Linear Algebra : A Modern Introduction (Third Edition)

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https://gonitsora.com/linear-algebra-modern-introduction-third-edition/

David Poole

Brooks/Cole, Cengage Learning, 2011, xxvi+726 pp.

For an introductory book, this is a thick book with more than 700 pages. For a book on linear algebra, it contains more than usual amount of material on special matrices like positive matrices, Markov chains and numerical matrix analysis.

About 60% of the book (444 pages in 5 chapters) deals with linear algebra from a matrix point of view. Starting from scratch with vectors in 2 and 3 dimensions, this half continues with systems of linear equations, matrices, eigenvalues and eigenvectors and orthogonality– basically, the standard fare in elementary matrix algebra. After a rather thorough grounding in the computational aspects of matrices, the reader is introduced to more general and abstract concepts like vector spaces and inner products in the last two chapters.

This book differs from earlier elementary books on linear algebra in the way that it progressively develops an awareness and appreciation of the relevance of linear algebra in a modern society. Every chapter has a section on various useful applications to modern life. The inclusion of such applications may justify this book as a “modern introduction”. Examples of these applications are coding used in bar codes, solving linear systems arising in GPS (Global Positioning System) and network analysis, error-correcting codes, linear codes, linear transformations in tessellations and modelling of robotic arms, Perron eigenvectors occurring in sports ranking and internet search engines, singular value decomposition in digital image compression and least square approximation in statistics.

At the end of the book is a rather long list of applications (presented in the book) to other areas in the biological sciences, economics and social sciences, physical sciences, engineering and computer science. The “pure” algebraist may be surprised at the rather wide range of “usefulness” of basic results of a purely theoretical nature.

Some basic ideas and results of Markov chains and positive matrices are presented with proofs wherever possible. These are illustrated in linear economic models and discrete linear dynamical systems.

Except for one chapter (on matrices), each chapter has a brief section labelled “Exploration(s)”, which leads the reader to more mathematical ideas or to other aspects of the topic in that chapter. For example, one exploration deals with the modified QR factorisation and the QR factorisation for approximating eigenvalues and another to a brief introduction of the analysis of algorithms for the Gaussian elimination method of solving linear equations.

Besides learning the fundamentals of linear and matrix algebra, the reader picks up some elementary ideas in numerical analysis and computer science. For those who are coming face to face with mathematical proofs for the first time, there are 4 appendices which briefly describe some methods of proof, mathematical induction and basic notions and results concerning complex numbers and polynomials. A website is also available to enhance the learning and teaching of the material in this book.

As is a common trend in many introductory books on scientific topics, an attempt is made to put a human touch to the abstract concepts by including numerous short informative biographical notes on past and contemporary mathematicians who have played a role in the development of mathematics in general and linear algebra in particular. In addition, there are many photographs of those mathematicians, most of whom are the famous and well-known ones from the past decades and centuries, but there are some rarely publicized photographs of more contemporary household names in the field.

This is a book to consult if you are interested in an introductory book on linear algebra that combines mathematical rigour and modern relevance.

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