapter 5 of the second edition. As in the first edition, Chapter 5 deals with inertial sensors and attitude determination. Chapter 6 is devoted to navigation systems, primarily inertial navigation systems (INS), GPS, attitude heading reference systems (AHRS), and hybrid systems. The treatment of aided navigation systems is adequate; however, considering the importance of the Kalman filter algorithm in such hybrid navigation, detail on this subject is lacking. In particular, a correct definition of the covariance matrix should have been given. It is also surprising to read a classical erroneous account of the east-gyro reading in the

INS gyroscoping alignment process. The author claims that as a result of azimuth misalignment, the east gyro reads the projection of the north component of Earth rate on the east-gyro axis. On the contrary, it is widely held that the east gyro reads nothing. It is the lack of this reading which causes the physical, as well as the mathematical, INS platforms to develop a miss-level error with respect to ground about the east axis. Fortunately, the author's incorrect explanation nonetheless yields the correct consequence as long as the operation of an east monitor gyro does not have to be analyzed. Chapter 8 presents autopilots and flight management systems, and Chapter 9 discusses the integration of avionics systems.

Because this is an introductory book about general avionics rather than a particular system, it discusses a potpourri of various avionics systems. Therefore, it does not present an in-depth exposition of the subjects covered. In addition, some topics that are at the center of the avionics field such as radar, in particular Doppler radar and radio navigation aids, are missing in this book. Curiously, a discussion of Doppler radar was included in the first edition.

Despite the aforementioned shortcomings, the book has its merit; namely, it gives the reader a basic understanding of the principles and methods used by a large variety of avionics systems. It also includes descriptions of the way these systems operate. Although we do not rate the book as a graduate level textbook, as is claimed in its Foreword, it is appealing as a book for self-study. It presents the avionics systems in a simple, easy fashion and is therefore useful.

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