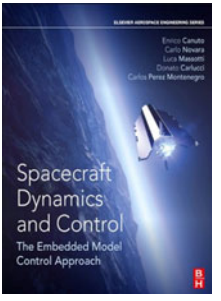
Suffice to note that a little prior acquaintance with Microsoft Excel software is required, but other than that there are many coloured screen images to guide the reader on their way. Suffice to list the four worked examples provided:

1. Drawing shear and moment diagrams
2. Drawing Mohr's circle
3. Principal stresses in three-dimensional stress elements
4. Computation of combined stresses

But one has to ask: How many of the 1,200 plus problems set in chapters 1–9 will ever see the light of day? Appendices A–H are, however, an essential contribution to the subject. This book is immaculately produced. The high quality of the illustrations seems most impressive, while the text would appear to be technically correct throughout. The reviewer always tries to present the hard work of others in a favourable light and has read almost every page, some sections many times over, but still cannot gel with the authors' approach to the subject.

The reviewer knows that there are several, far more lucid, highly respected, texts on offer, but in fairness to the authors of this book, the reviewer suggests that prospective buyers, having read this review, should also ponder the words of a previous reviewer on the back cover of the book.

Peter C. Gasson, CEng MIMechE, FRAeS



Spacecraft Dynamics and Control: The Embedded Model Control Approach

E. Canuto *et al.*

Elsevier Butterworth-Heinemann, The Boulevard, Langford Lane, Kidlington, Oxford OX5 1GB, UK. 2018. viii; 781 pp. Illustrated. £119. ISBN 978-0-08100700-6.

Spacecraft Dynamics and Control approaches the problem of controlling a spacecraft from a model-based control perspective. Both orbit and attitude control are dealt with, although with more focus on the latter.

The orbital part includes a presentation of the classical two-body problem in chapter 3, orbital perturbations in chapter 4 and the integration of perturbed dynamics in chapter 5. Some useful elements for mission analysis are also provided, including the most relevant types of geocentric orbits, Lambert's problem, Hohmann transfers, gravity assists and periodic and quasi-periodic orbits in the restricted three-body problem.

The attitude sections cover different methods to represent the spacecraft attitude in chapter 2, main perturbing torques in chapter 4, attitude kinematics, dynamics and control in chapter 6 and 7 and lastly attitude estimation algorithms in chapter 10.

The models for orbit and attitude sensors are derived in chapter 8, and those for orbit and attitude actuators are given in chapter 9. The reader is thus provided with all the ingredients required to formulate and solve complex spacecraft control problems in the model-based approach.

In chapters 11 and 12, everything comes nicely together with the detailed analysis of practical orbit and attitude control problems. In particular, chapter 11 presents the orbital drag-free and orbital quaternion prediction problems, while in chapter 12 a full attitude control design is addressed in great detail. In both chapters, ESA's gravity field and steady-state Ocean Circulation Explorer (GOCE) mission is used as a test case, taking advantage of the practical experience gained by the authors by working on the different phases of this challenging ESA mission.

Although placed at the end of the book, chapters 13 and 14 are introductory chapters that the unfamiliar reader should read first. They consist in a review of the key elements necessary to fully appreciate the model-based approach adopted by the authors. Chapter 13 introduces to the fundamentals of state equations and their properties, the derivation of linear time-invariant error equations, predictors and control design via pole placement, and random processes description. The main elements of the embedded model control approach adopted by the authors are summarised in the final chapter.

In my opinion, there are two main strengths of this book. Being the result of the authors' collaboration with ESA, the book presents the material with a focus on practical applications. The case studies and proposed and solved exercises are carefully designed, and they are a critical support for reading comprehension and self-assessment.

This book distinguishes itself by its focus on strong model-based control. As such, I consider it useful for researchers and practitioners with classical control theory expertise who wish to become familiar with astrodynamics problems, and for those with a more physics-based background to get their hands on spacecraft control problems. Undergraduate and graduate students will find this book useful to understand fundamental concepts and carry out individual or group projects.

The notation and terminology used are sometimes non-standard, however this does not impair the reading much, as consistency is preserved throughout the manuscript.

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