

ZMATH 2013b.00806**Rebaza, Jorge****A first course in applied mathematics.**

Hoboken, NJ: John Wiley & Sons (ISBN 978-1-118-22962-0/hbk; 978-1-1182-7715-7/ebook). xvi, 439 p. (2012).

Although the debate on what areas of mathematics should be labelled as “pure” and “applied” has been going on for a very long time, no satisfactory and generally accepted classification has been produced yet. In the preface to this textbook, Dr. Rebaza suggests the following division. “(Pure) mathematics: topology, abstract algebra, analysis, linear algebra. Applied mathematics: dynamical systems, matrix computations, optimization, financial mathematics, numerical methods.” Although this grouping cannot be acknowledged the most versatile and comprehensive, it clearly reflects the author’s research experience and determines the choice of material for this book. As Dr. Rebaza mentions in the preface, “only some selected topics in applied mathematics will be considered, mainly because of limitations of space and time. Thus, for the applications we have in mind, we need to review some mathematical concepts and techniques, especially those in linear algebra, matrix analysis, and differential equations.” There are eight chapters in the book. Chapter 1 introduces fundamentals of matrix analysis and some basic facts on vector spaces; it concludes with the demonstration of how Bézier curves and Bézier splines can be used in computer graphics to generate sophisticated curves and design fonts. In Chapter 2, the problem of ranking documents and web pages is analyzed using matrix computations and numerical analysis. Some of the most important matrix factorizations, LU , QR , and Schur factorizations, as well as singular value decomposition are discussed along with applications of matrix factorization to information retrieval and cryptography. The minimization algorithm of least squares is explained in Chapter 4. Elegant applications of mathematical methods from numerical analysis and linear algebra to image compression form the subject of Chapter 5. Chapter 6 is mainly devoted to linear differential equations and systems of linear differential equations. Basic definitions, theoretical facts, and solution techniques are presented here. In the introductory part to this chapter, the author asserts that “once we leave the textbook or classroom examples, most differential equations are still theoretically solvable by analytical methods, but, impossible to solve in practice due to their complexity. At that point, we need to make use of numerical approximations to the solutions of differential equations. For initial value problems, there exists a number of very reliable software applications, (e.g., Matlab) that can readily compute the numerical solution with such a degree of accuracy that it can be considered to be the exact solution.” This statement confuses the reader who might expect existence of analytical solutions, although difficult to compute, for most differential equations arising in applications. On the other hand, author’s controversial opinion regarding numerical solution undermines the usefulness of the qualitative theory of differential equations whose elements are briefly presented in Chapter 7 along with applications to predator-prey models with harvesting. In the final Chapter 8, several interesting applied problems are collected – optimization of the waste management, grouping problem for optimal performance of computers in networks, a model of an infectious disease (American cutaneous leishmaniasis), and a two species population model that may describe mutualism, competition, or host-parasite behavior. The book is well illustrated, contains many examples and numerous exercises for independent study (unfortunately, without answers), a bibliography comprising 68 titles and an extensive index. It has developed from lecture notes for the course Applied Mathematics at Missouri State University “with a typical audience of juniors and mostly seniors from mathematics and computer science, as well as first-year graduate students.” Since this text has been designed primarily to introduce a number of interesting and important applications based on the use of linear algebra, matrix analysis, differential equations, and numerical methods, it may be a perfect match for the reader looking for this particular combination of topics. On the other hand, as “a first course in applied mathematics,” it does not cover quite a few important areas and methods, but may be well used as a complementary reading for courses in engineering mathematics, differential equations, applied mathematics, or mathematical modeling.

Yuri V. Rogovchenko (Kristiansand)

Classification: M15 N15

Keywords: applied mathematics; matrix analysis; differential equations; linear algebra; networks; cryptography; population biology; optimization

<http://eu.wiley.com/WileyCDA/WileyTitle/productCd-1118229622.html>